

Readiness and Skills in Adapting to Industry 5.0 of SMEs in Lower Central Region 1

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Abstract

This research aimed to study the readiness and skills of SMEs in the Lower Central Region 1 in adapting to Industry 5.0. The sample consisted of 400 SME entrepreneurs or business executives in the region. The results revealed that most SMEs still have small business structures, with fixed assets not exceeding 50 million baht and fewer than 50 employees. The importance given to adapting to digital technology was moderate (average 3.19). The highest importance was placed on adapting to digital technology (average 3.46), while the lowest was on automation in production processes (average 3.06). Overall readiness to enter Industry 5.0 was at a moderate level (average 3.10), with the highest readiness in AI, IoT, and Cloud (average 3.31), but low readiness in investment for organizational transformation toward Industry 5.0 (average 2.92).

The skill gap was found to be 0.589. Hypothesis testing using the t-test showed statistically significant differences at the .001 level for all skills. Emotional intelligence ($t = 8.738$, $p < .001$) and digital literacy ($t = 7.665$, $p < .001$) had the largest gaps, indicating high demand from entrepreneurs compared with the actual skills of employees. Although data analysis skills had the smallest gap ($t = 5.774$, $p < .001$), the difference was still statistically significant, reflecting the need for continuous development of these and other skills.

SMEs in the Lower Central Region 1 viewed Industry 5.0 as influencing competition in terms of quality and sustainability. However, SMEs in this region still face limitations in capital, human resources, and access to technology. The study suggests that the government should provide financial and digital infrastructure support, as well as training programs in soft skills and digital skills for employees, in order to enhance competitiveness and foster sustainable Growth of SMEs in the industry 5.0 era.

Keywords: 1) Readiness for Industry 5.0 2) Digital Transformation 3) Skill Gap 4) SMEs

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Introduction

The world is now entering Industry 5.0, which builds upon Industry 4.0 by integrating advanced digital technologies with human-centric approaches, societal value creation, and sustainable business practices. Industry 5.0 goes beyond automation and artificial intelligence to encompass sustainability, workforce engagement, and environmental responsibility (European Commission, 2021, p. 15).

Small and medium-sized enterprises (SMEs) play a vital role in driving the national economy, employing more than 13 million people, or about 70% of total employment. However, in today's digital era, SMEs must adapt to remain competitive and resilient. Key technologies influencing this transformation include advanced robotics, artificial intelligence (AI), the Internet of Things (IoT), cloud computing, big data analytics, 3D printing, and blockchain. These technologies affect employment, decision-making, innovation, efficiency, and transparency (OSMEP, 2023, p. 50; OECD, 2024, pp. 2-3).

According to the Office of Small and Medium Enterprises Promotion (OSMEP), in 2019 the number of SMEs in the Lower Central Region 1 was 127,966 enterprises, comprising 31,406 in Kanchanaburi, 38,361 in Nakhon Pathom, 32,445 in Ratchaburi, and 25,754 in Suphanburi. However, SMEs in the Lower Central Region 1 still face challenges such as limited access to digital technology compared with larger enterprises, delays in adopting digital tools, and a shortage of ICT professionals. Entrepreneurs also depend heavily on foreign

technologies and platforms, with limited local R&D or innovation (UNTAD, 2015, p. 55). Although there is government and private sector support, the growth of SMEs still depends on the vision and adaptability of entrepreneurs themselves. Thus, examining the readiness and adaptability skills of SMEs in this region to enter Industry 5.0 is critically important.

Research Objectives

1. To study the readiness of SMEs in the Lower Central Region 1 to adapt to Industry 5.0.
2. To examine the skills required for Industry 5.0 as prioritized by entrepreneurs and assess the current skill levels of SME employees.
3. To compare the differences in mean values between the skills entrepreneurs emphasize and the actual skills employees currently possess.

Literature Review

Industry 5.0 Concept

Industry 5.0 builds on Industry 4.0's emphasis on connectivity, big data, and automation, shifting toward balancing digital technology with human creativity (human-machine collaboration). The European Commission (2021, p. 15) defines Industry 5.0 as the integration of technological innovation, research, and industrial development with sustainability, human-centricity, and resilience to global challenges.

