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COMPETENCIES OF SMEs EXECUTIVES IN THE INDUSTRY 4.0 ERA

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Abstract

Executive competencies play a crucial role in any organization, as executives play a pivotal role in driving success, particularly in the context of Industry 4.0, where technology has revolutionized production processes and business management models. The objective of this research was to conduct a Confirmatory Factor Analysis of the competencies possessed by small and medium business executives operating in the industry 4.0 era. Data were collected through interviews and questionnaires administered to experts and executives. The analysis encompassed content analysis, frequency, percentages, exploratory factor analysis, and confirmatory factor analysis. The research findings revealed that the competencies of SMEs executives in Industry 4.0 can be categorized into three main components: knowledge, skills, and attributes. Within these, there are nine sub-components, including 1) proficiency in marketing and corporate communications, 2) expertise in production, network establishment, and staff development, 3) knowledge of innovation and leadership in the transition to digital organizations, 4) proficiency in information accessibility and digital marketing skills, 5) proficiency in business networking, human resource development, and electronic tool utilization, 6) skillfulness in production quality control, data analysis, and new product development, 7) proficiency in cultivating strong relationships and demonstrating commitments to work, 8) proficiency in leadership and decision-making, and 9) the ability to pursue business opportunities. These findings align with empirical data, exhibiting a good fit with indices such as $\chi^2/df = 2.46$, GFI =0.97, AGFI = 0.93, CFI =0.99, and RMSEA = 0.06.

Keywords: Executive Competency, SMEs, Industry 4.0

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Introduction

Thailand's economic system heavily relies on exports. In April 2023, Thai exports amounted to 21,723.2 million US dollars. Although this represented a 7.6 percent decrease, it still exceeded the average for April over the past five years. The primary reason for this decline can be attributed to the global economic slowdown resulting from high inflation. The rise in interest rates, influenced by banking crises in the United States and the European Union, has adversely affected consumer purchasing power and confidence (Trade Policy and Strategy Office, 2023). The majority of Thailand's industrial output contributing to the GDP comes from manufacturing industries focused on exports. Consequently, Thailand possesses substantial economic potential within the industry, ranking 35th in the world among 64 countries and second among ASEAN nations. Notably, seven Thai industries are among the top 15 globally, including coking coal and petroleum refining products, rubber and plastic manufacturing, food and beverage production, healthcare, art-related businesses, entertainment and recreation retail, wholesale operations, and the clothing and accessories sector, as depicted in Figure 1. In a comparison with 13 countries in the Asia-Pacific region, Thailand's industry ranks among the top three, particularly in the rubber and plastic industries, food and beverage production, and healthcare (Charuchart, 2021). These industries serve as a robust foundation for all sectors, with small and medium-sized enterprises (SMEs) forming the cornerstone of the supporting industry.

