Co-funded by the Erasmus+ Programme of the European Union

Building Skills 4.0 through University and Enterprise Collaboration

SHYFTE 4.0

WP2: Implementation of SHYFTE framework for training and learning

D2.1: Pilot in domain 1

Industrial Engineering & Management

vs:2.0

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Contributing Partners: ALL

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The objectives of this deliverable are to describe:
- the learning materials
- the Training of trainers (ToT)
- the evaluation of the quality of the learning material and training
- the Training of students (ToS)
- the mitigation actions due to Covid 19.

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Further Information

http://www.shyfte.eu/

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Project Partners:

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1. Executive Summary

This document describes the implementation of the pilot project in Thailand to significantly improve the quality of "Industrial Engineering and Management" courses through the use of the new skills required by the companies for the industry of the future. Based on the skills 4.0 framework and the teaching and learning materials defined in the WP1, the objectives of this deliverable are to describe:
- the learning materials
- the training of trainers sessions
- the evaluation of the quality of the learning material and training
- the training of students
- deviations and mitigation actions

1.1 KPI's are defined

Activity N°	Activity Title	Description of the activity to be carried out	Specific and measurable indicators of progress	Achieved KPI
T2.1	Pilot in Domain 1 - Industrial engineering and management	The T2.1 Task describes the implementation of a first pilot project in Thailand to significantly improve the quality of "Industrial Engineering and Management" skills.		
T2.1-0	Learning Material development	Skill set and modules developed: theoretical part, industrial use cases, learning method, data sets and equipment used…	- at least 6 Modules are developed for Industrial Engineering - at least 5 Modules are developed for Business Management	- 6 modules are developed for Industrial Engineering - 5 modules are developed for business management
T2.1- 1	Validation by the group of expert	The module validation process (by the Advisory Board and Academic experts)	- 11 modules reviewed by Internal and External experts	- 11 modules reviewed by Internal and External experts
T2.1- 2	Training of the trainer's sessions	Training at KU (Bangkok)	- 5 to 10 trainers trained from KU - 1 staff per partner trained	62 trainers trained from KU - 4 staff per partner trained

Activity N°	Activity Title	Description of the activity to be carried out	Specific and measurable indicators of progress	Achieved KPI
			- 5 quality evaluation questionnaire filled per module	- 6 quality evaluation questionnaire filled per modules
T2.1- 2	Training of the trainer's sessions	Training at CMU (Chiang Mai)	- 5 to 10 trainers trained from CMU - 1 staff per partner trained - 5 quality evaluation questionnaire filled per module	- 49 trainers trained from CMU - 4 staff per partner trained - 10 quality evaluation questionnaire filled per modules
T2.1- 3	Learning materials assessment & update	Analysis of the quality questionnaire and assessment of the learning materials	- Analysis of the training quality questionnaire - 1 improvement plan per module is defined - All the modules are updated	- Having analysis of the training quality questionnaire - 1 improvement plan per module is defined - All the modules are updated
T2.1- 4	Student's maturity level assessment	Evaluation of the skills maturity students' level	- The maturity level is defined for each category of students (in KU and CMU)	- The maturity level is defined for each module
T2.1- 5	Training of the student's sessions	Training of the students in CMU and KU	- 100 to 120 students trained from CMU and from KU - at least 70% of the students fill the quality evaluation questionnaire - 80% of the students are globally satisfied	- 137 students trained from CMU and KU - 60% of the students fill the equality evaluation questionnaire - 93.45% of the students are globally satisfied

Activity N°	Activity Title	Description of the activity to be carried out	Specific and measurable indicators of progress	Achieved KPI
T2.1- 6	Learning materials assessment & update	Analysis of the quality questionnaire and assessment of the learning materials	- Analysis of the training quality questionnaire - 1 improvement plan per module is defined - All the modules are updated	- Having analysis of the training quality questionnaire - 1 improvement plan per module is defined - All the modules are updated
T2.1- 7	Training of Companies	Organize training for companies and evaluate the interest and quality of the training.	- 5 to 10 persons from one or different companies trained - A quality evaluation questionnaire is filled - Analysis of the quality questionnaire is done	- 5 persons from five private companies trained by KU - 10 persons form private companies trained by CMU - Quality evaluation questionnaires are filled - Analysis of the quality questionnaires is done

2. Domain 1: Industrial Engineering and Management

The Learning framework for the first domain, “Industrial Engineering and Management”, is described on the two topics: “Industrial Engineering” and “Management”.

2.1 Domain 1: Skill Sets

For Domain 1: Skill Sets, this part involves the details of skills sets relating to both industrial engineering and management which are described as below:

Part I: Industrial Engineering
The “Industrial Engineering” domain is composed of two sub-domains :
Production Management and Manufacturing System
Quantitative Analysis

The first sub-domain is composed by three Skill Sets (SkS):

SkS-D1.1-1: Smart Production Management
SkS-D1.1-2: Agile Manufacturing System
SkS-D1.1-3: Quality System 4.0

The second sub-domain is composed by one Skill Set (SkS):

