



**CAPACITY BUILDING FOR DIGITALIZATION OF
MANUFACTURING INDUSTRIES TOWARD INDUSTRY 4.0
IN THAILAND**

BY

NAJAVADH KAEO-TAD

**AN INDEPENDENT STUDY SUBMITTED IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ENGINEERING**

**(LOGISTICS AND SUPPLY CHAIN SYSTEMS ENGINEERING)
SIRINDHORN INTERNATIONAL INSTITUTE OF TECHNOLOGY**

THAMMASAT UNIVERSITY

ACADEMIC YEAR 2021

COPYRIGHT OF THAMMASAT UNIVERSITY

THAMMASAT UNIVERSITY
SIRINDHORN INTERNATIONAL INSTITUTE OF TECHNOLOGY

INDEPENDENT STUDY

BY

NAJAVADH KAEO-TAD

ENTITLED

CAPACITY BUILDING FOR DIGITALIZATION OF MANUFACTURING
INDUSTRIES TOWARD INDUSTRY 4.0 IN THAILAND

was approved as partial fulfillment of the requirements for the degree of
Master of Engineering (Logistics and Supply Chain Systems Engineering)

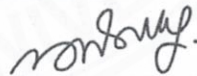
on July 11, 2022

Member and Advisor



(Associate Professor Chawalit Jeenanunta, Ph.D.)

Member



(Nucharin Intalar, Ph.D.)

Director



(Professor Pruettha Nanakorn, D.Eng.)

Independent Study Title	CAPACITY BUILDING FOR DIGITALIZATION OF MANUFACTURING INDUSTRIES TOWARD INDUSTRY 4.0 IN THAILAND
Author	Najavadh Kaeo-tad
Degree	Master of Engineering (Logistics and Supply Chain Systems Engineering)
Faculty/University	Sirindhorn International Institute of Technology/ Thammasat University
Advisor	Associate Professor Chawalit Jeenanunta, Ph.D.
Academic Years	2021

ABSTRACT

Manufacturing is the most important sector, contributing the most gdp in Thailand. The organizations are trying to develop to industry 4.0 through technology adoption. Capability building is one of the key factors companies invest in to step up in industry 4.0. The study's objective is to investigate the key factors for collaboration between the companies and academic sectors, including the participation of the government. The three outstanding large companies related to digitalization were selected to be the case study of this paper. Data collection is interpreted by literature review and secondary case study and then analyzed by the thematic analysis of focus point and key success model. The detail of the result of the analysis is broken down by the focus point of the case factor between sectors of each case study.

Keywords: Self-motivation, Industry 4.0, Talent management, Digital transformation, Knowledge management, Capability building

ACKNOWLEDGEMENTS

Without the assistance of several people, this independent study would not have been feasible. Many thanks to Assoc. Prof. Dr. Chawalit Jeenanunta, the best advisor since undergraduate level, who looked through my various edits and assisted in clearing out all conflict. Also grateful to Dr. Nuchjarin Intalar who is my committee who also provided advice and assistance.

I am grateful to the SIIT where for giving me a opportunity to extend my knowledge and I could finish my next step of education. Finally, I would want to express my gratitude to my parents, and the many friends who supported and loved me throughout this protracted process. I would like to say thank you to all parties whoever take part during my master's degree period.

Najavadh Kaeo-tad

TABLE OF CONTENTS

	Page
ABSTRACT	(1)
ACKNOWLEDGEMENTS	(2)
LIST OF TABLES	(5)
CHAPTER 1 INTRODUCTION	1
1.1 GDP Contribution of Manufacturing Sector in Thailand	2
1.2 Objective	2
CHAPTER 2 REVIEW OF LITERATURE	3
2.1 Digital Learning	3
2.2 Motivation to Development	3
2.3 Opportunity to Grow in Industry 4.0	4
2.4 People operations strategic	5
2.5 Research Gap	6
CHAPTER 3 RESEARCH METHODOLOGY	7
CHAPTER 4 RESEARCH RESULT	8
4.1 WHA PEOPLE OPERATION DEVELOPMENT	8
4.1.1 Company Profile	8
4.1.2 WHA: Demand-Driven & Precision Education	8
4.1.3 Dual Vocational Education project (DVE)	10
4.2 WESTERN DIGITAL PEOPLE OPERATION DEVELOPMENT	11
4.2.1 Company Profile	11

4.2.2 Cooperative Education and Research Collaboration (Talent Mobility)	11
4.2.3 The framework of Western Digital	13
4.3 SNC FORMER PEOPLE OPERATION DEVELOPMENT	14
4.3.1 Company Profile	14
4.3.2 Collaboration with the Government Sector	14
4.3.3 Collaboration with the Academic Sector	15
CHAPTER 5 RESEARCH ANALYSIS AND SUMMARY	17
5.1 The Cross-Case analysis and Thematic Analysis	17
5.2 Case Analysis Summary	21
5.2.1 Vision to the transformation from the leader	21
5.2.2 Self-motivation from employee	21
5.2.3 Technology adoption for upskilling and/or reskilling	22
5.2.4 Sandbox for demonstration of knowledge Management	22
5.3 Conclusion	23
5.4 Key success factors	23
5.4.1 Top-down strategy	23
5.4.2 Technology Readiness	24
5.4.3 Potential and talent for capability building	24
REFERENCES	25
BIOGRAPHY	29

LIST OF TABLES

Table	Page
5.1 The characteristic of each company in this study	17
5.2 The Thematic Analysis	18



CHAPTER 1

INTRODUCTION

Nowadays, most manufacturing industries have a capacity between Industry 2.0 and 3.0. The Thai government has been promoting the model of the Industry 4.0 to improve the manufacturing industry efficiency by implementing modern digital technology (i.e., Internet of Things and Artificial Intelligence). to facilitate decision making. Many firms are still unsure how or what to do to enhance capabilities to the next level. Some firms are struggling during the implementation phase. Many factors are affecting the capacity building for digital transformation, such as leadership, technology transformation from the partner, contribution to practice, maturity of education, the capacity of innovation, and company spending on R&D, by a case study and data acquisition from the companies who are involving the digital transformation.