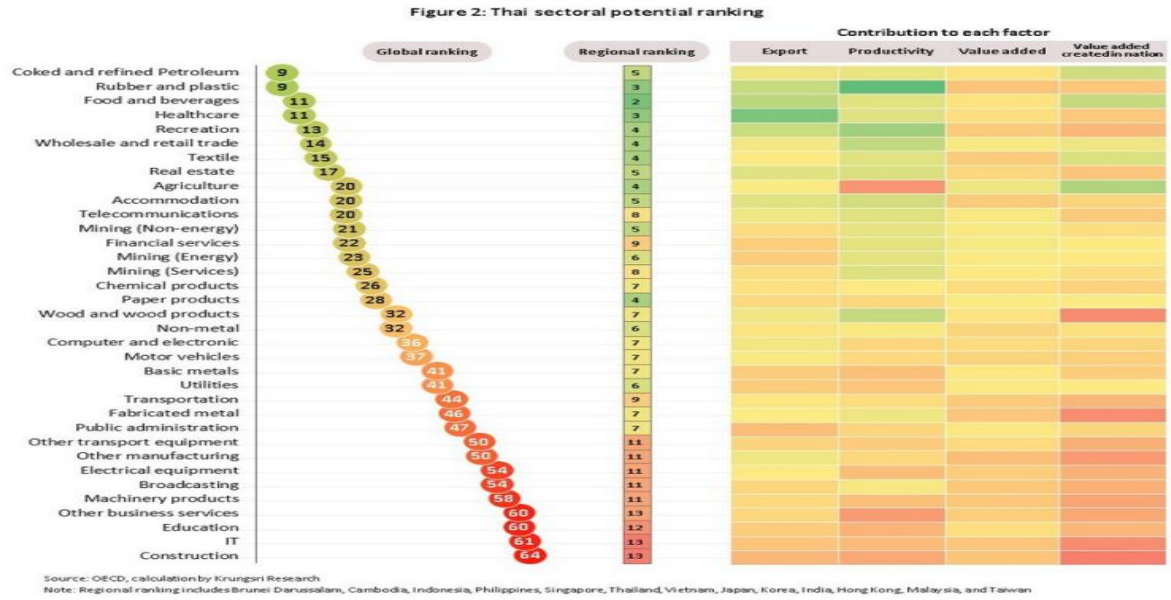


Figure 1 Thai sectoral potential ranking
Source: Charuchart (2021)

Historically, the industry has experienced significant shifts driven by technological advancements and innovation. These transformative periods are often referred to as Industrial Revolutions, each characterized by distinct technological breakthroughs. The First Industrial Revolution was marked by the use of machines, followed by the Second Industrial Revolution, which harnessed electrical energy. The Third Industrial Revolution saw the integration of electronics and automation (Lasi et al., 2014). In recent years, the term "Industry 4.0," also known as the Fourth Industrial Revolution, has gained substantial attention. It represents a concept that encapsulates the ongoing changes in technology and business organization. This evolution encompasses the integration of value chains, the introduction of new business models, and the utilization of technology in the development of products and services. Industry 4.0 fundamentally shifts the nature of leadership, moving away from traditional, time-bound

job duties towards the creation and delivery of innovative cyberspace initiatives. The realization of technological and organizational transformation under Industry 4.0 hinges on the guidance of Industry 4.0 leaders, who must steer organizations through the process of digital transformation, identify the direction of change, and inspire and support their employees (Kwiotkowska et al., 2021). It is worth noting that the concept of Industry 4.0 originated in developed countries, including industrialized nations in Europe, the United States, Japan, and Korea. These countries have been actively researching and developing high technology to prepare for Industry 4.0 for many years. In contrast, many industries in Thailand are still operating at the 2.0 and 3.0 levels of technological advancement (Office of Industrial Economics, 2019).

Promoting industrial development for sustainable growth necessitates the enhancement of executive capabilities, as executives serve as the driving force behind the industrial economy. Therefore, it is imperative to cultivate leadership skills at every organizational level. Many entities have invested in the potential of individuals and organizations to not only survive but thrive in the Industry 4.0 era. This development should prioritize fortifying the nation's existing resources to wield sufficient influence in propelling the national development process. Particularly, emphasis should be placed on empowering the human capital, reinforcing an environment conducive to nurturing high-quality individuals capable of adapting to future technological shifts (Soontornwipat et al., 2020). For clear and effective guidance, it is crucial to formulate competency models tailored to the specific organizational context, serving as a blueprint for business practices and organizational management (Rimcharone & Photchanachan, 2022). Consequently, various sectors are devoted to enhancing the competencies of executives at all levels, encompassing knowledge and expertise spanning development, production, and management stages, ultimately culminating in business innovation that propels the organization towards becoming an Innovation-Driven Enterprise (IDE). Given these considerations, conducting a study on the competencies of SMEs executives in the industry 4.0 era proves highly beneficial for organizations. The insights garnered from such research can be instrumental in evaluating, planning, and providing training for existing executives, thereby equipping them with enhanced competencies to drive organizational success.