SkS-D1.1-4: Intelligence Quantitative Analysis

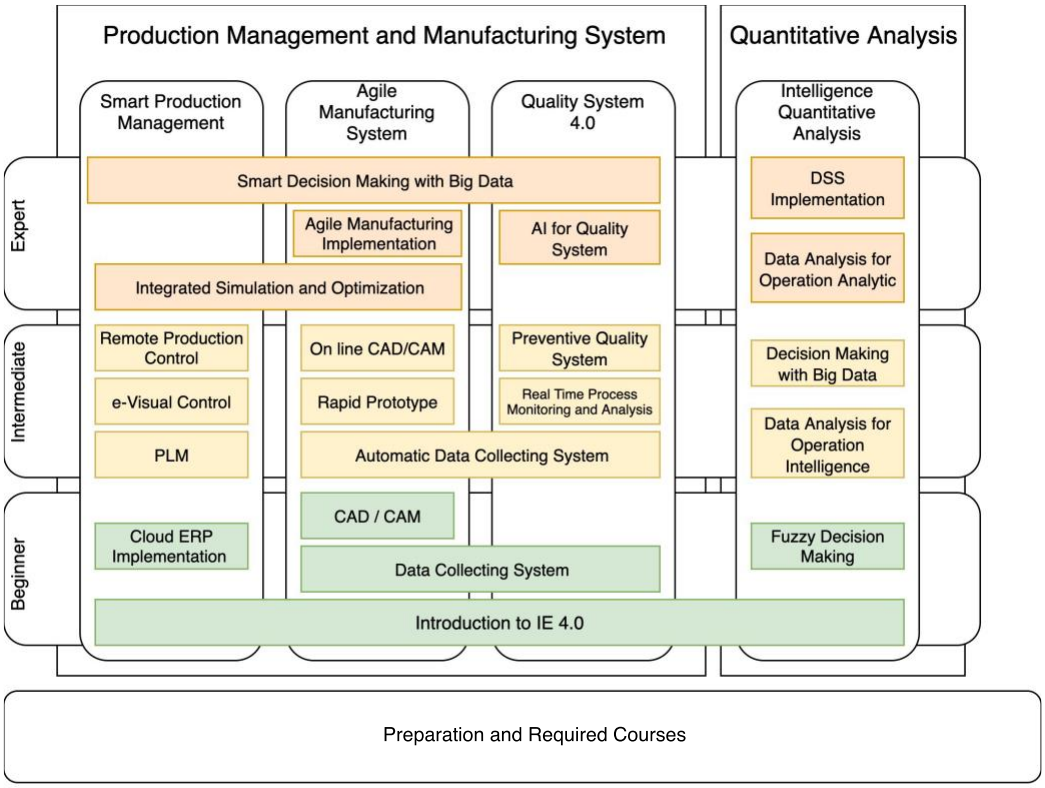


Figure 1: Learning Framework – Domain 1: Industrial Engineering
21 Modules are defined in this Framework for the Domain 1: Industrial Engineering

These modules are defined based on the maturity level of the trainees. Three levels are identified: Beginners, Intermediate, and Expert.
The trainees, based on their background and knowledge, can select different modules to enhance their competencies and be upskilled.

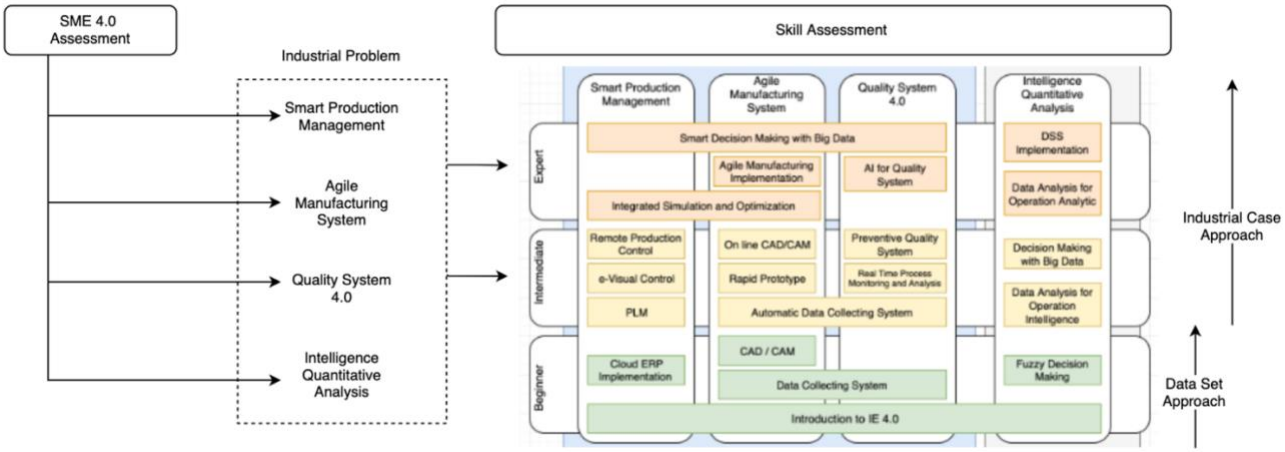


Figure 2: Learning Framework – Domain 1: Industrial Engineering – Skills Development

Part II: Management

For the first domain part II, it relates to the survey based on McKinsey Global Institute and World Economic Forum, indicating that it is very essential for small and medium-sized enterprises to develop skills for industry 4.0 regarding the management domain with three skillsets as presented follows (Figure 3):

SkS-D1.2-1: Digital talent management
SkS-D1.2-2: Organizational transformation
SkS-D1.2-3: Business revolution for industry 4.0

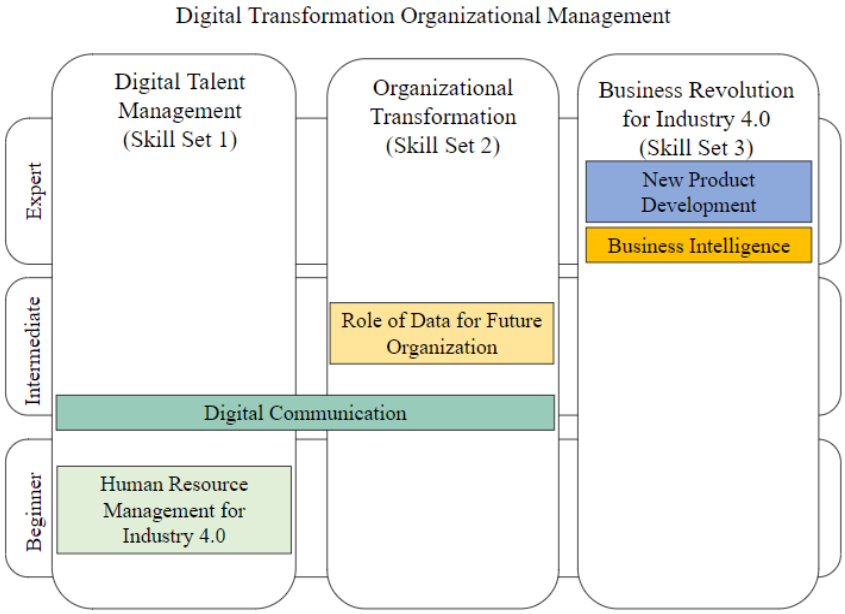


Figure 3 : Learning Framework – Domain 1.2: Management

2.2 Domain 1: Learning materials overview

The purpose of this document “Shyfte 4.0” is to build skills 4.0 through university and enterprise collaboration with learning material which consists of two parts: 1) Industrial Engineering and 2) Management. For details of each part, we explain as details below:

Part I: Industrial Engineering

According to the 21 modules of the "Industrial Engineering" domain, 19 are new modules that address the knowledge gap and Skills4.0 requirement between higher education institutions and businesses. The only existing modules are CAD/CAM and Fuzzy Decision Making. Nonetheless, these modules need modifications to accommodate the I4.0 context. The six modules have been selected as pilot modules for the creation of educational material. Figure 4 illustrates the screening methodology. The pilot modules should include all skill sets and all levels, have a significant impact on industrial engineering, and incorporate the researcher's knowledge. The 21 modules in SHYFTE are divided into three groups following the screening process: new modules, existing modules with some improvements, and pilot modules (as shown in Figure 5).