In recent years, Industry 4.0 has become increasingly attractive among manufacturing sectors. Still, most of them have rarely been increasing in a group of middle-income nations since 1996, according to the Industry 3.0 model.

Industry 4.0 is a revolution in conventional manufacturing techniques that allows supply chain integration and information sharing for manufacturing, warehousing, and logistics using technologies, e.g., artificial intelligence, system integration, robotics, etc.

Based in Thailand, I decided to study the detail of the manufacturing sector since it contributes to the most GDP in Thailand. The plan of Industry 4.0 is the popular idea of technology adoption, which aims to develop the organization into an innovative company, value-based industry by focusing on people operation capacity building in various knowledge areas such as technology in robotics and automation, aviation and logistics, biofuel and biochemicals, and digital.

There are various collaborations with abroad colleges to boost education in this field, e.g., AMATA University, The CMU-Thailand Program, Les Roches Global Hospitality Education, and many more. That's why some organizations adopt the role model to develop capability in industry 4.0.

In this study, I will focus on the collaboration between the academic and industry sectors, e.g., SNC, WHA, and WD.

This research explores what factors contribute to capacity building using a case study approach. The target group is the companies in the digital transformation process.

1.1 GDP Contribution of Manufacturing Sector in Thailand

According to the World Bank's collection of development indicators derived from officially recognized sources, Thailand's manufacturing value added (percent of GDP) was recorded as 25.24 percent in 2020 (TRADING ECONOMICS, n.d.). Thailand - Manufacturing, value added (percent of GDP) Thailand's manufacturing industry is highly competitive due to several variables, including raw materials, low-cost labor, and new technology. The industrial sector is a significant engine of the Thai economy. Although the manufacturing sector's contribution to Thailand's GDP has fluctuated over the last decade, it is expected to contribute roughly 4.4 trillion Thai baht in 2021. The manufacturing sector strongly influences the Thai economy more than other significant economic sectors. It accounts for the bulk of Thailand's overall exports and creates considerable employment, with about six million workers expected in 2021. As of the fourth quarter of 2021, the manufacturing sector contributed 34% of Thai GDP, ahead of other main businesses such as service and commerce. (Manakitsomboon, 2022).

1.2 Objective

1. To analyze the capability and capacity building in the industrial/manufacturing sector.
2. To construct the guideline for the HRD plan from the relationship among the manufacturing, education, and government sectors.

CHAPTER 2

REVIEW OF LITERATURE

2.1 Digital learning

When smart devices become common in modern culture, the Internet transcends time and location constraints and becomes a pervasive learning tool. The primary difficulties for modern information technology integrated education include flexibly designing educational activities for digital learning and deploying technology tools. According to the findings of (Lin et al., 2017), digital learning had a more significant positive effect on learning motivation and outcomes than traditional teaching and significantly affected learning impact learning outcomes. Finally, learning motivation has a remarkable positive effect on learning gain in learning outcomes. In recent years, research has developed a variety of reasons in support of a gradual marginalization of Internet access, so-called the first-level digital divide. Even though people have equal access to computers and the Internet, they may not be able to fully utilization use the online services that are accessible to them. As a result, the one-dimensional idea of the online access gap has given way to multidimensional conceptions of digital inclusion, digital inequalities, or digital disparities, which concentrate on how people engage with the Internet (Lissitsa et al., 2017). The primary skills needed in Industry 4.0 are artificial intelligence, nanotechnology, robotization, the Internet of things, augmented reality, and digitalization. They are together to adopt digital learning contexts, such as mobile technologies, tablets, and smartphone applications, which have been increasingly popular among employees. (Sousa & Rocha, 2019) aim the assist firms in rethinking their strategy for talent development in response to the challenges of digital transformation.

2.2 Motivation to development

According to (Shahzadi, Javed, et al., 2014), employee motivation is defined as a driving force that motivates employees toward achieving the organization's unique goals and objectives. Firms expect to utilize people operations. The purpose of (Shahzadi, Javed, et al., 2014) study is to find out what factors influence employee

motivation in Pakistan and how motivation affects work performance. A significant and favorable association between employee motivation and performance is determined beneficial. Sometimes employees' perceptions of training effectiveness have a negative relationship with motivation. Their responses also show that they were provided with training courses but that this training was not implemented into their daily teaching since they regarded it ineffective. (Shahzadi, Javed, et al., 2014). Most firms are battling for survival in the turbulent and competitive business climate. Employee motivation and performance are critical tools for every organization's long-term success.

On the one hand, assessing performance is crucial to organizational management since it displays the organization's progress and success. Previous studies, however, show a favorable association between employee motivation and organizational effectiveness. (Dobre, 2013) To investigate the impact of motivation on employee performance using organizational culture characteristics. According to the findings of this study, (1) motivation had a direct and significant effect on employee performance, (2) motivation had a direct and significant effect on organizational culture, (3) organizational culture had a direct effect on employee performance, and (4) organizational culture could mediate the relationship between motivation and employee performance indirectly. (Anisya, 2021)