Literature Reviews

Executive Competency

The concept of competency, as elucidated by various academics, largely aligns with McClelland's framework. This framework illustrates the interplay between the components of competency, resulting in commendable behavior and outstanding outcomes. Parry (1997), for instance, defines competency as a combination of knowledge, skills, and attributes pertinent to the core responsibilities of a specific role. This amalgamation of knowledge, skills, and attributes is directly correlated with performance in that particular position and can be objectively assessed against established benchmarks (Suthamdee & Suthamdee, 2017). Smithikrai (2013) categorizes personnel competency into three distinct types: 1) Core Competency, which encompasses the essential competency shared by all personnel, irrespective of their position. 2) Functional Competency, encompassing the knowledge and skills requisite for tasks within a specific line of work. 3) Role Competency, concerning the competencies imperative for personnel at the management level to proficiently fulfill executive duties and responsibilities. Competency serves as a tool for gauging and overseeing success in an organization's business operations. The competency of executives is intricately tied to the growth and sustainability of the organization (Sajilan & Tehseen, 2015). This research places a focal point on executive competency, synthesized from pertinent concepts and research findings. It includes crucial executive competencies such as the ability to seize opportunities

for creating value, adeptness in building relationships and networks, systematic management skills, and strategic decision-making (Ahmad et al., 2011; Man et al., 2008; Li et al., 2009). Additionally, it encompasses attributes like commitment and mindset (Man et al., 2002), creativity and innovation (Zarefard & Cho, 2017; Grzybowska & Łupicka, 2017; Li et al., 2009), effective communication skills (Baron & Markman, 2003), relationship building and continuous learning (Sakib et al., 2022), teamwork (Bartram, 2012; Grzybowska & Łupicka, 2017), proficiency in Information and Communication Technology (Bartram, 2012), and multi-faceted leadership and decision-making capabilities (Bartram, 2012; Boyatzis, 2008; Grzybowska & Łupicka, 2017).

Therefore, it can be concluded that competency encompasses the knowledge, skills, and attributes requisite for proficient job performance, aiming to achieve outcomes under specified standards or surpassing them.

Research Methodology

This study employed a mixed-methods approach, combining qualitative research and quantitative research techniques. The study population and samples were divided into two distinct groups. The first group, consisting of key informants, comprised 100 executives or experts. The second group, providing quantitative data, was composed of executives from SMEs in the food industry located in the Southern region. The sample size was determined using the formula proposed by Krejcie & Morgan (1970), resulting in a total of 241 cases. This sample size was chosen to enhance the reliability of statistical estimations, particularly in preparation for the use of component analysis in the research. Denis (2021 cited in Chomeya et al., 2022), recommends a minimum sample size of 300 or more for conducting compositional analysis. In light of this recommendation, the researcher opted for a sample size of 350 individuals in this study. The data analysis encompassed content analysis, frequency, and percentage analysis, as well as Exploratory Factor Analysis (EFA) employing Principal Component Analysis with an Orthogonal model, Varimax rotation, along with the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) to assess the suitability of the data for factor analysis. Additionally, Confirmatory Factor Analysis (CFA) was conducted using specialized research programs to validate the structural integrity of the models using empirical data.

Research Results

Level of opinions on competency under the main components of competency of SMEs executives in the industry 4.0 era

The development of competency of SMEs executives in the industry 4.0 Era, overall, is shown in Table 1. Table 1 revealed that respondents expressed their opinions regarding business operations under the main components of SMEs executives in the industry 4.0 Era, and, overall, the assessments were at a highest level ($\bar{\mathbf{X}}$ = 4.23, S.D. = 0.49).

Table 1 Mean, standard deviation, and opinion level regarding the main components of competency of SMEs executives in the industry 4.0 era

Assessed Issues	$\bar{X}$	S.D.	Importance level
Knowledge	4.22	0.50	Highest
Skills	4.24	0.49	Highest
Attributes	4.23	0.48	Highest
Total	**4.23**	**0.49**	**Highest**

Competency components of SMEs executives in the era of industry 4.0

The competency components of SMEs executives in the industry 4.0 era, specifically in the domain of knowledge, were analyzed. Through statistical data analysis to assess the suitability of the data, it was determined that the Kaiser-Meyer-Olkin (KMO) measure was 0.925, with a statistically significant value of 0.000. This indicated that the data was well-suited for factor analysis. The knowledge competencies encompassed fifteen variables, with component weights ranging from 0.432 to 0.749. These variables could be categorized into three sub-components: marketing knowledge and corporate communication, production knowledge, networking and human resource development, as well as knowledge of innovation and leadership in the transition to digital organizations.

The competency components of SMEs executives in the industry 4.0 era, specifically in the domain of skills, were analyzed. Through statistical data analysis to assess the suitability of the data, it was determined that the Kaiser-Meyer-Olkin (KMO) measure was 0.923, with a statistically significant value of 0.000. This indicated that the data was well-suited for factor analysis. The skill competencies encompassed fourteen variables, with component weights ranging from 0.456 to 0.800. These variables could be categorized into three sub-components: proficiency in accessing information and digital marketing, adeptness in business networking, business networking, human resource development and electronic tool use, production quality control, data analysis, and new product development.

The competency components of SMEs executives in the industry 4.0 era, specifically in the domain of attributes, were analyzed. Through statistical data analysis to assess the suitability of the data, it was determined that the Kaiser-Meyer-Olkin (KMO) measure was 0.867, with a statistically significant value of 0.000. This indicated that the data was well-suited for factor analysis. The attribute competencies encompassed thirteen variables, with component weights ranging from 0.354 to 0.864. These variables could be categorized into three sub-components: the ability to build strong relationships and demonstrate commitment to work, proficiency in leadership and decision-making, and a proactive approach to identifying and pursuing business opportunities.

Table 2 summarizes the results of the analysis of the competency components of SMEs executives in the industry 4.0 era by the exploratory component analysis (EFA) method.

Table 2 Summarizes the results of the exploratory composition analysis

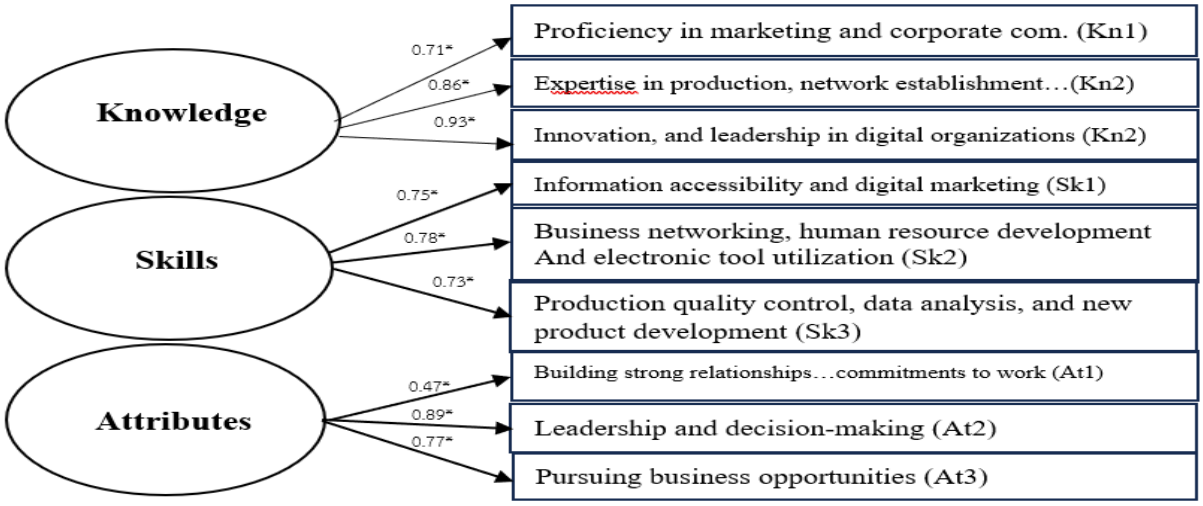
Main Components	Sub-Components	No. of Variables
1) Knowledge	1.1) Proficiency in marketing knowledge and corporate communication 1.2) Expertise in production, network establishment, and staff development 1.3) Knowledge of innovation and leadership in the transition to digital organizations	15
2) Skills	2.1) Proficiency in information accessibility and digital marketing skills 2.2) Proficiency in business networking, human resource development, and electronic tool utilization 2.3) Skillfulness in production quality control, data analysis, and new product development	14
3) Attributes	3.1) Ability to build strong relationships and demonstrate commitment to work 3.2) Proficiency in leadership and decision-making 3.3) Ability to pursue business opportunities	13

SMEs executive competency model in the industry 4.0 era

The results of the analysis of the competency components of SMEs executives in the industry 4.0 era have been prepared as shown in Figure 1.

Figure 1 SMEs Executive Competency Model in the Industry 4.0 Era

Confirmatory factor analysis of the competencies of SMEs executives in the industry 4.0 era



Chi-square = 46.92, df = 19, GFI = 0.97, RMSEA = 0.06
*P < 0.05

Figure 2 competency components of SMEs executives in the industry 4.0 era

Figure 2 revealed the results of a SMEs executive competency model in the industry 4.0 era. When considering the fit index the chi-square value (χ^2) was equal to 46.92, the relative chi-square value (χ^2/df) was equal to 2.46, the Goodness of the Fit Index (GFI)) was equal to 0.97, Adjusted Goodness of Fit Index (AGFI) was equal to 0.93, the Comparative Fit Index (CFI) was equal to 0.99, the Root Mean Square Error of Approximation (RMSEA) was equal to 0.06, the Root Mean Square Residual (RMR) was equal to 0.01, indicating that the confirmatory components of the competency of SMEs in the Industry 4.0 Era developed in harmony with empirical data as shown in Table 3.

Table 3 Results of statistical analysis testing the harmony of the model with empirical data

Index Value	Consideration Criteria	The Value Obtained	Consideration Results
χ^2/df	<3	2.46	Passed
GFI	≥0.90	0.97	Passed
AGFI	≥0.90	0.93	Passed
CFI	≥0.90	0.99	Passed
RMR	<0.08	0.01	Passed
RMSEA	<0.08	0.06	Passed

When examining the validity of the competency model for SMEs executives in the industry 4.0 era, it was observed that the knowledge competency (KN) encompassed three variables, all of which displayed positive factor loadings. Among these, the variable related to innovation knowledge and leading the organization towards digital transformation (Kn3) held the highest importance (Factor Loading = 0.93). It exhibited a substantial co-variation with knowledge competencies, amounting to 86 percent. Following closely was production knowledge, network building, and human resource development (Kn2) (Factor Loading = 0.86), which also showed a co-variation with knowledge competency of 74 percent. Marketing and corporate communication knowledge (Knl) (Factor Loading = 0.71) displayed a co-variation with knowledge competency of 50 percent. Skill competency (SK) comprised three variables, all demonstrating positive factor loadings. The variable concerning about business networking skills, human resource development, and the utilization of electronic tools (Sk2) held the highest significance (Factor Loading = 0.78), exhibiting a co-variation with skill competencies of 61 percent. Following this, skills in accessing information and digital marketing (Sk1) (Factor Loading = 0.75) displayed a co-variation with skill competency of 56 percent. Production control skills, quality data analysis, and new product development (Sk3) (Factor Loading = 0.73) showed a co-variation with skill competency of 53 percent. Attributes (AT) included three variables, all of which presented positive factor loadings. Leadership and decision-making variables (At2) were deemed the most crucial (Factor Loading = 0.89), showing a co-variation with attributes of 79 percent. Pursuing business opportunities (At3) (Factor Loading = 0.77) exhibited a co-variation with attribute competency of 59 percent. Building good relationships and demonstrating commitment to work (At1) (Factor Loading = 0.47) displayed a co-variation with attributes of 22 percent. These findings are summarized in Table 4.

Table 4 Results of the validation of the competency model for SMEs executives in the industry 4.0 era.

Components/Variables	Factor Loading			R^2
	b	S.E.	Beta	
Knowledge				
Proficiency in marketing and corporate communications, (Kn1)	1.00	-	0.71	0.50
Expertise in production, network establishment, and staff development (Kn2)	0.94	0.07	0.86*	0.74
Knowledge in innovation, and leadership in digital organizations (Kn3)	1.26	0.09	0.93*	0.86
Skills				
Proficiency in information accessibility and digital marketing skills (Sk1)	1.00	-	0.75	0.56

Components/Variables	Factor Loading			R^2
	b	S.E.	Beta	
Proficiency in business networking, human resource development, and electronic tool utilization (Sk2)	1.13	0.09	0.78*	0.61
skillfulness in production quality control, data analysis, and new product development (Sk3)	0.99	0.07	0.73*	0.53
Attributes				
Proficiency in cultivating strong relationships and demonstrating commitment to work (At1)	1.00	-	0.47	0.22
Proficiency in leadership and decision-making (At2)	1.36	0.12	0.89*	0.79
Ability to pursue business opportunities (At3)	1.71	0.15	0.77*	0.59

*P < 0.05

Conclusion and Discussion

The results of this research found that the competency of SMEs executives in the Industry 4.0 era consists of three main components, and nine sub-components, including 1) proficiency in marketing and corporate communications, 2) expertise in production, network establishment, and staff development, 3) knowledge of innovation and leadership in the transition to digital organizations, 4) proficiency in information accessibility and digital marketing skills, 5) proficiency in business networking, human resource development, and electronic tool utilization, 6) skillfulness in production quality control, data analysis, and new product development, 7) proficiency in cultivating strong relationships and demonstrating commitments to work, 8) proficiency in leadership and decision-making, and 9) the ability to pursue business opportunities. The research results indicate that knowledge about innovation and organizational leadership is the most influential factor affecting executives' knowledge competencies. This is because Industry 4.0 represents an era of change in production systems and methods, which necessitates innovation and modern technology to drive the organization's operations. This finding aligns with Laorach (2021), who concludes that in the creation of goods and services, including new business formats, corporate executives must develop an operational plan to respond effectively to changes in the current competitive landscape. This is also in line with the research of Chuckpaiwong & Virunraj (2020), who found that the ability to generate innovations is a significant but often overlooked factor that influences business sustainability. Therefore, factors related to innovation and organizational leadership should be given the highest priority by executives in developing enterprise executive competencies in Industry 4.0. Leadership and decision-making come next in importance, as they are key attributes affecting the ability to address immediate problems, make informed decisions, and adapt to change. This finding resonates with the research of Kwiotkowska et al. (2021), which emphasizes the critical importance of leadership ability in navigating the challenges of the Industry 4.0 era, as it is a determining factor for executive success. Furthermore, it is consistent with the study by Hernandez-de-Menendez et al. (2020), which underscores that leadership and decision-making are pivotal competencies needed to develop personnel in the Industry 4.0 era, particularly for organizations aiming to thrive in this new environment.

In Industry 4.0, we find ourselves in an era of profound change. Executives must harness knowledge, creativity, innovation, and technology to drive sustainable business operations and foster growth. The competencies of SMEs executives within this transformative landscape encompass three main components and nine sub-components. To successfully navigate Industry 4.0, it is imperative to enhance the capabilities of existing executives. This involves a focus on three key knowledge-based sub-components: proficiency in marketing and corporate

communications, expertise in production, network establishment, and staff development, as well as knowledge of innovation and leadership in the transition to digital organizations. In terms of skills, three vital sub-components come to the fore: proficiency in information accessibility and digital marketing skills, adeptness in business networking, human resource development, and electronic tool utilization, and mastery in production quality control, data analysis, and new product development. Additionally, executives must embody three essential attributes: proficiency in cultivating strong relationships and demonstrating unwavering commitment to their work, proficiency in leadership and decision-making, and the acumen to identify and pursue promising business opportunities.

Recommendations

1) Organizations should invest in executive training to keep pace with the rapid technological advancements of Industry 4.0. This includes a focus on fostering individual and worker-level learning processes, recognized as a pivotal factor for achieving success and gaining a competitive edge for the organization.

2) To achieve the main goals of Industry 4.0, organizations should actively promote and prioritize innovation and the strategic utilization of technology. This approach will enable the creation of products and services with heightened value.

3) There is a need to broaden the scope of research in areas related to the development of leadership styles and executive decision-making in the context of Industry 4.0. Such research endeavors are essential for fostering continuous and sustainable development within organizations.

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