The following modules are pilot programs:

- Module 1: Introduction to IR4.0
- Module 2: Cloud ERP
- Module 3: Integrated simulation and optimization
- Module 4: Data collecting system
- Module 5: Automatic data collecting system
- Module 6: Decision-making with Big Data

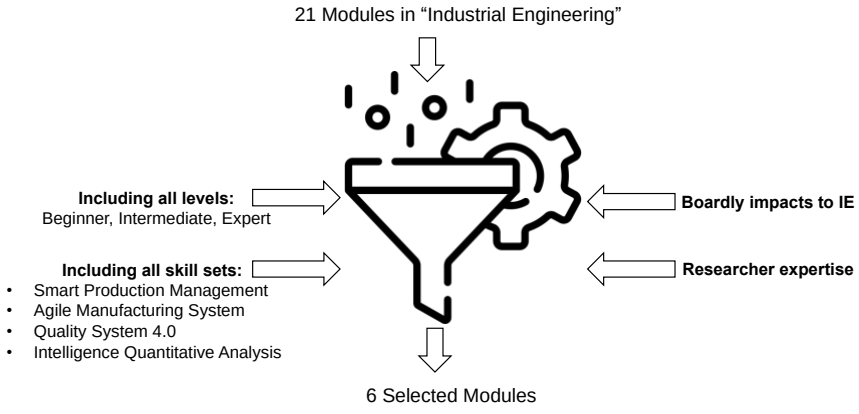


Figure 4: Screening process for pilot modules

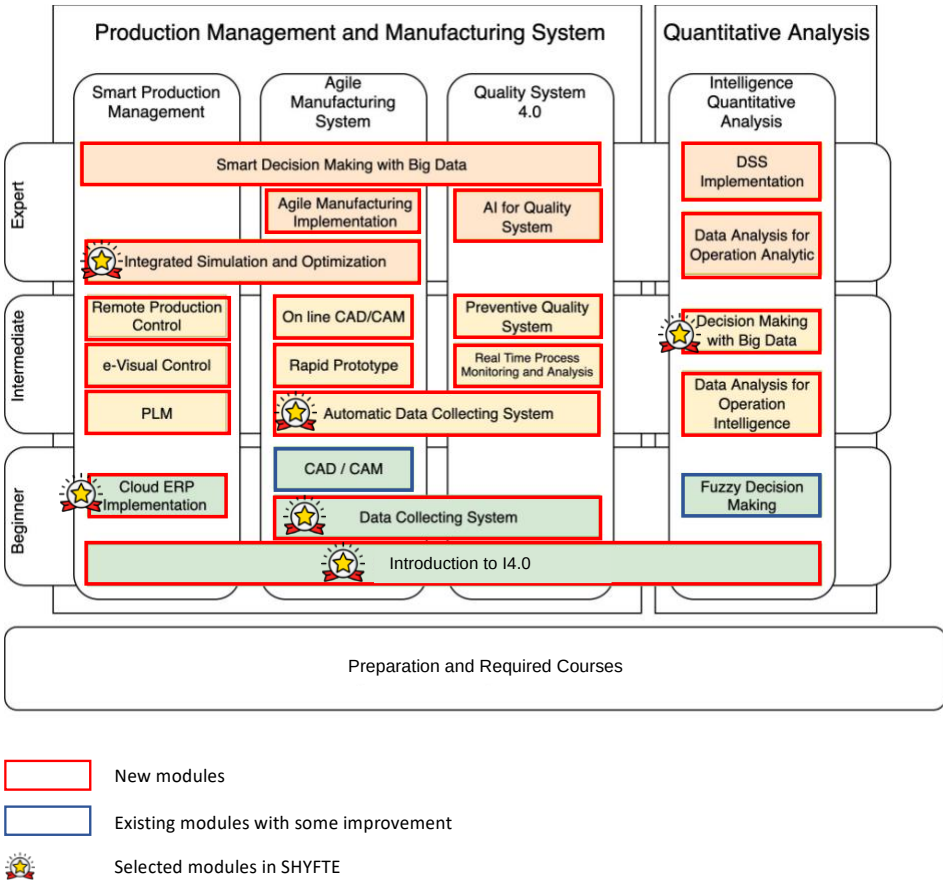


Figure 5: Module Categories: Domain 1.1-Industrial Engineering

Module 1: Introduction to IR4.0

Introduction to Industry 4.0 begins with a discussion of the industrial revolution, Industry4.0's context, and its environment. The challenges of implementing the I4.0 concept and technology, particularly for small and medium-sized enterprises, are introduced in terms of organization management, information technology, production and operation, and human resource. The implementation framework for SMEs 4.0 is explained through case studies. Industry 4.0 transforms business operations into intelligent factories and digital supply chains. The differences between data warehouse and big data are elucidated. The evolution of big data and the type of big data utilized in Industry 4.0 are explained. CPS is a system in which cyber and physical systems are tightly integrated across all scales and levels, as opposed to cyber simply being applied to physical. The CPS shifts from a physical to a "Computing as parts" (commodity-based) mentality. The generation of sensors is then described with examples of how to implement various sensors in an Industry 4.0 setting. This module provides an overview of the maturity assessment model as well as preliminary research findings. The data was gathered in Thailand and three additional European countries. Assessment and Maturity Stage Models for Evaluating the Implementation of Industry 4.0 were investigated and presented.

Module 2: Cloud ERP

This module provides an understanding of Enterprise Systems Architecture (also known as Enterprise Resource Planning Systems, or ERPs). Using a case study and simulation game, an ERP concept is introduced. After defining these systems, the advantages of cloud-based enterprise resource planning (ERP) are outlined. Students would be exposed to the various positions and occupations associated with the use and deployment of cloud ERPs. This module offers case studies and data sets for purchase and procurement, production planning, order management, and warehouse management in cloud ERP software implementation. Students will be able to apply cloud ERP to real-world business issues.