2.3 Opportunity to grow in Industry 4.0

Industry 4.0 efforts can impact the whole business system by changing how goods are created, manufactured, transported, and discarded. Industry 4.0 is relatively new to emerging countries, particularly India, and requires a detailed description for good understanding and commercial practice. The purpose of the study (Luthra & Mangla, 2018) is to identify critical hurdles to Industry 4.0 projects and examine the identified main difficulties to prioritize them for successful Industry 4.0 ideas for supply chain sustainability in emerging countries, with a focus on the Indian manufacturing industry. (Luthra & Mangla, 2018) In recent years, buzzwords like Industry 4.0, the Internet of Things (IoT), and Cyber-Physical Systems have helped to popularize future industrial systems (CPS). While Industry 4.0 and similar technologies offer numerous potential benefits for manufacturing, the bulk of these technologies are developed for or by large corporations. (Masood & Sonntag, 2020) Today's Industrial Enterprises are

confronted with the challenge of the Fourth Industrial Revolution. Manufacturing substantially altered how items were made and how producers transferred products from the factory to the client. The current study addresses “Industry 4.0” and its primary qualities. In addition, a theoretical framework for evaluating major technologies and concepts in terms of their influence on production engineering and management is provided. In addition, this article explores and presents some arguments for why manufacturers must adapt their old understanding of the functioning of the production system in light of “Industry 4.0. (Koleva, 2018) Intelligent resources communicating through current Internet of Things technology, big data, and cloud computing will connect enterprises. As a result, modern businesses face a new challenge: the need to construct and collaborate inside cyber-physical systems. (Saniuk & Saniuk, 2018) The Explanatory Factor Analysis divided the identified difficulties into four primary aspects of challenges. The Analytical Hierarchy Process ranks the discovered dimensions of difficulties and associated challenges even further. According to the study, the most significant obstacles are organizational challenges and technological, strategic, legal, and ethical concerns. (Luthra & Mangla, 2018)

2.4 People operations strategic

The strategic aspects of people operation management and entrepreneurial activity in businesses have emerged as two of the most notable areas of study studies. The impact of strategic people operation management on corporate performance has been widely researched in the literature. According to the findings of the analyses, entrepreneurial attitude moderated the association between strategic people operation management and company performance (Zehir et al., 2016). According to a study, some companies gain a competitive advantage from their capability and people operation management. The trainee has closely aligned their trainers’ expertise with corporate. The market entry approach progressed and enhanced various distinct, complex, and integrated people operation management interventions with self-sustaining effects. (Gannon et al., 2015). The impact of strategic people operation management, servant leadership behaviors, and work satisfaction of their organization’s capabilities have been investigated. Their results and analysis reveal that private organizations are terrified of losing clients in competitive contexts; thus, their staff go above and beyond

the established processes to protect their interests. Future research should concentrate on individual attitudes and actions to generate new theoretical notions and conduct studies on human resources and leadership styles (Adiguzel et al., 2020). Firms should establish innovation capabilities to manage the innovation process from idea generation through commercialization. Because the human element is included in the innovation culture, strategic people operation management is seen as a critical component of innovation capabilities (Aryanto et al., 2015). Differences in management, science, engineering, technology, and labor quality between nations and regions have become variables that explain the complex dynamics of the twenty-first century. As a result, strengthening the worldwide competitiveness of local enterprises within the context of regional development policies and improving entrepreneurship and innovation ability in the local area are critical in the twenty-first century (Uslu, 2015).

2.5 Research Gap

The above literature reviews have a gap: a lack of data on Thailand. Thailand tries to involve Industry 4.0, and the technology has grown very fast while the capability can slightly grow. Not only company are trying to approach technology readiness, but they are also sticking with how to manage and optimize their people operation. The majority of the company are tie-up with their employees. This reason is the main idea of this study, and I would like to figure out how talent management and knowledge management in each case handle these issues by top-down strategies from the leaders

CHAPTER 3

RESEARCH METHODOLOGY

This qualitative research was finished using a secondary study from August 2021 until July 2022. Information or facts are gathered in the form of documents or collated in other media such as journals, periodicals, statistics, or reports. Secondary data can also relate to previously researched study findings. Utilizing examination, Examine the facts thoroughly. It can be regarded as secondary data if used scientifically to aid in re-exploration. Previous study data may be incompatible with the goal of future research. I decided to use the existing information from three company case studies which are the large size of the company that had the plan to develop their company to adopt and involve in Industry 4.0. Thematic analysis and cross-case analysis are used to summarize the data collected to identify the key success factors.

Begin by gathering extensive information about each case and referring to a topic that may be categorized. After collecting the data, categorizing it will help us identify the overall direction of the company's technique to deal with the current problem they were trying to solve. When the correlation between the occurrences was established, an explanation with supporting evidence was created to analyze the connections between each case.

CHAPTER 4

RESEARCH RESULT

4.1 WHA PEOPLE OPERATION DEVELOPMENT

4.1.1 Company Profile

The WHA Group, founded in 2003 by a group of forward-thinking entrepreneurs active in industrial property development, has grown to become a major player in logistics, industrial estates, utilities and electricity, and digital services in Thailand and Southeast Asia. WHA is directed by Dr. Somyos Anantaprayoon and Ms. Jareeporn Jarukornsakul, accompanied by several enterprises searching for an experienced professional warehouse and factory expert throughout its early years. The number of clients rapidly rose, while services changed continuously to meet various demands. WHA Corporation Plc. was listed on the Thai Stock Exchange in 2012, thanks to the company's management team's unwavering efforts (SET). Three years later, it purchased WHA Industrial Development Plc. (previously Hemaraj Land and Development PLC.), Thailand's largest and most successful developer of industrial parks, utilities and electricity, and property solutions. Because of this strategic development, the newly revitalized WHA Group now has the resources to be "the ultimate solution partner" of local and international investors, allowing them to operate more efficiently.

4.1.2 WHA: Demand-Driven & Precision Education

Refer to news from WHA, Ms. Jeeraporn, leader of WHA, gave the interview about cooperating with a government agency as follows, the business should be adapted to the "digital disruption trend" that is spreading and influencing the upskill and reskill in the future as the key to success which everyone should take care and develop all the time. As the economy of the 21st century is characterized by innovation and technology as a key driver, the demands of the labor market are changing, with the need for more skilled workers of the future. The development of education models and the production personnel in line with these changes is, therefore, a challenge in the education system. As the current education curriculum was developed with the supply push concept, most

workers have skills that do not meet industry requirements and create skills gaps that simultaneously lead to unemployment and labor shortages. For this reason, the concept of education system development should be shifted to a model. Demand-driven, to acquire skills and numbered workers that meet the needs of entrepreneurs by the transition of education to a model Demand-driven. That requires cooperation from both the government. Educational institutions and the industrial sector to develop human resources and labor to meet the development of the industrial sector. WHA mentioned that many countries have interesting human resource development approaches. For instance, Singapore's Skills Future Program is a program co-planned with the Industrial Strategic Plan to make the production need of labor in terms of quantity and quality skill in the industry line industry. There are also the Japanese KOSEN Institute and Germany's Dual Vocational Training, which focuses on the development of vocational personnel by parallel education that focuses on practical learning, etc.

As for the EEC, there is a push for the industrial group of the future that focuses on using technology and innovation as essential items to drive the economy—resulting in the demand for new types of labor and job skills. It is necessary to develop and upgrade education to produce personnel with knowledge and skills that can meet the needs of entrepreneurs and investors. Currently, the government and the EEC are accelerating personnel development through the cooperation of 3 ministries, namely the Ministry of Education. Ministry of Higher Education Science Research and Innovation and the Ministry of Labor, using EEC HDC as a platform to push ongoing collaboration with all sectors, whether business or educational institutions, covering various departments. To guide the development of demand-driven personnel skills through the EEC Model that aims to develop the staff who can keep up with the technological development and adapt to the industry in the long term. There is a mechanism for entrepreneurs to participate in designing courses that meet the natural working environment. It also supports expenses and guarantees employment after graduation.

For the private sector, it has also been a part of upgrading the quality of education. For example, the WHA Group, which recognizes the importance of education and human resource development, has collaborated with vocational colleges to create a Dual Vocational Education project. (DVE) to encourage students to have practical experience in parallel with theoretical studies. There is also a cooperation

project with the Ministry of Labor, King Mongkut's University of Technology Thonburi (KMUTT), and the Thai-German Institute (TGI) to establish a cooperation center for industrial skills training that focuses on human resource development and skill upgrading of workers in the EEC area, etc.

In addition to the benefits measures and a complete infrastructure system, the Availability of labor is another key factor in attracting investment capital. Focusing on developing a workforce that meets the real needs of the industrial sector is, therefore, a driving force toward sustainable economic growth of the country in the future.

4.1.3 Dual Vocational Education project (DVE)

Objectives of Vocational Training

- To develop personnel to be able to work effectively
- To develop personnel to be skilled, knowledgeable, capable, and up to date with technology to meet the needs of the establishment
- To prepare vocational personnel to enter the labor market

Student benefits students receive

- General benefits
 - Receive allowance and other welfare as agreed
 - Opportunity to a training company that is exclusively available to students participating in this program.
 - Obtain a certificate from the establishment
 - Receive a vocational certificate and vocational certificate, same as regular students
 - Opportunities for further higher education
- Academic benefits
 - Theoretical knowledge learned at educational institutions can be applied to practice in business immediately before graduating to enhance knowledge insight and have skills in professional practice that meet the needs of the workplace because students
 - Real vocational training is already in the workplace. Therefore, the chances of getting a job are higher than those who study.

4.2 WESTERN DIGITAL PEOPLE OPERATION DEVELOPMENT

4.2.1 Company Profile

Western Digital has an ongoing effort to support research at universities worldwide. They financed research subjects chosen from the discussion about the current issues that our committees need to solve at Western Digital, recognizing areas that require further exploration. The study subjects are assigned to a team, university, or institution with competence relevant to the specific issue under examination. A lead researcher is chosen from the Western Digital group to collaborate with the institution to build a thorough strategy and outline the work to be accomplished as well as milestones to monitor progress until achieving the objective(s) of the project. The research initiatives involve many technical or scientific areas.

Technology is developing at an ever-increasing rate in the world of data storage and analysis, creating a challenge and opportunity for Western Digital to drive the transformation of our industry and give value to our customers. The programs are designed to benefit Western Digital, and the universities involved. Some benefits to research institutes include investigations into real-world challenges, working with a team from industry, and collaborative development. Some studies last several years, while others have a more restricted scope and length. Western Digital has an internal framework to monitor specific initiatives' progress regularly and an annual process to align the sponsored investigations with Western Digital's business goals.

4.2.2 Cooperative Education and Research Collaboration (Talent Mobility)

Western Digital has collaborated with well-known and famous universities among the global in Thailand since 2008. Western Digital Thailand has collaborated with the leading university in Thailand, e.g., Thammasat University, Chulalongkorn University, Mahidol University, etc. In 2012 Western Digital started collaborating with internationalized academic universities in more than 30 countries. The project that Western Digital and academic institute gathering study called "WD-University Talent Mobility" as known as "TM," which structure based on cooperative and work integration Education (CWIE), Fundamental science to create know-why and Research-based for all classes of higher education. The main processes of CWIE are project align with 4 months project with mentoring from professors and experts then, come up with

an outcome or a result of the project so, the project will be evaluated and reflected by committees to eliminate the research gap, improve their project, and develop to industry

The project's trilateral collaboration intends to enable, grow, and elevate Thailand's hard disc industry to compete with other nations in the area. The initiative aspires to generate 56 Master's degree graduates with the most advanced capabilities in hard disc drive technology over the next five years through this pioneering public and private sector relationship with postgraduate education in Thailand. Dr. Pansak Siriruchatapong, Director of the National Electronics and Computer Technology Center (NECTEC), Thailand's hard disc drive business, is rapidly expanding. As a result, it is strategically necessary to execute and plan for personnel development to strengthen the country's capacity to compete with other countries in the area. "We endorse the government's strategy of encouraging the hard disc drive industry." Using a progressive strategy, the government expands its support for implementing the supply chain in domestic markets. As a result, we have joined forces with Western Digital (Thailand) Co, Ltd, the manufacturer of hard disc technology, and the Asian Institute of Technology, the postgraduate institute in this field that is eager to collaborate in the development of quality engineers at the Master's degree level. AIT will use its extensive experience and knowledge to participate and support in developing engineering skills in Thailand and producing high-quality products."

The WD-University Talent Mobility aims to know the new technology and technology transfer, as the primary purpose of this program will make WD a leader in technology in the industry.

4.2.3 The framework of Western Digital

Firstly, identify the core problem, which is finding the root cause of the problem or the current situation the industry found. Secondly, WD translates the industry problem into academic research questions to respond to the industry by creating “Know Why” with the “Tacit and Explicit Knowledge” the problem issue occurs conduct the literature review to develop a hypothesis to eliminate or reduce the problem end up with the publication or conference. Lastly, they will give the outcome, which is the solution to the problem or the innovation to develop the industry.



4.3 SNC FORMER PEOPLE OPERATION DEVELOPMENT

4.3.1 Company Profile

Dr. Somchai Thaisa-nguanvorakul founded SNC Former Public Company Limited in 1994 with a registered and charged capital of one million baht. SNC is an OEM company producing air conditioner parts, household appliances, and automotive air conditioning equipment. For made-to-order customers who own the product brand or for retail sales who manufacture in-car air conditioners to be compiled into a complete set of air conditioners before having to pass to final automotive manufacturers. The industries are located in Pathum Thani, Samut Prakan, and Rayong provinces.

4.3.2 Collaboration with the Government Sector

Applying for the Industry 4.0 program, SNC actively engages with HRD toward Industry 4.0. It launched the SNC's Industrial Production System Development Strategy 4.0 to improve human resource skills and keep up with the rapid speed of technological development. It worked with the EEC-HDC, higher education institutions, and educational institutions under the Vocational Education Commission to develop the "Three-Part Education Model" for EEC as a collaborative project in Mechatronics Engineering and Robotics. SNC provides a testbed, machinery, equipment, and a learning center in Rayong Province using the Industry 4.0 production system as a learning model. The Memorandum of Understanding for collaboration with three industry sector stakeholders. A contract for higher vocational colleges and more than 50 educational institutes was signed. This degree focuses on mechanical, electrical engineering, engineering automated control, and computer science. It strives to provide a new approach to teaching and learning systems to stay up with advances in the craft group, such as robotics, mechanical electronics, and artificial intelligence (AI). Students who get a vocational or high vocational certificate will be prepared to work in the industries.

4.3.3 Collaboration with the Academic Sector

The following are the program's aims the following objective

1. Drive and expand automation, robotics, and mechatronics education toward EEC Industry 4.0, equipping workers with skills, knowledge, abilities, and competence in real-world practice to support the expansion of the industrial sector both inside and outside the EEC region.
2. Continuously create specific educational and training programs to improve the teaching and learning system and generate qualified individuals to fulfill the demands of the industrial sector.
3. By bringing in a group of entrepreneurs and industrial sectors recognized as essential partners in people operation development to be in charge of the significant HRD that meets both the production process and the service.
4. To develop a program for small and medium-sized firms (SMEs) in the European Union (EU) to adapt production to the Industry 4.0 system.
5. Increase collaboration between the public and commercial sectors in implementing a training program with EEC-HDC to help all relevant sectors develop.

SNC collaborates with universities and vocational schools to create and produce curricula under the EEC Model, including training programs, diploma courses (non-degree), and bachelor's and master's degrees.

SNC urges students to pursue a bachelor's degree in Mechatronics for 1.5 -2 years at the Rajamangala University of Technology Tawan-ok. SNC accepted 30 candidates from the third year of Vocational Certificate and 20 candidates from the first year of High Vocational Certificate to continue their studies in the Department of Mechatronics at Chonburi Technical College for two years of EEC Type A Model. After graduating from school, SNC hires them as workers with monthly salaries ranging from 22,000 to 28,000 THB.

Another program is known as the "Technicians to Engineers Program." In this program, SNC provides scholarships to students pursuing a vocational certificate, a high vocational certificate, or a bachelor's degree for three years, two years, or two

years, respectively. Scholarship winners will participate in manufacturing training while also earning a salary. Throughout the semester, students are designed to establish projects for implementation in production lines that present personnel advice. Students with a High Vocational Certificate earn between 25,000 and 28,000 THB per month. Bachelor's degree holders earn between 28,000 and 35,000 THB per year. Graduate students will be recruited with a high wage following graduation.

Furthermore, SNC built the ARAI Academy as a training center for automation and robotics in the manufacturing line, as well as artificial intelligence to connect the network of equipment and systems that can be managed and controlled remotely via the Internet of Things. ARAI comprises a finished manufacturing process, a control room, and a classroom. The target is to provide employees and students with advanced skills and relevant knowledge in the production line using real-world practices and innovative machines to enhance effectiveness and decrease the potential of an accident occurring while working on the production line. Employees and students can enroll in a training course to improve their skills and understanding of technology, allowing them to operate more effectively.

CHAPTER 5

RESEARCH ANALYSIS AND SUMMARY

5.1 The Cross-Case analysis and Thematic Analysis.

This part will discuss the similarities and differences between the three case studies. Since all of them has oversea customer, they need to develop themselves to service the customers. Non-Thai company is very out standing in people operation development part, especially collaboration with academic sector in advance technology area. On the other hands, Thai companies have fulfilled their capacity with academic collaboration by produce the student who ready to join the industry. The students from training program have not only knowledge from their institution but also have the experience during internship with the manufacturing parts.

Table 5.1 The characteristic of each company in this study

Characteristics of company	Western Digital (WD)	WHA	SNC
Establish year	2014	2003	1981
Industry	Manufacturing	Logistics and Manufacturing	Manufacturing and automotive
Location	Ayutthaya	Krung Thep Maha Nakhon	Pathum Thani
Customer	Both domestic and oversea	Both domestic and oversea	Both domestic and oversea
Supplier	Both domestic and oversea	Both domestic and oversea	Both domestic and oversea
Organization Nationality	US-Thailand	Thai	Thai
Capital Structure	Co., Ltd.	PLC	PLC
Main Product	Electronics and Appliance	Logistics and Industrial Properties,	Automotive Parts, Electronics Parts, Electronics OEM,

		Industrial Development, Utilities, and Power, Digital Platform	and manufacturing OEM.
Academic collaboration	Undergraduate and above	Vacation School	Vacation school to undergraduate
Governance Collaboration	N/A	N/A	EEC

Table 5.2 The Thematic Analysis

Theme	Case analysis factor	Private Sector	Academic Sector
Operation Management	Topic	The problem that occurs in the current situation since the skilled labor shortage continuously, and some current employees need to learn more skills for new technology	Research question based on the current situation about how response skilled-employee demand from private sector toward Industry 4.0 adoption as the sustainable.
Strategy Management	Goal and Objective	Problem-solving: To find the response solution, the problem(s) occur as soon as possible but do not	Root cause and restrain: In part academic regarding the research question, we must find out

		<p>mention or deep-dive analysis of the problem.</p>	<p>the root cause of this problem, why it happens, and how it affects the company until the industry as overview effect. Finally, the Academic sector has to figure out the solution and create a strategy or plan to protect and prevent repeat short-term and/or long-term problems.</p>
<p>Operation Management</p>	<p>Time</p>	<p>Shortest: Because the industry sector has to run the business daily, every problem that is found must be eliminated within the shortest period, especially critical problem</p>	<p>Optimization: Since the academic sector would like to spend the time to answer all questions and respond to all concerns, why it needs time as a fundamental factor for the reason that it needs to study and collect the data is mandatory.</p>

<p>Knowledge Management</p>	<p>Result</p>	<p>Commercial in confidence: Since the private sector comes out with the solution or strategies that are sensitive issues for commercial, they would not dispose of all detail in-depth as they need to keep it as their key success factor.</p>	<p>Publication: The final result of academic sectors is creating innovation; publication is also part of them since the research result has been accepted by published at a conference or other related publication.</p>
<p>Financial Management</p>	<p>Budget</p>	<p>Minimize: The goal of business operation is to maximize profit, so top management's budget for research and development is limited.</p>	<p>Maximize: Academic need a relatively high budget due to there being short-tail detail of research operation including the compensation and allowance.</p>

5.2 Case Analysis Summary

5.2.1 Vision to the transformation from the leader

Digital transformation needs to plan or strategy to support these changes. An accurate and thorough evaluation of the health of your organization today is the first step in a good and effective digital transformation. Successful transformations begin with clear, consistent, and direction-setting actions to build the required preconditions for improving performance. The leadership team made a determined effort in virtually all of the activities we evaluated to define goals, build enthusiasm, and demonstrate commitment to change in performance and behavior using various approaches: anything from new themes and visions to new initiatives. The person who will guide your team through the digital transition must be a teachable, trustworthy, and devoted leader. Often, an existing employee familiar with the company's philosophies, objectives, and culture may fill this job. To encourage and guide, the managerial team's dedication must be continuous. Leaders must have a broad vision to develop the company and eliminate their weaknesses by finding a strategy or plan to increase business capacity to achieve the goal.

5.2.2 Self-motivation from employee

Companies will undoubtedly need to take steps to offset the impact of job losses through retraining efforts. We already see several businesses setting the bar for creating skills for related occupations. Values should not be viewed as static but as dynamic and developing. Setting objectives at the start of the year and then ignoring them because the evaluation period is a typical error. Failure to reassess objectives can be demotivating as realities change during the year. That is not to argue that goals should become movable targets and be adjusted in response to environmental changes. Targets are changed at one multinational firm where a corporation works if the hypotheses are used to determine their difference unexpectedly. This has aided in establishing an incentive scheme that aids in motivating performance. Self-motivation is a force that propels us forward. It promotes constant learning and achievement in every situation. Self-motivation is a significant way of achieving and growing. It is fundamentally tied

to our ingenuity in defining dynamic objectives for ourselves and our belief that we have the necessary abilities and competencies to accomplish those demanding goals. We frequently have a desire for self-motivation. Anticipate that changes in the workplace and the nature of work may favor employee motivation.

5.2.3 Technology adoption for upskilling and/or reskilling

The automation technologies such as the Internet of Things (IoT), artificial intelligence (AI), and machine robots can potentially displace one-third of current workforce planning operations. The majority of employment activities that automation excels at include predictable and physical labor, data collecting, and data processing. As automation eliminates the routine and banal, only cognitive occupations remain for the human task to manage and administrate. Because employment is altering, businesses are seizing the chance to restructure business processes and workflows so that people can work successfully alongside technology. Many companies are also changing their general architecture and workplaces to encourage more cooperation and less hierarchy, resulting in more team-based setups and agile working methods. As a result, employees have more freedom to create their days and build a stronger feeling of mastery and purpose over their contributions, increasing their enthusiasm to drive the job. Businesses would promote continual learning and expansion as essential components of the athletic ability strategy and culture. This will become increasingly essential in recruiting a new generation from the newly graduated workforce to prioritize continual learning as a primary career objective. Furthermore, this will be necessary for a firm to establish its capacity to sustain staff and convince them that they will not be left behind in their profession and sectors advance.

5.2.4 Sandbox for demonstration of knowledge Management

Knowledge Management is part of the strategy for developing digital transformation and business operations to understand what, when, why, and how to apply strategies to work with the company. The company needs to develop an innovation to demonstrate what they are thinking for digital transformation. Proposed guidelines for enhancing joint education between the academic and industrial sectors, expanding the mechanisms for moving personnel to work in the private sector in

addition to research work by comprehensive professional experience training, embedding in the workplace to extract knowledge from the workplace and apply it in teaching and learning management. Develop a standardized practice system in the workplace and send students for internships to expand the relevant mechanisms. Talent Resource Management Mechanism of Group technology university group and the cooperative education system to allow the private sector to access information from experts from universities National Talent Pool mechanism by adding data from experts from the private sector that will help lead to the development of learning to be up-to-date or meet the needs of the private sector

5.3 Conclusion

The critical factor of capability building in manufacturing sectors is the contribution of three key success factors. The top-down strategy refers to leadership's impact on the organization's goal, mission, and vision. The technology readiness mentioned in the steps of strategy from the leaders was performed by technology adoption from their vision. Last but not least, the potential and talent for capability building are the most significant to each company since talent management applied directly to evaluate their capability would have developed by the training from the development plan by both previous factors.

5.4 Key success factors

5.4.1 Top-down strategy

This factor aims to emphasize that if leaders of a company have the vision to launch the strategy to collaborate with the academic institutions to solve the current problem that the company is facing. The strategy has to state the problem clearly, which will help to find the method or develop the solution to eliminate this problem from both the industry and academic sectors. Industry sectors could help clarify the root cause of the problem. Moreover, the educational sector could help to upskill and reskill employees in the company to expand the vision to solve the problem.

5.4.2 Technology Readiness

Continues from top-down strategy and readiness for new technology in the part of leadership vision that prepares the company to develop to the next step, i.e., digital transformation or Industry 4.0. Since three of the companies in this study have an international market, they need to develop technology readiness to lead companies to respond to their customers. Technology can support a decision to invest or construct the innovation by developing the demonstration and/or simulation model. As an illustration, the pilot test among the various event possibility to help maximize the capacity. The company is preparing readiness to handle the non-stop development of technology from globalization.

5.4.3 Potential and talent for capability building

Neither technology nor potential capability building is ready. The development might struggle and need to figure out the solution to prepare the readiness for both factors. A method that concentrates on the value of developing skills while coordinating learning objectives with organizational requirements. Organizations must clarify their methods for preserving and enhancing capabilities if they want to benefit from the skill-development work they are presently undertaking. Technology readiness and capability building influence goal achievement because the workforce must support technology by working together. In terms of advanced technology, companies should assign the research and development not only technology application part but also to deep dive into related knowledge fields such as pure science or advanced engineering.

REFERENCES

- Adiguzel, Z., Ozcinar, M. F., & Karadal, H. (2020). Does servant leadership moderate the link between strategic human resource management on rule breaking and job satisfaction? *European Research on Management and Business Economics*, 26(2), 103–110. <https://doi.org/10.1016/j.iedeen.2020.04.002>
- Anisya, V. (2021). The Effect of Motivation on Employee Performance through Organizational Culture. *Journal of Economics, Finance And Management Studies*, 04(07). <https://doi.org/10.47191/jefms/v4-i7-16>
- Aryanto, R., Fontana, A., & Afiff, A. Z. (2015). Strategic Human Resource Management, Innovation Capability and Performance: An Empirical Study in Indonesia Software Industry. *Procedia - Social and Behavioral Sciences*, 211, 874–879. <https://doi.org/10.1016/j.sbspro.2015.11.115>
- Bucy, M., Schaninger, B., van Akin, K., & Weddle, B. (n.d.). *The science behind transformations: Maximizing value during implementation*. McKinsey & Company. Retrieved 2 July 2022, from <https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/the-organization-blog/the-science-behind-transformations-maximizing-value-during-implementation>
- Building capabilities for performance*. (2021, March 1). McKinsey & Company. Retrieved from <https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/building-capabilities-for-performance>
- Chowdhury, S., & Hioe, E. (n.d.). *How effective goal-setting motivates employees*. McKinsey & Company. Retrieved from <https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/the-organization-blog/how-effective-goal-setting-motivates-employees>
- Dhingra, N., Emmett, J., Samo, A., & Schaninger, B. (2021, March 30). *Igniting individual purpose in times of crisis*. McKinsey & Company. Retrieved from <https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/igniting-individual-purpose-in-times-of-crisis>
- Dichter, S. F., Gagnon, C., & Alexander, A. (2022, January 12). *Leading organizational transformations*. McKinsey & Company. Retrieved from

- <https://www.mckinsey.com/business-functions/people-and-organizational-performance/our-insights/leading-organizational-transformations>
- Ellingrud, K., Gupta, R., & Salguero, J. (2021, February 26). *Building the vital skills for the future of work in operations*. McKinsey & Company. Retrieved from <https://www.mckinsey.com/business-functions/operations/our-insights/building-the-vital-skills-for-the-future-of-work-in-operations>
- Gannon, J. M., Roper, A., & Doherty, L. (2015). Strategic human resource management: Insights from the international hotel industry. *International Journal of Hospitality Management*, 47, 65–75. <https://doi.org/10.1016/j.ijhm.2015.03.003>
- Gómez, J. G., Hernández, P., & Ocejó, R. (2020, December 16). *Four success factors for workforce automation*. McKinsey & Company. Retrieved from <https://www.mckinsey.com/business-functions/operations/our-insights/four-success-factors-for-workforce-automation>
- Hemerling, J., Dosik, D., & Rizvi, S. (2021, January 8). *A Leader's Guide to "Always-On" Transformation*. BCG Global. Retrieved from <https://www.bcg.com/publications/2015/people-organization-leaders-guide-to-always-on-transformation>
- How Do Transformational Leaders Inspire and Motivate Followers?* (2022, May 23). Verywell Mind. Retrieved from <https://www.verywellmind.com/what-is-transformational-leadership-2795313>
- Huang, C. J., Talla Chicoma, E., & Huang, Y. H. (2019). Evaluating the Factors that are Affecting the Implementation of Industry 4.0 Technologies in Manufacturing MSMEs, the Case of Peru. *Processes*, 7(3), 161. <https://doi.org/10.3390/pr7030161>
- Kohnová, L., Papula, J., & Salajová, N. (2019). Internal factors supporting business and technological transformation in the context of Industry 4.0. *Business: Theory and Practice*, 20, 137–145. <https://doi.org/10.3846/btp.2019.13>
- Lin, B., Wu, W., & Song, M. (2019). Industry 4.0: Driving factors and impacts on firm's performance: An empirical study on china's manufacturing industry. *Annals of Operations Research*. <https://doi.org/10.1007/s10479-019-03433-6>

- Lin, M. H., Chen, H. G., & Liu, K. S. (2017). A Study of the Effects of Digital Learning on Learning Motivation and Learning Outcome. *EURASIA Journal of Mathematics, Science and Technology Education*, 13(7).
<https://doi.org/10.12973/eurasia.2017.00744a>
- Lissitsa, S., Chachashvili-Bolotin, S., & Bokek-Cohen, Y. (2017). Digital skills and extrinsic rewards in late career. *Technology in Society*, 51, 46–55.
<https://doi.org/10.1016/j.techsoc.2017.07.006>
- Luthra, S., & Mangla, S. K. (2018). Evaluating challenges to Industry 4.0 initiatives for supply chain sustainability in emerging economies. *Process Safety and Environmental Protection*, 117, 168–179.
<https://doi.org/10.1016/j.psep.2018.04.018>
- Manakitsomboon, H. (2022, May 4). *Manufacturing sector in Thailand - statistics & facts*. Retrieved from Statista.
https://www.statista.com/topics/9315/manufacturing-sector-in-thailand/#dossierContents__outerWrapper
- Masood, T., & Sonntag, P. (2020). Industry 4.0: Adoption challenges and benefits for SMEs. *Computers in Industry*, 121, 103261.
<https://doi.org/10.1016/j.compind.2020.103261>
- Narula, S., Prakash, S., Dwivedy, M., Talwar, V., & Tiwari, S. P. (2020). Industry 4.0 adoption key factors: An empirical study on manufacturing industry. *Journal of Advances in Management Research*, 17(5), 697–725.
<https://doi.org/10.1108/jamr-03-2020-0039>
- Neumann, W. P., Winkelhaus, S., Grosse, E. H., & Glock, C. H. (2021). Industry 4.0 and the human factor – A systems framework and analysis methodology for successful development. *International Journal of Production Economics*, 233, 107992. <https://doi.org/10.1016/j.ijpe.2020.107992>
- Saniuk, S., & Saniuk, A. (2018). Challenges of Industry 4.0 for Production Enterprises Functioning Within Cyber Industry Networks. *Management Systems in Production Engineering*, 26(4), 212–216.
<https://doi.org/10.1515/mspe-2018-0034>
- Scharf, S., & Weerda, K. (n.d.). *How to lead in a hybrid environment*. McKinsey & Company. Retrieved from <https://www.mckinsey.com/business->

functions/people-and-organizational-performance/our-insights/the-organization-blog/how-to-lead-in-a-hybrid-environment

The smart SME technology readiness assessment methodology in the context of industry 4.0 / *Emerald Insight*. (2021, February 26). Emerald Insight.

Retrieved from <https://www.emerald.com/insight/content/doi/10.1108/JMTM-07-2020-0267/full/html>

Sousa, M. J., & Rocha, L. (2019). Digital learning: Developing skills for digital transformation of organizations. *Future Generation Computer Systems*, *91*, 327–334. <https://doi.org/10.1016/j.future.2018.08.048>

TRADING ECONOMICS. (n.d.). *Thailand GDP From Manufacturing - 2022 Data - 2023 Forecast - 1993–2021 Historical*. Retrieved from <https://tradingeconomics.com/thailand/gdp-from-manufacturing>

Uslu, T. (2015). Innovation Culture and Strategic Human Resource Management in Public and Private Sector within the Framework of Employee Ownership. *Procedia - Social and Behavioral Sciences*, *195*, 1463–1470. <https://doi.org/10.1016/j.sbspro.2015.06.445>

What are Technology Readiness Levels (TRL)? Retrieved from (n.d.). TWI. [https://www.twi-global.com/technical-knowledge/faqs/technology-readiness-levels#:~:text=Technology%20Readiness%20Levels%20\(TRLs\)%20are,regardless%20of%20their%20technical%20background.](https://www.twi-global.com/technical-knowledge/faqs/technology-readiness-levels#:~:text=Technology%20Readiness%20Levels%20(TRLs)%20are,regardless%20of%20their%20technical%20background.)

Zehir, C., Gurol, Y., Karaboga, T., & Kole, M. (2016). Strategic Human Resource Management and Firm Performance: The Mediating Role of Entrepreneurial Orientation. *Procedia - Social and Behavioral Sciences*, *235*, 372–381. <https://doi.org/10.1016/j.sbspro.2016.11.045>

BIOGRAPHY

Name Najavadh Kaeo-tad
Education 2020: Bachelor of Science (Engineering Management)
Sirindhorn International Institute of Technology
Thammasat University

Publication

Kaeo-Tad, N., Jeenanunta, C., Chumnumporn, K., Nitisahakul, T., & Sanprasert, V.
(2021). Resilient manufacturing: case studies in Thai automotive industries during the COVID-19 pandemic. *Engineering Management in Production and Services*, 13(3), 99–113. <https://doi.org/10.2478/emj-2021-0024>