1. Human-Centricity Technology is not meant to replace humans but to augment their capacity and creativity. Tools such as collabo-

rative robots (cobots), AI, and augmented reality (AR) reduce repetitive and dangerous work, allowing humans to focus on innovation and customer-centered products (Ghobakhloo, et al., 2023, p. 7, pp. 11-12).

2. Sustainability Industry 5.0 emphasizes environmentally responsible production, renewable energy use, efficient resource utilization, and circular economy models, aligning with consumer demand for corporate responsibility (Ghobakhloo, 2022, pp. 716-717).

3. Resilience The COVID-19 pandemic highlighted the vulnerability of global supply chains. Industry 5.0 advocates designing supply chains and production processes that adapt quickly by combining digital analytics with human strategic decision-making (Nazarejova, Soltysova and Rudeichuk, 2024).

SMEs and Adaptability

SMEs account for over 90% of businesses worldwide and are significant job creators (OECD, 2019, p. 30). However, they face capital constraints, limited access to advanced technologies, and shortages of highly skilled labor (World Bank, 2020, pp. 7, p. 11). Despite these challenges, SMEs are agile and flexible, enabling them to adapt in uncertain environments. Leadership vision, digital skills, and organizational development are key factors in enhancing adaptability (Bouwman, Nikou and De Reuver, 2019, pp. 1-2; Haseeb, et al., 2019, pp. 4-16).

Skills for industry 5.0

Key competencies for this era include

- Digital literacy : Accessing, analyzing, and creating digital information using ICT, essential for adopting AI, IoT, and big data (Vu

and Hartley, 2018, p.849).

- Creativity, innovation, and problem-solving : Crucial for responding to complex market demands and developing personalized, value-added solutions (Florida, 2014, p. 197).

- Lifelong learning : The ability to continually acquire new skills, including technical, social, and emotional, to balance human-technology collaboration (European Commission, 2021, pp. 16-18).

The problem of Digital Transformation and skill gaps among entrepreneurs

The problem of readiness among entrepreneurs was mainly associated with limited budgets, inadequate technological infrastructure, and insufficient strategic planning for Industry 5.0 adoption. At the same time, the problem of skills was reflected in the gap between the competencies required by entrepreneurs and the actual capabilities of employees, especially in digital, analytical, and adaptive skills. These findings indicate that readiness and skills are interrelated, since organizational transformation cannot be achieved effectively without both managerial preparedness and employee capability.

Research Framework

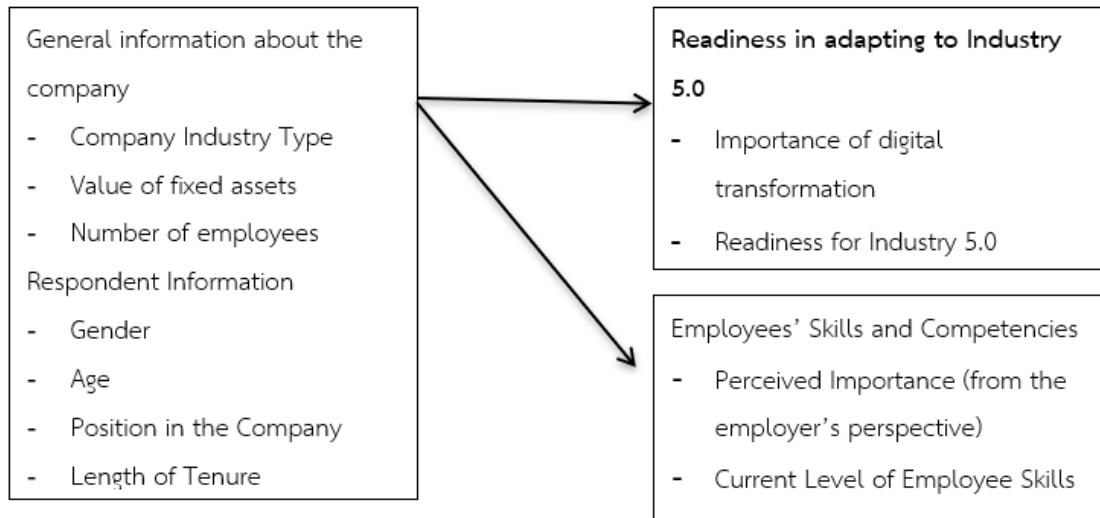


Figure 1 Conceptual framework of the research

Research Methodology

Population and Sample

The population of this study consists of 127,966 entrepreneurs or executives of SMEs in the lower central region 1 of Thailand, covering the provinces of Kanchanaburi, Nakhon Pathom, Ratchaburi, and Suphanburi.

Data Collection

The sample consisted of 400 SME entrepreneurs. The sample size was determined using Taro Yamane's formula (Yamane, 1973, pp. 886-887) at a 95% confidence level and a 0.05 margin of error. Stratified sampling was employed to select participants from SME entrepreneurs or executives in the lower central region 1 of Thailand, with 100 companies from each province, from a total population of approximately 127,966 entrepreneurs.

The questionnaire consisted of the following sections.

1. General Information about the Respondent's Company includes the type of industry according to economic activity classification standards, the amount of fixed assets,

and the number of employees.

2. Respondent Information includes gender, age, position in the company, and duration in the current position.

3. Importance of Digital Transformation covers adaptation to digital technologies, use of automation in production processes, digital training for employees, and investment in new technology systems.

4. Readiness for Industry 5.0 includes awareness of the Industry 5.0 concept, planning for its implementation, adoption of technologies such as AI, IoT, or Cloud Computing, and readiness to invest in organizational improvements toward Industry 5.0.

5. Skills for Industry 5.0 includes the skills considered important by entrepreneurs and the current skill levels of employees in six areas: analytical and synthetic thinking, problem-solving, creativity, teamwork, emotional maturity, digital skills, data analysis, and specialized technical competence.

6. Additional Opinions on Industry includes respondents' perspectives on the

impacts of Industry 5.0 and their comments on statements related to Industry 5.0.

Questions in Sections 1 and 2 are closed-ended with a single response option. Questions in Sections 3, 4, and 5 use a 5-level Likert scale to measure the level of importance, where 1 represents the lowest level of importance and 5 represents the highest. Section 6 consists of open-ended questions.

Instrument quality

For content validity assessment, the questionnaire was reviewed by three experts to evaluate the quality and relevance of the 16 items. The Index of Item-Objective Congruence (IOC) values ranged from 0.767 to 1.000 across all 35 items, indicating acceptable content validity (Rovinelli and Hambleton, 1977, pp. 49-60). The questionnaire was then pilot tested with 30 respondents who had characteristics similar to those of the target sample. Subsequently, the reliability of the instrument was examined using Cronbach's alpha coefficient. The 16 items measuring the Readiness in adapting to Industry 5.0 and Employees' Skills and Competencies. A reliability coefficient of 0.856, indicating a high level of internal consistency (Cronbach, 1951, pp. 297-334)

Data Analysis

Data were collected from 400 entrepreneurs or executives of SMEs representing 400 companies. The responses from the 400 completed questionnaires were categorized and analyzed by converting the variables of interest into quantitative data and assigning numerical values for coding. The coded data were then processed and analyzed using a computer with the Statistical Package for the

Social Sciences (SPSS). The analysis procedures were as follows:

1. Analysis of General Information and Business Readiness for Industry 5.0

Descriptive statistics, specifically frequency distribution, number, and percentage, were used to analyze the general characteristics of the companies, the demographic information of respondents, and the readiness of businesses to transition into Industry 5.0. For variables related to the importance of digital transformation and opinions toward Industry 5.0, mean scores were calculated and interpreted using the following scale : 1.00 – 1.80 = very low, 1.81 – 2.60 = low, 2.61 – 3.40 = moderate, 3.41 – 4.20 = high, 4.21 – 5.00 = very high. (Boonchom, 2002, p. 162).

2. Analysis of Skills for Industry 5.0

Primary data from the questionnaires were used to analyze the six key skills considered important by entrepreneurs and the existing skill levels of employees. A t-test was employed to examine the differences in mean values between the importance assigned to each skill by entrepreneurs and the actual skill levels demonstrated by employees.

Skill gaps = Perceived Importance (from the employer's perspective) - Current Level of Employee Skills

3. Analysis of Open-Ended Questions

The open-ended responses were analyzed using content analysis and are summarized in Table 7. All 400 respondents answered these questions, indicating a 100% response rate. Responses were reviewed, coded, and grouped into thematic categories based on similarity of meaning, and the frequencies



shown in the table represent the number of responses classified under each theme.

Results

The findings were divided into two main parts. The first part reported the general information of the companies, and the re-

spondents in the conceptual framework. The second part presented the research results according to the three research objectives of the study

1. General Information

Table 1 Number of Samples Classified by Industry Type, Fixed Assets, and Employment Size

Type			Number of employee			total	Percent
			Less than 15	15 – 50	More than 50		
Agriculture and Food	Assets	Less than 5 million baht	19	12	5	36	9.00
		5 – 50 million baht	14	22	6	42	10.50
		More than 50 million baht	11	7	3	21	5.25
Sub total			44	41	14	99	24.75
Tourism	Assets	Less than 5 million baht	8	8	4	20	5.00
		5 – 50 million baht	5	9	1	15	3.75
		More than 50 million baht	2	2	1	5	1.25
Sub total			15	19	6	40	10.00
Health and Medical	Assets	Less than 5 million baht	9	6	2	17	4.25
		5 – 50 million baht	7	15	4	26	6.50
		More than 50 million baht	7	3	0	10	2.50
Sub total			23	24	6	53	13.25
Manufacturing Industry	Assets	Less than 5 million baht	26	31	18	75	18.75
		5 – 50 million baht	35	27	7	69	17.25
		More than 50 million baht	8	14	4	26	6.50
Sub total			69	72	29	170	42.50
Others	Assets	Less than 5 million baht	3	7	6	16	4.00
		5 – 50 million baht	6	4	2	12	3.00
		More than 50 million baht	5	3	2	10	2.50
Sub total			14	14	10	38	9.50
All types included	Assets	Less than 5 million baht	65	64	35	164	41.00
		5 – 50 million baht	67	77	20	164	41.00
		More than 50 million baht	33	29	10	72	18.00
Total			165	170	65	400	100.00

From Table 1, it is evident that the business sector with the highest proportion is manufacturing, accounting for 42.50 percent, followed by the agriculture and food sector at 24.75 percent. In contrast, businesses in tourism, healthcare and medical services, and other categories each represent less than 15 percent. Considering fixed assets, the majority of enterprises hold assets not exceeding

50 million baht, representing 82 percent of the sample. In terms of employment, most businesses employ no more than 50 workers, accounting for 83.75 percent. These findings reflect the sample structure, which is predominantly composed of SMEs in the manufacturing and agriculture–food sectors that play a significant role in the regional economy.

Table 2 Respondent Information

Respondent Information	Number	Percentage
1. Gender	400	100.0
1.1 Male	196	49.0
1.2 Female	204	51.0
2. Age	400	100.0
2.1 Below 30 years	103	25.8
2.2 31–40 years	146	36.5
2.3 41–50 years	97	24.3
2.4 Above 50 years	54	13.5
3. Position in the Company	400	100.0
3.1 Business Owner	142	35.5
3.2 Senior Executive	79	19.8
3.3 Middle Management	102	25.5
3.4 Junior Management / Others	77	19.3
4. Length of Tenure	400	100.0
4.1 Less than 3 years	114	28.5
4.2 3–5 years	111	27.8
4.3 More than 5 years	175	43.8

The respondent profile shows a balanced gender distribution, with 49.0% male and 51.0% female participants. The largest age group was 31–40 years (36.5%), followed by below 30 years (25.8%), 41–50 years (24.3%), and above 50 years (13.5%). In terms of position, business owners accounted for the largest

group (35.5%), followed by middle management (25.5%), senior executives (19.8%), and junior management/others (19.3%). Regarding tenure, most respondents had worked for more than 5 years (43.8%), while 28.5% had less than 3 years of experience and 27.8% had 3–5 years. Overall, the sample reflects diverse



respondent characteristics across gender, age, organizational position, and work experience, providing a broad basis for the analysis.

2. The research results according to the three research objectives of the study

2.1 SMEs' Readiness for Industry 5.0 Adaptation in the Lower Central Region 1

Table 3 The company's level of importance to digital transformation

Subject	Mean	Standard deviation	Level of importance
Adaptation to Digital Technologies	3.46	1.17	high
Use of Automation in Production Processes	3.06	1.24	moderate
Digital Training for Employees	3.10	1.19	moderate
Investment in New Technologies	3.17	1.19	moderate
Overview	3.19	0.58	moderate

Table 3 illustrates the level of importance that companies assign to digital transformation, which overall is at a moderate level (Mean = 3.19, S.D. = 0.58). The most highly emphasized aspect is adaptation to digital technology (Mean = 3.46), reflecting firms' awareness of the structural changes brought about by modern technologies. In contrast, the least emphasized aspect is the use of automation in production processes (Mean = 3.06), indicating that businesses still face limitations

in adopting automation, possibly due to high investment costs and workforce readiness. Meanwhile, digital training (Mean = 3.10) and investment in new technologies (Mean = 3.17) are also at a moderate level, demonstrating firms' efforts to enhance workforce capabilities and strengthen digital infrastructure. Although these aspects are not yet emphasized at a high level, they represent a direction that reflects organizational readiness for digital transformation.

Table 4 Readiness for Industry 5.0

Subject	Mean	Standard deviation	Level of Readiness
Awareness of Industry 5.0 Concepts	3.14	1.19	moderate
Planning for Industry 5.0 Adoption	3.04	1.2	moderate
Utilization of AI, IoT, or Cloud Computing	3.31	1.21	moderate
Willingness to Invest in Industry 5.0 Transformation	2.92	1.24	moderate
Overview	3.10	0.60	moderate

Table 4 presents the analysis of firms' readiness to transition into Industry 5.0. The overall mean score is 3.10 (S.D. = 0.60), indicating a moderate level of readiness. This sug-

gests that businesses are still in the adjustment phase and not yet fully prepared for Industry 5.0. The highest-rated aspect is the utilization of AI, IoT, and Cloud technologies (Mean =

3.31, S.D. = 1.21), reflecting that some firms have begun adopting advanced digital technologies, though their implementation is not yet widespread. Conversely, the lowest-rated aspect is organizational investment readiness for Industry 5.0 (Mean = 2.92, S.D. = 1.24), which highlights the financial constraints and investment risks faced by SMEs. Meanwhile, awareness of the Industry 5.0 concept (Mean

= 3.14) and planning for its application (Mean = 3.04) remain at moderate levels, indicating that although businesses are increasingly aware of the new paradigm, they have not yet been able to systematically translate this awareness into concrete action plans.

2.2 Industry 5.0 Skills Identified by Entrepreneurs and Current Employee Skill Levels

Table 5 Employee skills from entrepreneurs' perspective compared to current employee skill levels

Skills	Entrepreneurs' perspective level	current employee level	Skill gap
Analytical and Synthetic Thinking	3.76	3.12	.645
Problem-Solving	3.68	3.14	.537
Creativity	3.76	3.18	.580
Collaboration and Teamwork	3.60	3.06	.542
Emotional Intelligence	3.71	3.03	.677
Digital Literacy	3.76	3.11	.652
Data Analysis	3.64	3.21	.437
Technical Expertise	3.81	3.17	.640
Overview	3.72	3.13	.589

Table 5 presents a comparison between employees' actual skill levels and the skills demanded by employers. Overall, the average skill demand is 3.72, while the employees' actual skill level is 3.13, resulting in an average skill gap of 0.589. The largest gaps

are found in emotional maturity (0.677) and digital skills (0.652), whereas the smallest gap is observed in data analysis skills (0.437).

2.3 Mean Differences between Expected and Existing Industry 5.0 Skills in SMEs

Table 6 Means, standard deviations, and statistics used to test the hypothesis of comparing the differences in employee skills between the perspectives of the companies and the current skill levels of the employees.

Skills	Difference		t-value	df	p-value
	Mean	Standard Deviation			
Analytical and Synthetic Thinking	.645	1.6388	7.872	399	.000
Problem-Solving	.537	1.6599	6.476	399	.000



Skills	Difference		t-value	df	p-value
	Mean	Standard Deviation			
Creativity	.580	1.5523	7.473	399	.000
Collaboration and Teamwork	.542	1.6583	6.543	399	.000
Emotional Intelligence	.677	1.5506	8.738	399	.000
Digital Literacy	.652	1.7026	7.665	399	.000
Data Analysis	.437	1.5155	5.774	399	.000
Technical Expertise	.640	1.5848	8.077	399	.000
Overview	.589	.5836	7.872	399	.000

The results from Table 6 are consistent with Table 5, which tested the hypothesis using t-test statistics, finding that all skills had statistically significant differences at the .001 level, especially emotional maturity ($t = 8.738$, $p < .001$) and digital skills ($t = 7.665$, $p < .001$).

This shows a high demand from entrepreneurs compared to the actual skill level of the workforce, while data analysis skills have the lowest gap ($t = 5.774$, $p < .001$). However, it is still statistically significant, reflecting that this skill still needs to be developed continuously.

Table 7 Results of open-ended question analysis

Question topics	Main answers	Number of answers
1. How do you think Industry 5.0 will impact your business?	1. Structural and competitive change	32
	2. Quality and safety enhancements	30
	3. Customer data management	25
	4. Data-driven decision-making and planning	20
	5. Sustainability and the environment	18
2. How ready do you think your business is to enter Industry 5.0?	1. Initial and inadequate readiness	37
	2. High readiness with technology partners	32
	3. Strategic readiness but limited by budget	28
	4. Moderate readiness	27
	5. Personnel planning and skills development	24
3. Additional suggestions or comments	1. Technology and automation upgrades, such as using robots for repetitive tasks and automated QC, establishing a cloud-based data architecture, and connecting ERP/MES/IoT.	28
	2. Requesting government benefits/funding, establishing cross-functional teams, and monitoring sustainability indicators (energy/waste rates).	26

Question topics	Main answers	Number of answers
3. Additional suggestions or comments	3. Develop a three-year roadmap, launch pilot projects with rapid return on investment, and conduct periodic measurement.	24
	4. Enhance data governance and cyber security, tier data and define access rights.	22
	5. Invest in developing digital and data skills for employees at all levels, collaborating with educational institutions.	20

The result from Table 7 were analyzed using content analysis. All 400 respondents answered these questions, indicating a 100% response rate. Responses were reviewed, coded, and grouped into thematic categories based on similarity of meaning, and the frequencies shown in the table represent the number of responses classified under each theme. Across the three questions, the most frequently reported themes concerned structural and competitive change, quality and safety improvement, varying levels of organizational readiness, technology upgrading, government support, roadmap development, data governance, cybersecurity, and employee skill development.

Discussion

This study was discussed the findings in relation to General Information and the three research objectives.

The analysis of general business characteristics of the respondents indicated that the largest proportion belonged to the manufacturing industry (42.50%), followed by the agriculture and food industry (24.75%). This finding is consistent with the work of Porter (1990), which highlights that manufacturing and agriculture industries constitute the economic

backbone of developing countries, playing a significant role in employment generation and value creation. Similarly, SMEs in Thailand are commonly classified by employment size and fixed capital, with small enterprises defined as those employing no more than 50 workers and having fixed capital of less than 50 million baht, which broadly corresponds with the results of the present study (Forest Trends, 2020, p. 1).

The study found that SMEs in the Lower Central Region 1 place considerable importance on adapting to digital technology, with a mean score of 3.46 (high level). However, the use of automation systems received the lowest score (3.06). This finding supports the work of (Vial, 2019, pp. 118-144), who argued that while SMEs generally recognize the importance of digitalization, they often face financial and human resource constraints, which limit the widespread implementation of automation systems.

The results indicated that the overall readiness of SMEs in the Lower Central Region 1 to transition toward Industry 5.0 remains at a moderate level (mean score = 3.10). This reflects that SMEs are still in a period of adaptation. The highest level of readiness was



found in AI, IoT, and Cloud technologies (mean score = 3.31), while the lowest was in access to investment capital (mean score = 2.92). These results align with (Xu, et al., 2021, pp. 534-535), who emphasized that Industry 5.0 centers on the integration of humans and advanced technologies, but SMEs frequently encounter resource-related challenges. Moreover, the assessment conducted by the National Science and Technology Development Agency (NSTDA) in 2022 revealed that Thai industries overall remain at the Industry 2.0 level. This demonstrates a significant readiness gap that continues to hinder Thailand's capacity to transition effectively into Industry 5.0, thereby posing challenges to industrial advancement and long-term economic stability (Patikorn, Suphawatt and Worasit, 2024, p. 189).

The findings on the comparison between employees' current skill levels and the skills required by employers revealed an overall skill gap of 0.589. The most significant gaps were observed in emotional intelligence (0.677) and digital skills (0.652). By contrast, data analysis skills showed the lowest gap (0.437), though they remain important. These results are consistent with the World Economic Forum (2020, p. 36), which emphasized that emotional intelligence and digital skills are among the most crucial competencies in the Industry 5.0 era.

5. Insights from Open-Ended Questions

The analysis of open-ended responses indicated that entrepreneurs perceive Industry 5.0 as driving structural transformation, intensifying competition, enhancing quality, and fostering sustainability. This is consistent

with the view that Industry 5.0 emphasizes sustainability, human-centred value creation, and customer-oriented personalization in industrial transformation (European Commission, 2021, p.7; Grabowska, 2022, pp. 4–5). Regarding readiness, entrepreneurs reported being at a low to moderate level of preparedness and emphasized the need for government support in advancing automation, digital infrastructure, cybersecurity, and collaboration between universities and businesses for innovation development. They also suggested reducing complex regulations and enhancing workforce skills. These findings correspond with the article *Looking Ahead : Preparing Thai Businesses for Global Transformations*, which observed that Thai businesses have begun adopting technology to strengthen competitiveness and create new ventures. Examples include the use of big data for marketing, customer service, and inventory management, as well as the integration of artificial intelligence (AI) to support service delivery. Nevertheless, the adoption of such technologies remains limited due to entrepreneurs' lack of knowledge, insufficient investment capital, and restricted access to government-driven technological innovations (depa, 2025).

Conclusion

This study aimed to analyze the readiness and skills of SMEs in the Lower Central Region 1 of Thailand to adapt to Industry 5.0. The sample consisted of 400 SME entrepreneurs and executives across four provinces: Kanchanaburi, Ratchaburi, Suphanburi, and Nakhon Pathom. The findings revealed that the

majority of businesses were engaged in manufacturing (42.50%) and agriculture and food (24.75%). Most possessed fixed assets not exceeding 50 million baht (82%) and employed fewer than 50 workers (83.75%). The respondents placed a moderate level of importance on digital adaptation (mean = 3.19), with the highest emphasis on adopting digital technologies, while the use of automation in production processes was considered least important.

In terms of readiness for Industry 5.0, SMEs demonstrated an overall moderate level of preparedness. The highest readiness was found in the adoption of AI, IoT, and Cloud technologies, whereas the lowest was in investment toward organizational transformation for Industry 5.0. The skill analysis showed that the overall skill gap among employees was 0.589 across six competencies. The largest gaps were observed in emotional intelligence and digital skills, while the smallest was in data analysis. Results from the t-test revealed that all skill gaps were statistically significant at the .001 level.

Open-ended responses suggested that entrepreneurs perceived Industry 5.0 as influencing structural transformation, competition, quality improvement, and sustainability. However, they assessed their readiness as being at a low to moderate level. Key limitations identified were insufficient capital, limited human resources, and restricted access to advanced digital technologies. Respondents expressed the need for government support in terms of financial investment, incentives, and digital infrastructure, as well as workforce development, technological upgrading, and

collaboration with academic institutions and related agencies.

In conclusion, SMEs in the four provinces of the Lower Central Region 1 Kanchanaburi, Ratchaburi, Suphanburi, and Nakhon Pathom are still in a transitional phase. They require greater governmental support for financial investment, access to state-developed technologies and innovations, and workforce development. Employees must enhance their competencies in analytical and synthetic thinking, problem-solving, creativity, teamwork, emotional intelligence, digital literacy, data analysis, and domain-specific technical expertise to ensure a sustainable transition into Industry 5.0.

Policy Recommendations

1. Financial support. The findings showed that many SMEs were aware of the importance of Industry 5.0 but remained constrained by limited budgets. Therefore, the government should provide targeted financial support, such as dedicated funds, low-interest loans, or matching grants, to facilitate investment in technology and innovation.

2. Digital infrastructure. Since SME transformation depends on the effective use of digital systems and data-driven processes, improving national and local digital infrastructure is essential. Reliable internet access and digital connectivity would help SMEs adopt advanced technologies more effectively.

3. Regulatory support. The findings also imply that bureaucratic complexity may hinder SME adaptation. Relevant agencies should therefore simplify regulations, reduce administrative procedures, and establish more accessible



support mechanisms for SMEs undergoing digital transformation.

4. Skills development. As the results revealed a gap between the skills prioritized by entrepreneurs and the actual competencies of employees, the government should establish practical training programs in digital skills, data analysis, automation, and technology application for both entrepreneurs and employees.

5. Collaboration mechanisms. The results further suggest the need for stronger collaboration among SMEs, technology providers, and educational institutions. Such partnerships would enhance knowledge transfer, workforce

development, and the long-term sustainability of Industry 5.0 adoption.

Practical Recommendations

1. Enterprises should participate in government training programs to strengthen financial and digital skills.
2. Enterprises should initiate pilot projects within their organizations, such as adopting standardized software, before transitioning to fully automated systems.
3. Enterprises should foster collaboration with universities and vocational training institutes to develop training curricula tailored to their actual needs.

Bibliography

- Boonchom, S. (2002). **Research primary** (7th ed.). Bangkok: Suveeriyasan.
- Bouwman, H., Nikou, S. and De Reuver, M. (2019). Digitalization, business models, and SMEs: How do business model innovation practices improve performance of digitalizing SMEs?. **Telecommunications Policy**, 43(9), 101828.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. **Psychometrika**, 16(3), 297–334.
- Demirkan, H. and Spohrer, J. C. (2018). Commentary—cultivating T-shaped professionals in the era of digital transformation. **Service Science**, 10(1), 98-109.
- Digital Economy Promotion Agency. (2025, April 23). **Depa reveals 2024 digital density survey in Thai industry.**
- European Commission. (2021). **Industry 5.0: Towards a sustainable, human-centric and resilient European industry.** Brussels: European Union.
- Florida, R. (2014). The creative class and economic development. **Economic Development Quarterly**, 28(3), 196–205.
- Ghobakhloo, M., Iranmanesh, M., Mubarak, M. F., Mubarik, M., Rejeb, A. and Nilashi, M. (2022). Identifying Industry 5.0 contributions to sustainable development: A strategy roadmap for delivering sustainability values. **Sustainable Production and Consumption**, 33, 716–737.
- Ghobakhloo, M., Iranmanesh, M., Foroughi, B., Tirkolaee, E. B., Asadi, S. and Amran, A. (2023). Industry 5.0 implications for inclusive sustainable manufacturing: An evidence-knowledge-based strategic roadmap. **Journal of Cleaner Production**, 417, 138023.
- Haseeb, M., Hussain, H. I., Ślusarczyk, B. and Jermisittiparsert, K. (2019). Industry 4.0: A solution towards technology challenges of sustainable business performance. **Social Sciences**, 8(5), 154.

- Nazarejova, J., Soltysova, Z. and Rudeichuk, T. (2024). Requirements and barriers for human-centered SMEs. **Sensors**, 24(14), 4681.
- OECD. (2019). **OECD SME and entrepreneurship outlook 2019**. OECD Publishing.
- Rovinelli, R. J. and Hambleton, R. K. (1977). On the use of content specialists in the assessment of criterion-referenced test item validity. **Tijdschrift voor Onderwijsresearch**, 2(2), 49–60.
- UNCTAD. (2015). **Science, technology and innovation policy review: Thailand**. United Nations Conference on Trade and Development.
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. **The Journal of Strategic Information Systems**, 28(2), 118–144.
- Vu, K. and Hartley, K. (2018). Promoting smart cities in developing countries: Policy insights from Vietnam. **Telecommunications Policy**, 42(10), 845–859.
- Wattanaamat, P., Sukhaoaramate, S. and Charoenputh, V. (2024). The transition to Industry 5.0 and analysis of government promotion policies for small and medium enterprises (SMEs) in Thailand. **Interdisciplinary Academic and Research Journal**, 4(6), 189–200.
- World Economic Forum. (2020). **The future of jobs report 2020**. World Economic Forum.
- Xu, X., Lu, Y., Vogel-Heuser, B. and Wang, L. (2021). Industry 4.0 and Industry 5.0: Inception, conception and perception. **Journal of Manufacturing Systems**, 61, 530–535.
- Yamane, T. (1973). **Statistics: An introductory analysis** (3rd ed.). New York: Harper & Row.