Module 3: Integrated simulation and optimization

The first section introduces modeling, optimization, and simulation as they pertain to the analysis and study of manufacturing systems for decision support. The introduction of optimization models and algorithms provides a framework for considering many issues that arise in manufacturing systems. A case study demonstrates the advantages of simulation and optimization. This module offers a data set and simulation software in order to conduct a practical analysis. The second step is to introduce students to a wide range of applications for these methods and models and to integrate this content with their introduction to operations management.

Module 4: Data collecting system

Variability affects product quality and yield in manufacturing environments. This module will teach students why analysis of manufacturing processes is crucial for diagnosing and correcting operational defects to improve outcomes and reduce costs. Acquire an understanding of the effective methods for collecting, preparing, and analyzing data, as well as the computational platforms that can be used to collect and process data over an extended period. Develop the skills necessary to participate as a member of an advanced analysis team and to provide valuable input on effective implementation. The clearly defined objectives and KPIs of data collecting in the production process is an important step that leads to the effective data collecting system design.

Module 5: Automatic data collecting system

A significant competitive advantage can be gained by properly collecting and utilizing the enormous amount of data that modern manufacturing processes generate. This information can help organizations improve operational efficiency. Gathering and capturing all of the necessary data during the operational process can be quite difficult. The information in this module covers the different types of data and recording devices, how to identify the data collection point, and some equipment for automating data collection from the manufacturing shop floor. With the aid of a data set and practical tools, students will learn how to design a data collection system. This equipment serves as the intermediary layer of communication between monitoring and analysis systems and machines. Through the practical assignment, students will learn how to gather data from the production process.

Module 6: Decision-making with Big Data

Numerous datasets can help solve significant problems and guide decision-making. However, these datasets are challenging to process and analyze due to their size, complexity, quality, and diversity. An introduction to data analytics is provided in this module. Data and its importance, Data and its relations, Data analytics, and the background required for Data analytics. The six phases of data preparation—discovery, preparation, model planning, model building, communication, and operationalization—are explained. Regression, decision trees, clustering, central tendency and standard deviation, and other data analysis tools and techniques are all explained in this module. In order to demonstrate how to use big data to lead successful business analytics initiatives and make fact-driven decisions includes the analysis, the case studies (CMU traffic management system, a water work enterprise, and a quarry enterprise) are shown in the final section.

Part II: Management

Regarding the framework of management domain, a total number of 5 modules are included in the first domain in part II learning framework. Based on this, 5 modules are newly developed modules to response for skill development in the industry 4.0. The new modules are as follows:

Module 7: Human Resource Management for Industry 4.0

Module 8: Digital Communication

Module 9: Role of Data for Future Organization

Module 10: Business Intelligence

Module 11: New Product Development

Module 7: Human Resource Management for Industry 4.0

Human Resource Development for Industry 4.0 incorporates the process for acquiring human resource, developing human resource and organization, maintaining human resource and human resource transformation. Job analysis, personal planning and recruiting and employee testing and selection and interviewing candidates are the essential processes for acquiring human resource. Human resource development includes individual development, career development and organization development. Human resource training and development process indicates the

steps for determining specific needs, determine specific objectives, select methods and delivery system, implement the program and evaluate the program. The performance management system is required for maintaining human resource. It composes of plan, follow, develop, estimate and reward. In addition, employee relationship management means the relationship between employer and employee both structural and non-structural forms. Finally, human resource 4.0 and human resource transformation is specified as the target to be achieved.

Module 8: Digital Communication

Communication for industry 4.0 starts from functions of communication which are control, motivation, emotional expression and information. Direction of communication becomes downward, upward, horizontal and diagonal communication. Interpersonal communication composes of oral, written and nonverbal communication. Organizational communication includes formal and informal communication network. Sender, media and receiver are integrated in the communication process. The workplace needs to prepare the workforce for industry 4.0, specifically people, environment and tool. For people, workplace should focus on self-awareness, empathy, courage and resilience. Transparency and psychological safety are focal point for environment. In addition, several tools must be applied as assertive communication, recognition and appreciate listening.

Module 9: Role of Data for Future Organization

Data represent any information, numbers, facts, and instructions which are helpful to understand an object or an entity that exists in a specified environment. Data can drive a company's decision and concerns regarding planning and marketing. ERP is one of the practices of consolidating and enterprise's planning manufacturing, sales and marketing efforts into one management system. ERP combines all databases across departments into a single database, automates the tasks involved in performing a business process and integrates all functions across a company to a single computer system that can serve all those functions' specific needs. A case study of Airways Hotel is shown as ERP systems is a business solution to integrate all hospitality functions from front office to payroll and create a centralized system of operations. The Entity–Relationship model (ER model) describes the structure of a database with diagram, known as Entity Relationship Diagram (ER Diagram). An ER model is a design or blueprint of a database that can later be implemented as a database. The main components of E-R model are entity set, attribute and relationship set. Finally, the example of normalization process is used to make a database table as efficient as possible.

Module 10: Business Intelligence

Business Intelligence is emerging from advanced processing of high-quality data, information and knowledge, and analytical practices that support decision-making and performance measurement. BI incorporates with dashboards, data mining and reporting system. Several vendors are offered, particularly Power BI which is a business analytics service by Microsoft. It aims to provide interactive visualizations and business intelligence capabilities with an interface simple enough for end users to create their own reports and dashboards. Power BI composes of getting data / query editor (power query in excel), data model (relationship), DAX formular (power pivot in excel) and report (power view in excel). Power BI workshop is introduced as the ways of

set up Power BI, import data from website and prepare data, save files, sign up and publish, transform data and edit format, Power BI application in mobile phone, create dashboard and create report on Power BI web, import data from excel, filter function and edit interaction, slicer function, sorting, number format and natural language query, refresh data by manual, data type conversion, calculation and measure, extraction and hierarchy and conditional format and DAX function.

Module 11: New Product Development

New product development begins with the exploration of the relationship between new product and sustainable growth strategies, the wide range of NPD ranging from packaging alterations to new technological research and a network model of NPD. The NPD processes include several stages; idea generation, idea screening, concept testing, business analysis, product development, test marketing, commercialization and monitoring and evaluation. The example of new product development on process of electric car is presented, and the workshop on NPD model with several templates including NPD process, concept development, new service development or service blueprints, business model canvas and new product development plan. The nature of creativity and innovation and their role in organization are introduced. The steps in the creative process are described and identify the four major types of innovation; creative people, creative processes, creative products and creative places. In addition, the nature of open and close innovation and the steps in open innovation process is described.

3. Learning Materials Description

This section provides detailed information about the learning materials developed including the topics, teaching plans (delivery method and soft skills), prerequisites, learning outcomes, synopsis, reference, and link that include two parts: 1) Industrial Engineering and 2) Management as details following:

Part I: Industrial Engineering

3.1 Introduction to IR4.0

MODULE TITLE	**Introduction to Industrial Revolution 4.0**		
TOTAL LEARNING HOURS	18 hours		
PRE-REQUISITE	None		
LEARNING OUTCOMES	Participants are able to :		
	Explain the concept of Industry4.0 Realize how to implement this concept to targeted industry.		
SYNOPSIS	Introduction to Industry 4.0 concept application and case studies		
MODULE CONTENTS			
			Learning Hours
TOPICS	1	Introduction to I4.0	2
		Background of Industry4.0 Industry 4.0 Environment	
		The implementation challenges of Industry 4.0	2
		Introduction to Smart factories	2
		Digital Supply Chain	2
		The Role of Big Data Analytic in Industry 4.0	2
		Industrial IoT - Application and case studies 1	1.5
		Maturity assessment tool for Industry 4.0	2
		Cyber Physical System and next generation of sensors	3
		Industrial IoT - Application and case studies 2	2
		Total	**12**
DELIVERY METHOD	Lecture		
	Case study		
	Group work		

SOFT SKILLS	Team working	
	Problem solving	
	Ability to work with data	
RESOURCES	**Presentation Slide**	https://disp-ds.univ-lyon2.fr/owncloud/f/1118695
REFERENCES	Korrakot Y. Tippayawong (2021) Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits (2020), Industry 4.0 for SMEs: Challenges, Opportunities and Requirements, Palgrave Macmillan Cham Dominik T. Matt, Vladimír Modrák, Helmut Zsifkovits (2020), Implementing Industry 4.0 in SMEs: Concepts, Examples and Applications, Palgrave Macmillan Cham Santiteerakul S, Sopadang A, Yaibuathet Tippayawong K, Tamvimol K. The Role of Smart Technology in Sustainable Agriculture: A Case Study of Wangree Plant Factory. Sustainability. 2020; 12(11):4640. https://doi.org/10.3390/su12114640	

3.2 Cloud ERP

MODULE TITLE	**Cloud ERP**		
TOTAL LEARNING HOURS	12hours		
PRE-REQUISITE	None		
LEARNING OUTCOMES	Participants are able to :		
	design the ERP system for manufacturing		
SYNOPSIS	This module introduces cloud solutions in ERP system for manufacturing		
MODULE CONTENTS			
			Learning Hours
TOPICS			
	1	ERP concept	1
	2	Enterprise System Architecture	3
	3	Introduction to Case Purchase and procurement	3

		Production planning Order management Warehouse management	
	4	Cloud ERP implementation	5
		Total	**12**
DELIVERY	Lecture		
METHOD	Case study		
	Group work		
SOFT SKILLS	Team working		
	Problem solving		
	Communication Skill Presentation skill		
RESOURCES	**Presentation Slide**	https://disp-ds.univ-lyon2.fr/owncloud/f/1118697	
REFERENCES	Wapee Manopiniwes (2021)		

3.3 Integrated simulation and optimization

MODULE TITLE	**Integrated simulation and optimization**		
TOTAL LEARNING HOURS	12hours		
PRE-REQUISITE	None		
LEARNING OUTCOMES	Participants are able to :		
	make smart decision using integrated simulation and optimization		
SYNOPSIS	Integration of simulation and optimization for Smart production and manufacturing system		
MODULE CONTENTS			
			Learning Hours
TOPICS			
	1	Benefit of simulation and optimization	3
	2	Problem modeling and approach design	3
	3	Integrating simulation and optimization	3
	4	Decision making	3
		Total	**12**
DELIVERY	Lecture		
METHOD	Case study		
	Group work		

	Project assignment	
SOFT SKILLS	Team working	
	Problem solving	
	Ability to work with data Presentation skill Decision making	
RESOURCES	**Presentation Slide**	https://disp-ds.univ-lyon2.fr/owncloud/f/1118700
REFERENCES	Apichat Sopadang (2021), Sakgasem Ramingwong (2021)	

3.4 Data collecting system

MODULE TITLE	**Data collecting system**		
TOTAL LEARNING HOURS	12hours		
PRE-REQUISITE	None		
LEARNING OUTCOMES	Participants are able to :		
	design the data collecting system for manufacturing		
SYNOPSIS	Modern manufacturing processes produce an enormous amount of data that, if collected and properly utilized, can provide valuable information that can aid enterprise in making business decisions and lead to significant competitive advantage. This module will make student understand an importance of data collection system in manufacturing.		
MODULE CONTENTS			
			Learning Hours
TOPICS			
	1	Importance of data in manufacturing system	1
	2	Define objective(s) and KPI of data collecting in production process	4
	3	Design the data collecting system	4
	4	Simulate production process and display the result	3
		Total	**12**
DELIVERY	Lecture		
METHOD	Case study		
	Group work		
	Project assignment		
SOFT SKILLS	Team working		
	Problem solving		

	Ability to work with data Presentation skill	
RESOURCES	**Presentation Slide**	https://disp-ds.univ-lyon2.fr/owncloud/f/1118698
REFERENCES	Narongsak Nanthagasigorn, Salinee Santiteerakul (2021)	

3.5 Automatic data collecting system

MODULE TITLE	**Automatic data collecting system**		
TOTAL LEARNING HOURS	12hours		
PRE-REQUISITE	None		
LEARNING OUTCOMES	Participants are able to :		
	design the automatic data collecting system for manufacturing		
SYNOPSIS	Modern manufacturing processes produce an enormous amount of data that, if collected and properly utilized, can provide valuable information that can aid enterprise in making business decisions and lead to significant competitive advantage. This module will make students This module will make student understand an importance of data collection system in manufacturing.		
MODULE CONTENTS			
			Learning Hours
TOPICS			
	1	Type of data and recording devices	1
	2	Identify the source of collecting data	2
	3	Set up and design the data collecting system	4
	4	Collecting the data from the process and display the results	5
		Total	**12**
DELIVERY	Lecture		
METHOD	Case study		
	Group work		
	Project assignment		
SOFT SKILLS	Team working		
	Problem solving		
	Ability to work with data Presentation skill		

RESOURCES	**Presentation Slide**	https://disp-ds.univ-lyon2.fr/owncloud/f/1118696
REFERENCES	Narongsak Nanthagasigorn, Salinee Santiteerakul (2021)	

3.6 Decision making with Big Data

MODULE TITLE	**Decision making with Big Data**		
TOTAL LEARNING HOURS	12hours		
PRE-REQUISITE	None		
LEARNING OUTCOMES	Participants are able to :		
	design the automatic data collecting system for manufacturing		
SYNOPSIS	Utilizing big data in making strategic decision		
MODULE CONTENTS			
			Learning Hours
TOPICS			
	1	Introduction to data analytics	2
	2	Big data and data preparation	4
	3	Data analytics tools and techniques	4
	4	Case study	2
		Total	**12**
DELIVERY METHOD	Lecture		
	Case study		
	Group work		
	Project assignment		
SOFT SKILLS	Team working		
	Problem solving		
	Ability to work with data Presentation skill Decision making		
RESOURCES	**Presentation Slide**	https://disp-ds.univ-lyon2.fr/owncloud/f/1118697	
REFERENCES	Sakgasit Ramingwong (2021)		

Part II: Business Management

3.7 Human Resource Management for Industry 4.0

MODULE TITLE	Human Resource Management for Industry 4.0		
TOTAL LEARNING HOURS	6 hours		
PRE-REQUISITE	-		
LEARNING OUTCOMES	Participants are able to :		
	Identity each of the major HRM functions for Industry 4.0		
SYNOPSIS	This course involves a specialization within the field of Management that encompasses several functions including the recruitment, selection, and maintenance of a qualified, motivated, and productive workforce dealing with "people-related" issues, it is important that you are introduced to the major topics associated with managing people in the context for Industry 4.0. Furthermore, this course will be useful no matter what career path you pursue since it addresses issues that will have an impact on you in the workplace for Industry 4.0.		
MODULE CONTENTS			
			Learning Hours
TOPICS		Introducing People Management and Analytics	12
		Cryptography for Beginners	
		Cybersecurity Threat: Malware	
		Cybersecurity Threat: Security Breaches	
		Total	**12**
DELIVERY	Lecture		
METHOD	Case Study		
	Class Activity Workshop *All equipments are used for this module		
SOFT SKILLS	Human Resource Management		
	Talent Management		
RESOURCE	Presentation https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing		
REFERENCES	Thitatorn (2021)		

3.8 Digital Communication

MODULE TITLE	Digital Communication		
TOTAL LEARNING HOURS	9 hours		
PRE-REQUISITE	-		
LEARNING OUTCOMES	Participants are able to :		
	Understand self-concept and its relationship to communication Recognize and describe appropriate strategies for self-disclosure and learn how to tell data stories with visualizations.		
SYNOPSIS	Communication for Industry 4.0, which is essentially a focus on communication within two-person relationships. This course presents concepts essential to understanding the complex dynamics that go into constructing and maintaining our relationships, offering a multitude of research-based insights that will help students better understand themselves, their relationship partners, and relationship dynamics. The concepts presented here can be applied to relationships of all types--personal and professional: family, friends, romantic partners, co-workers, and supervisors. This module combines the science of data visualization with the art of graphic design to help you communicate complex information more accurately and e!ectively. By transforming data sets into visual graphics		
MODULE CONTENTS			
			Learning Hours
TOPICS		Interpersonal Communication	9
		Group Communication	
		Organizational Communication & Strategies	
		Data Visualization	
		Total	**9**
DELIVERY	Lecture		
METHOD	Case Study		
	Class Activity Workshop Project assignment *All equipment's are used for this module		
SOFT SKILLS	Communication		
RESOURCE	Presentation		

	https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing
REFERENCES	Thitatorn (2021)

3.9 Role of Data for Future Organization

MODULE TITLE	**Role of Data for Future Organization**		
TOTAL LEARNING HOURS	5 hours		
PRE-REQUISITE	-		
LEARNING OUTCOMES	Participants are able to :		
	Understand how to design the database to suit the requirements from customers Design a database and use basic SQL to improve many business processes.		
SYNOPSIS	Data is critical for effective and efficient business operations, and managers need to understand why they need data and how data impacts the business. This module will explain how to acquire the right quality of data that is suitable for the organization in order to deliver timely insights when required by the managers. Also, this module will allow students to understand how to design databases and basic functions of SQL.		
MODULE CONTENTS			
			Learning Hours
TOPICS	The Importance of Data in Business		5
	Database design for Business function.		
	Database normalization and SQL functions.		
	Total		**5**
DELIVERY	Lecture Demonstration		
METHOD	Case Study		
SOFT SKILLS	Problem Solving Analytical Skill		
RESOURCE	Presentation https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing		
REFERENCES	Boonsiritomachai (2021)		

3.10 Business Intelligence

MODULE TITLE	Business Intelligence		
TOTAL LEARNING HOURS	5 hours		
PRE-REQUISITE	-		
LEARNING OUTCOMES	Participants are able to :		
	Understand the importance and different levels of Business Intelligence for organizations Have ability to have hands-on experience with “Power BI” to analyze data and use the insights to support decision-making		
SYNOPSIS	Business intelligence involves analyzing data sets and software programs to help organizations make better business decisions. In this module, the student will understand the concept of Business Intelligence and the different types of Business Intelligence tools in the current market. Also, they will familiarize with “Power BI” (Business Intelligence software) to make effective decisions for companies based on data.		
MODULE CONTENTS			
			Learning Hours
TOPICS		The evolution of Business Intelligence	5
		Business Intelligence tools in the market	
		Power BI - Introduction and Implementation / Presentation of Dashboard / Analysis of market data	
		Total	**5**
DELIVERY	Lecture Demonstration		
METHOD	Case Study Assignment *All equipments are used for this module		
SOFT SKILLS	Problem Solving Analytical Skill		
RESOURCE	Presentation https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing		
REFERENCES	Boonsiritomachai (2021)		

3.11 New Product Development

MODULE TITLE	New Product Development		
TOTAL LEARNING HOURS	6 hours		
PRE-REQUISITE	-		
LEARNING OUTCOMES	Participants are able to :		
	Understand how to develop new product Create new product for business development		
SYNOPSIS	This module will provide the knowledge of new product development including creativity and innovation and open innovation, encouraging learner to have a core concept to create new product regarding business development		
MODULE CONTENTS			
			Learning Hours
TOPICS		Creativity and Innovation	6
		New Product Development	
		Open Innovation	
		Total	**6**
DELIVERY	Lecture Demonstration		
METHOD	Case Study *All equipments are used for this module		
SOFT SKILLS	Creativity and Innovation management New product management		
RESOURCE	Presentation https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing		
REFERENCES	Thanasrivanitchai (2021)		

4. Use of Shyfte Equipment

Regarding the use of Shyfte equipment, this part introduces equipment description, the whole process of using this equipment and the examples of use cases which are summarized as details below:

Part I: Industrial Engineering

The equipment purchased under the project has been used in all six modules. Data loggers and data collection equipment were used in the Automatic Data Collection System. In Integrated simulation and optimization, simulation software was used. The summary on how the equipment is being used in the modules are presented in the table below. The figures below illustrate the equipments that have been used for the module's implementation.

Module Title	Equipment	Implementation
Introduction to IR 4.0 Cloud ERP Integrated Simulation and Optimization Data Collecting System Automatic Data Collecting System Decision Making with Big Data	Asus ZenBook 14UX	The Asus ZenBook 14UX use as a computer for teaching and learing for six modules at Faculty of Engineering, Chiang Mai University under normal situation or at home office under COVID-19 situation
Automatic Data Collecting System	Data Logger and Data Collecting Devices : • LabQuest Interface System • LabQuest Viewer Software • Logger Pro 3 • Go Direct Accelerometer • Go Direct CO2 Sensor • Go Direct Conductivity • Go Direct Force/Acceleration • Go Direct O2 Gas Sensor • Go Direct pH	In this module, the data collecting devices are used to collecting data from the situation that students design as their project assignment. The data collecting devices consist of a lot of sensor types. Thus the students can design various of situations in manufacturing system. Logger Pro 3, the LabQuest Interface System, and LabQuest Viewer Software are the tools that are utilized in order to connect with data collection devices in order to carry out automatic data collection and visualization. Students have the ability to connect these data with their excel sheet in order to conduct an analysis of the status or performance of their system.

Module Title	Equipment	Implementation
	• Go Direct Surface Temperature Sensor • Go Direct Temperature • Go Direct Charging Station • Go Direct Voltage • Arduino Red Board • Vernier Interface Shield • Stainless Steel Temperature Probe • Surface Temperature Probe • Relative Humidity Sensor	
Integrated simulation and optimization	Decision Tools Ind Course License software	Integrated simulation and optimization module employs Decision Tools Ind Course License software to simulate and optimize models in case studies and projects.

Figure 6 – Data logger equipment

The training modules make use of all hardware and software equipment. LabQuest Viewer Software and Decision Tools Ind Course License has been installed on the laptop. Automatic Data Collecting System usеห a data logger to design and collect data from a practical case study. Integrated simulation and optimization module employs Decision Tools Ind Course License software to simulate and optimize models in case studies and projects.

Part II: Business Management

To provide training of the students and the training of the trainers for skill development, relating to the learning materials of the management domain, we have the equipment in Figure 7 as details below:

Equipment description used for all five modules as follows:

Notebook with Pointer and Pen

- Dell Latitude 5300 2in1 Notebook
- Logitech Spotlight Presentation Remote
- Dell Premium Active Pen

Digital Board

- BenQ Interactive TV Flat Panel Display 65”

Projector, Printer and Camera

- Project EPSON EB-U42
- Printer EPSON WF-C579R
- Camera Canon 800 D

Notebook with Pointer and Pen

Digital Board

Projector, Printer and Camera

Figure 7: Equipment for Business Management Domain

The whole process of using this equipment

For the process of using this equipment, initially, we prepare the equipment both software and hardware for teacher and student to use them in the classroom. Therefore, all equipment is ready for them to organise and manage. After finish the classroom, the teacher and student can return the equipment to the department for others to use afterwards.

Examples of use cases / hands on

Application 1: Brainstorming

We use digital board for student to do some exercises and let them use digital board for brainstorming to find solutions

Application 2: Building team work

We assign work and let student in class to work as a team to use equipments including notebook, projector, camera and printer for presentation, leading to building team work.

Application 2: Training

Trainers of each module use notebook with pointer and pen to teach student in the class which are good to interact with student efficiently.

Link to the modules (where these applications are used)

These equipments will be used for teaching and learning for five modules at Faculty of Business Administration, Kasetsart University under normal situation or at home office under COVID-19 situation which they are linked to five modules including Human Resource Management, Digital Communication, Role of Data for Future Organization, New Product Development, Business Intelligence for training of the trainers and training of the students.

5. Learning Materials Review

To ensure the quality of developed learning materials, all the newly developed modules have been reviewed and improved based on the feedback of internal and external reviewers. This section will highlight the overview of both the internal and external reviews. Details of the reviews have been filled in the reviewer form.

Part I: Industrial Engineering

5.1 Introduction to IR4.0

Internal Reviewer's Name	Assoc. Prof. Dr. Wichai Chattinnawat
Position	Associate Professor
Organization (University/Company)	Chiang Mai University
Date Review Completed	June 18, 2021
Instructional Design Elements Score	43/48 (average 3.58)
Content Score	19/20 (average 3.80)
Suggestions	If the video links are accessible to the public, you should include the link in the material so that trainees can rewatch it.
Improvement	The instructional material has been improved by including a link to a video on it.

5.2 Cloud ERP

Internal Reviewer's Name	Assist. Prof. Dr. Warisa Wisittipanich
Position	Assistant Professor
Organization (University/Company)	Chiang Mai University
Date Review Completed	July 27, 2021
Instructional Design Eléments Score	44/48 (average 3.67)
Content Score	18/20 (average 3.60)
Suggestions	The content of course comprehensive are informative. However, students will have a much better understanding of the benefits of cloud-based enterprise resource planning if some real-world case studies are included in the curriculum.
Improvement	

5.3 Integrated simulation and optimization

Internal Reviewer's Name	Assoc. Prof. Dr. Komgrit Leksakul
Position	Associate Professor
Organization (University/Company)	Chiang Mai University
Date Review Completed	November 14, 2021
Instructional Design Eléments Score	45/48 (average 3.75)
Content Score	19/20 (average 3,80)
Suggestions	-
Improvement	

5.4 Data collecting system

Internal Reviewer's Name	Assist. Prof. Dr. Uttapol Smutkupt
Position	Assistant Professor
Organization (University/Company)	Chiang Mai University
Date Review Completed	December 6, 2021
Instructional Design Eléments Score	44/48 (average 3.67)
Content Score	20/20 (average 4.00)
Suggestions	
Improvement	

5.5 Automatic data collecting system

Internal Reviewer's Name	Assist. Prof. Dr. Uttapol Smutkupt
Position	Assistant Professor
Organization (University/Company)	Chiang Mai University
Date Review Completed	December 13 2021
Instructional Design Eléments Score	44/48 (average 3.67)
Content Score	19/20 (average 3.80)

Suggestions	
Improvement	

5.6 Decision-making with Big Data

Internal Reviewer's Name	Assoc. Prof. Dr. Wimalin Laosiritaworn
Position	Associate Professor
Organization (University/Company)	Chiang Mai University
Date Review Completed	January 27, 2022
Instructional Design Eléments Score	46/48 (average 3.83)
Content Score	20/20 (average 4.00)
Suggestions	
Improvement	

Part II: Business Management

5.7 Human Resource Management for Industry 4.0

Internal Reviewer's Name	Assoc. Prof. Dr. Yuraporn Sudharatna
Position	Associate Professor
Organization (University/Company)	Kasetsart University
Date Review Completed	January 27, 2022
Instructional Design Eléments Score	41/48 (average 3.72)
Content Score	20/20 (average 4.00)
Suggestions	The need of references at the end of presentation and the citation of some slides
Improvement	The learning materials of module has incorporated all the required references and citation to the materials for reliability to the trainers and students.

5.8 Digital Communication

External Reviewer's Name	Dr. Papitchaya Wisankosol
Position	Lecturer
Organization (University/Company)	Assumption University
Date Review Completed	January 21, 2022
Instructional Design Eléments Score	30/48 (average 3.33)
Content Score	20/20 (average 4.00)
Suggestions	Contents (on some slides) are too small The and overall contents are interesting.
Improvement	The learning materials of module is adjusted to use the bigger font size to become more appropriate.

5.9 Business Intelligence

External Reviewer's Name	Dr.Ploy Sudon
Position	Lecturer
Organization (University/Company)	Mahidol University
Date Review Completed	July 13, 2021
Instructional Design Eléments Score	42/48 (average 3.5)
Content Score	16.5/20 (average 3.3)
Suggestions	The use of real data set or real-life example may be required to help the audiences to better understand on how BI can be used to support the business functions.
Improvement	The learning materials of module is adjusted to present more example of using BI in the company (real data / real example) and how BI support the business functions.

5.10 Role of Data for Future Organization

External Reviewer's Name	Dr.Ploy Sudon
Position	Lecturer
Organization (University/Company)	Mahidol University

Date Review Completed	December 20, 2021
Instructional Design Eléments Score	41/48 (average 3.41)
Content Score	20/20 (average 3.60)
Suggestions	To bring more real-life example (case study) of company using ERP and ERP handbook or manual may need to be provided.
Improvement	The learning materials of module is adjusted to present more case study of ERP application in the company and provide the practical manual.

5.11 New Product Development

External Reviewer's Name	Ajarn Norapatra Janpong
Position	Lecturer
Organization (University/Company)	Dhurakij Pundit University
Date Review Completed	August 7, 2021
Instructional Design Eléments Score	43/48 (average 3.58)
Content Score	19/20 (average 3.80)
Suggestions	(1) Concerning the New Product Development (NPD) process, there are eight stages as clearly stated in the teaching materials followed by example (s)/ showcase (s) at the end of each stage. A few more examples/ showcases, running through stage 1 to 8, are strongly recommended as to holistically encourage better understanding of the topic. (2) As regards to the "Creativity and Innovation & Open Innovation" topic, it seems that there isn't any clear-cut way of distinguishing 'Innovation' from 'Creativity', thus adding key differences as well as examples/ showcases can be absolutely useful. (3) Some examples/ showcases of 'Open Innovation' can be of great envisioning for the trainers to apply with their workshop activities
Improvement	The learning materials of module is adjusted to present more example at the end of NPD stages to be better understanding. In addition, the additional content for key difference between innovation and creativity is identified with more examples.

Overall improvement action

The overall improvement actions from all five modules have divided into two parts: The instruction design element and the content. Regarding the instruction design element, the trainer manual has been improved to incorporate all the required references and citations for the reliable sources of information. In addition, the format and font size were adjusted to be more appropriate to all the trainee. According to the content of the learning materials, all of the suggestion are about the real-life example was not sufficient. As a result, the content of the learning materials has added up more examples or showcase which was the case study from the real sector or company to be better understanding for the trainers and students.

6. Training of the Trainers Sessions

In this section, we explain the training of the trainers for each session regarding two domain consisting of 1) Industrial Engineering (six modules) and 2) Management (five modules) respectively. For details of each part, they are provided in summary as detail following:

Part I: Industrial Engineering

After developing and revising the learning materials, the Training of the Trainers (ToT) sessions are conducted.

We have invited participants relevant to the industrial engineering in academic field from public and private universities to join the ToT. Emails and social media platforms are used to promote groups from the Faculty of Industrial Engineering, Business Management, and affiliated institutions.

For domain 1 (Part I): Industrial Engineering, the ToT is divided into two parts, with each part covering different modules. The decision to organize ToT in two parts is based on the need to adapt the delivery methods to the COVID situation. Due to travel restrictions imposed by partner nations, the first part of the ToT for domain 1 (Part I) is organized virtually. The first part involves the Introduction to IR4.0 during July and August 2021. The second part of the ToT for domain 1 (Part I) is being conducted virtually and face to face. This part involves cloud ERP, