Digital Competencies for Industrial Production Managers

M. Suphapanworakul, W. Kaewurai, and P. Nilsook

***Abstract*—This research aims to study digital competencies for industrial production managers. The sample group in this research was 68 managers from industrial production. They were chosen by purposive sampling. The research instrument used for data collection were questionnaire and interview. The statistics used for data analysis were percentage, mean, and standard deviation. The results showed that digital performance for industrial production managers consists of 1) information management, 2) digital communication management, 3) digital knowledge management, and 4) assessing and solving digital problems. From seminars by group discussions with experts in digital competencies who needed and were necessary in the performance of production managers in industrial plants, it was found that the production managers needed to have two additional digital capabilities, which are 1) digital safety and 2) digital specific operations.**

***Index Terms*—Digital competencies, production managers, industrial plants.**

I. Introduction

Thailand has announced a 20-year national strategy to be a mechanism to drive the nation. It has adopted the National Economic and Social Development Plan - Twelfth Edition, 2017 – 2021 which has established a strategy for national development, especially the first strategy which is on strengthening and developing human capital potential with relevant goals and indicators. The second goal is the highlight. People in Thai society at all ages attain increased skill, knowledge, and ability. Indicator 2.3 states that, for labor age, knowledge and skills are in need according to the needs of the job market, and financial skills should be suitable for the economic environment. In addition, the development has guidelines in 3.2.3 which is promoting workers to have knowledge and skills in occupations that meet the needs of the labor market which has details on the implementation of the development of labor competency training centers that meet the standards, systems, professional qualifications, and skilled labor standards [1].

One important development mechanism in the country apart from the 20-year national strategy announcement and The Twelfth National Economic and Social Development Plan 2017 – 2021 is that various government agencies need to attach importance to formulating a development strategy at the same time. In terms of industrial development, Thailand by the Ministry of Industry has determined the strategy of Thai industrial development 4.0 for 20 years (2017 - 2036), by establishing a framework for driving Thai industrial development - an important engine for driving the country's economy in the next 20 years according to the Thailand Development Framework 4.0. Ministry of Industry by the Office of Industrial Economics therefore has developed a strategy for Thai industrial development 4.0, 20 years (2017 - 2036) under the vision "Focusing on intelligence-driven industries and linking with the global economy" by setting goals for the next 20 years (2017 - 2036), allowing the Thai industrial sector to have an average GDP growth rate of not less than 4.5 percent per year. The average growth of investment is not less than 10 percent per year. The export value grows at an average of 8 percent per year, and TFP grows at an average of not less than 2.0 percent per year, which is an expansion rate that will result in Thailand being able to move to become a high country income by 2036 according to the goals of the national strategy [2].

From the 20-year national strategy, the socio-economic development plan and the Thai 4.0 industrial development strategy, the industry must analyze the problems that are being affected by the changes in the industrial sector. It is causing the industrial sector to analyze problems that are affected by the changes in the industry, especially the impact on human development in various industries by increasing competitiveness and being a condition for economic development in Thailand 4.0 and industry 4.0. One thing that is necessary to increase the competitiveness is to have an executive in the industry [3]. Therefore, under Thailand 4.0 policy, one important mechanism to drive the future economy (new engine of growth) is the development of 10 target industries which consists the addition of 5 potential former industries (Existing S-Curve) containing modern automotive industries, intelligent electronics industry, tourism industry and health tourism, agriculture and biotechnology industry, and food processing industry. Moreover, there are 5 additional future industries (New S-Curve) which consists of industrial robots and automatic machines, aviation and logistics industry, biofuels and bio-chemical industries, digital industry, and complete medical industry [4].

From the 20-year Thai 4.0 industrial development strategy, it has already been established a framework for driving development of the Thai industrial sector which is an important tool to drive the country's economy for the next 20 years. According to this framework, Ministry of Industry has set up the economic development in the industry 4.0 for the next 20 years (2017-2036), based on the vision “Towards an industry that is driven by intelligence and linked to the global economy.” The aim is to promote Thai industry to increase the average GDP growth not less than 4.5% per year, the average investment growth is not less than 10 % per year, the value of exports grows at an average rate of 8% per year, and TFP grows at least 2.0% per year which is the rate of expansion that will enable Thailand to move into a high-income country by 2036 according to the national strategy [2], the 20-year national strategy, the socio-economic development plan, and the Thai 4.0

Manuscript received October 9, 2019; revised July 15, 2020.

The authors are with Naresuan University Thailand, Thailand (e-mail: manoch.su@hotmail.com).

industrial development strategy. As a result, the industry sector needs to analyze the occurring problems affecting the changes in the industry, especially the impact on human resource development in various industries by increasing competitiveness and being a condition for economic development in the era of Thailand 4.0 and Industry 4.0. One thing that is necessary to increase the potential of competition is the executives in the industrial sector [3]. It can be seen that, in Thailand, there has been continuous economic and industrial development with the development of mechanisms for driving the country's wealth. In the first phase, the Thailand 1.0 model was used to focus on driving the country with agriculture since Thailand is rich in natural resources and biodiversity. The economic driving force in this era is therefore largely dependent on the use of natural resources. Thai agricultural products has been exported to foreign countries. In the next phase, when Thailand entered the industrial age, the Thailand 2.0 model was used which emphasized the development of light industry. It started with the manufacturing industry to substitute for imports, followed by the Thailand 3.0 model that focuses on the development of heavy industry focusing on production for export, such as electronic products, petrochemicals, automobiles, and various parts. This is an economic drive by the industrial sector that focuses on improving production efficiency and providing basic services to generate income for the country and under the current Thailand 3.0 model. Thailand is currently facing the problem of Middle Income Trap, inequality of income distribution or Inequality Trap, and Imbalance Trap. Also, competitiveness is also low. According to the competitiveness ranking of international institutions, such as IMD, WEF, and World Bank, it is found that the factors affecting the success of national development in many aspects are, for example, an investment for research and development of the potential of science and technology and productivity and production efficiency. In addition, the efficiency of the government is still low. When considering the results of industrial development which is an important mechanism for driving the national economy in the past 10 years, it was revealed that the average growth of industrial GDP was only 3% per year, the average investment growth was only 2% per year, the value of industrial exports grew by an average of 5.4% per year, and Total Factor Productivity (TFP) in the industrial sector increased by an average of 0.7% per year, which is still considered low and not enough for leading to propel the country towards a high-income country by the year 2579 as the target of the 20-year national strategy. It can be seen that in order to overcome the aforementioned problems, it is necessary to reform the country once again with the cooperation of all sectors using Thailand 4.0 model as a tool to lead the country to become a country in the first world that is rich and sustainable and develop from middle-income countries to high-income countries which needs to be adjusted from efficiency driving to driving by technology and innovation and change from basic services to services that require advanced skills. The Thailand 4.0 model must be changed in terms of the economic structure from the previous driving by the development of industrial production efficiency to an economy that is driven by technology and innovation [2].

According to research from PIAAC (2009) and Ala-Mutka (2011) [5], digital technology has an effect on changes in the way of learning, work, communication, and the duties of people in society. This is in line with the OECD (2016) [6] that place an emphasis on the term “digital performance” which is important for economic world in every dimension and has more influence on the work structure and employment than in the past. As a result, it makes digital skills important to everyone. Additionally, Valsamis *et al*. (2015) [7] notes that digital performance has many various effects on the labor market, both job creation and job loss in various work sections and can be concluded that digital performance is a skill that is needed now and in the future. In addition, Rung Tawan Ngamchit-anan (2018, page 6) [8] said that the current industrial development pattern in Thailand is characterized by dependence on exports, emphasizing the employment of minimum labor, lack of technology development for industrial development, and production that still lacks environmental care. An important factor that is an obstacle to driving Thai industry is that 75% of Thai entrepreneurs still use technology below level 2.5, especially for small and medium sized entrepreneurs because of the cost limitation, lack of a large number of new technicians with operational skills, and also lack of soft skill that facilitates work as well. Overall, the Thai industry still uses robots in their production processes less than other manufacturers in Asia. This shows the importance of digital performance to Thai 4.0 industry development. Therefore, under the Thailand 4.0 policy, one of the most important mechanisms for driving the economy for the future (new engine of growth) is the development of 10 target industries consisting of the extension of 5 former potential industries that have Existing S-Curve consisting of modern automotive industry, intelligent electronics industry, tourism industry in good income groups and health tourism, agriculture and biotechnology industry, and food processing and filling industry and the inclusion of 5 future industries (New S-Curve) which consist of robotics and automation industry, aviation and logistics Industry, biofuel and biochemical industry, digital industry, and medical hub industry (Thailand Development Research Institute, 2018) [4].

For the above reasons, the researcher is interested in studying digital competency focusing on studying and exploring digital competencies of industrial production managers. The objective is to study the digital competency of industrial production managers which can be used to develop and improve the digital capabilities of the production manager to be ready to meet the needs of the establishment, the production situation, and changes in market demand, as well as, enhance the competitiveness of the digital age industry. The researcher therefore laid out the guidelines for the research and a survey of digital competency of production managers in industrial plants that are needed to perform their work in order to be a guideline for the development of a form of digital capacity development for workers in Thailand.

II. Research Purposes

To study and explore digital competencies of production managers in industrial plants in applying to create a competency-based training course for industrial development in Thailand.

III. Research Methodology

A. Population and Sample

1) Quantitative research

The population used in this study were production managers from Bang Pa-in Industrial Estate, Hitech Industrial Estate, Rojana Industrial Park Nava Nakorn Industrial Estate, Bang Kradi Industrial Estate, Bang poo industrial Estate, Amata Nakorn Industrial Estate, and Lat Krabang Industrial Estate (331 places in total). The population was qualified scholars, factory production managers, assistant production managers, production managers, assistant production department managers, and equivalent positions. The researcher selected and sampled by means of selecting a specific model (purposive sampling). For quantitative research, the research sample was selected from the population of industrial production managers who had working experience more than 5 years. The factory has been operating for at least 3 years and has 100 staff members or more. They were a group of 500 production managers in industrial production sections from 204 factories.

2) Qualitative research

The population used in the seminar was qualified scholars, factory production managers, assistant production managers, production managers, assistant production department managers, and equivalent positions. The searcher sample was a group of six people from above population. The researcher selected and sampled by means of selecting a specific model (purposive sampling).

B. Research Instruments

Questionnaire was employed to elicit information about the personal status of respondents, such as gender, age, educational attainment, job position, work experience, and digital performance in the current operations of the manufacturing managers in industrial plants.

The interview was conducted with the executive managers to elicit information about digital performance and competency that are relevant for the position as manager to increase its quality, as designed and expected for the successful operation of the management in the industrial plant.

C. Statistics Used in Data Analysis

The Number and Percentage (Percentage) was used to analyze each personal characteristics. Mean ($\bar{x}$) and standard deviation (S.D) are used to analyze and describe the level of digital performance.In addition, Factor Analysis was employed by using Exploratory Factor Analysis and explaining the component of digital performance components of production managers in industrial plants.

IV. Research Results

A. Personal Data Analysis Results

Most of the respondents were 403 males (80.6%) and 97 females (19.4%).

The majority of respondents aged between 36-45 years (315 people; 63%), followed by the age below 36 years, most of which were 109 people (21.8%) and over 45 years of age, 76 people (15.2%).

In the education level, most respondents had the level of education of bachelor's degree at the highest level. There were 378 people (59%), followed by a master's degree, 94 people (18.8%), and lower than bachelor's degree of 28 people (5.6%).

For work experience, most respondents had 11-15 years of work experience, 166 people (33.2%), followed by working experience 5-10 years, 163 people (32.6%), work experience 16-20 years, 138 people (27.6%), and work experience over than 21 years, 33 people (6.6%).

B. The Analysis Results of the Digital Competency Level of the Production Managers in the Industrial Factory

For the digital competency level of the industrial production managers, it was revealed that the level of digital performance in the overall picture is at a high level. However, when considering the variables with the mean ($\bar{x}$) at the highest level, 4 variables are 1) information management, 2) digital communication management, 3) digital knowledge management, and 4) assessing and solving digital problems, respectively.

C. The Results of the Needs Survey of Digital Competencies in the Operations of the Manufacturing Managers in Industrial Plants

From the seminar organized by the focus group of experts on the needs, expectations, in digital competencies in the operations of the production managers in industrial plants, it was found that the production managers in the industrial factory need to be able to perform as required in the digital industry which includes 1) the ability to use internet connection technology, 2) competency in innovation development, and 3) competency in marketing data analysis.

V. Discussion and Conclusion

Based on the study of digital competencies of industrial production managers by studying, analyzing data from studies, documents and research related to digital competencies, then researched by exploring the digital competencies of the manufacturing managers in the industry from the production manager, and interviewing experts with expertise in digital competencies in the industry, the researcher found that the production managers in the industrial factory need to have to use all four core digital competencies consisting of 1) information management, 2) digital communication management, 3) digital knowledge management, and 4) assessing and solving digital problems. All competencies rely on core competencies, such as knowledge management that will enable knowledge to innovate (Phuangkamnerd, Nilsook, Thamrongviwanna, & Phuangkamnerd, 2015) and information management that will lead to data management processes for agencies in response to work and having work data (Thanachawengsakul, Wannapiroon, & Nilsook, 2019). The management decisions require more information than feelings and must have competency in information management, especially in the digital age where there is a lot of information, and this information must be screened for work benefits (Anupan, Nilsook & Wannapiroon, 2016).

Moreover, regarding the development of digital competency of the industrial production managers, From the seminar on the components of digital competency of industrial production managers by a focus group discussion of experts, it was revealed that the industrial production managers need to have and use digital competency in all 4 competencies since they would promote the digital industry operations in accordance with the 4.0 industrial development guidelines for 20 years (2019 - 2036) of the Ministry of Industry and follow the 20-year national strategy with efficiency and effectiveness. Additionally, the experts also gave opinions and recommendations that industrial production managers should have two additional digital capabilities, which are 1) digital safety and 2) digital specific operations.

VI. Research Suggestions

The researcher has two suggestions: general recommendations and suggestions for further research.

A. General Suggestion

Industrial production managers should focus on the development of digital competencies seriously by creating guidelines for human resource development by using concrete and clear competency principles in the organization's development and training plans.

B. Suggestions for Further Research

1) There should be a research study on finding digital competencies in the performance of personnel at the executive level, the supervisor, and important and potential staff of other organizations that is not the target group assigned by the researcher in the organization in order to reduce labor shortages in important positions and to develop the work progress for the employees as well.

2) There should be research studies on finding digital competencies and significant operational performance of production managers in other industries in order to verify the research results.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Mr. Manoch Suphapanworakul conducted the research, analyzed the data, and wrote the paper; Ms. Wareerat Kaewurai and Mr. Prachanan Nilsook worked as advisors; all authors had approved the final version.

Acknowledgment

Digital Competencies for the Production Manager in the Factory was well executed because of the all-out support coming from Associate Professor Dr. Wareerat Keaw-u-rai - Naresuan University, Associate Professor Dr. Pratchanan Nilsuk, - King Mongkut's University of Technology North Bangkok who always offers and gives good advice, and Teacher Kritsanapong Lertbamrungchai - Rajamangala University of Technology Thanyaburi who always helps and coordinates with research information. Moreover, I would like to thank all experts who have sacrificed their time in in-depth interviews.

References

[1] Office of the National Economic and Social Development Board, The Twelfth National Economic and Social Development Plan (2017-2021), Thailand, p. 6, 2016.
[2] Ministry of Industry, *Thailand Development Strategy 4.0*, Thailand, 2016.
[3] Ministry of Industry, *National Strategy 2018*-2037, Thailand, 2011.
[4] Institute of Development Research Institute of Thailand, *The Development of Digital Manpower for S-Curve and Eastern Economic Corridor (EEC*), Thailand, 2018.
[5] K. Ala-Mutka, *Mapping Digital Competence: Towards A Conceptual Understanding*, European Commission, JRC-IPTS, Seville, 2011.
[6] OECD, "Innovating education and educating for innovation," *Power of Digital Technologies and Skills*, Paris: OECD Publishing, 2016.
[7] D. Valsamis, A. De Coen, V. Vanoeteren, and W. Van der Beken, *Employment and Skills Aspects of the 'igital Single Market Strategy*, European Parliament, Study for the EMPL Committee, Europäische Union., 2015.
[8] R. T. Ngamchit-anan, *Thailand Education Journal*, Thailand, 2018, p. 6.

Manoch Suphapanworakul was born in Thailand in 1978. He received the B.Sc degree in industrial technology (mechanics) from Rajabhat Institute Phetchaburi, Thailand in 2001 and the M.SIE degree in computer and information technology from King Mongkut's University of Technology Thonburi, Thailand in 2007. From 2014 to 2015, he joined Deestone Group Company Limited, Thailand. From 2015 to 2018, he joined Ichitan Public Company Limited, Thailand. Since 2018, he has been with Panus Assembly Company, Thailand, where he currently works as a human resource manager. His main areas of research interest are human resource development and human resource management, curriculum and instruction development, and digital industry.

Wareerat Kaewurai was born in Thailand in 1966. She received the B.Ed. degree in biological and physical science from Srinakarinwirot University, Thailand in 1989. She received the M.Ed. degree in science education from Chiang Mai University, Thailand, in 1987, and received the Ph.D degree in curriculum and instruction from Chulalongkorn University, Thailand, in 1999. Since 1993, she has been a lecturer with Naresuan University, Thailand, where she currently works as an associate professor at the Faculty of Education. Her main areas of research interest are curriculum and instruction development and teachers networking.

Prachanan Nilsook was born in Thailand in 1965. He received the B.Ed. degree in audio-visual education from Ramkhamhang University, Thailand in 1989, received the M.Ed. degree in educational technology from Srinakarinwirot University Prasarnmitra, Thailand in 1995, and received the Ph.D. degree in educational communications and technology from Chulalongkorn University, Thailand in 2001. Since 1987, he has been with Naresuan University, Thailand, where she currently works as a lecturer at the Faculty of Technical Education. His main areas of research interest are information and communication technology, educational technology, imagineering and information technology in education.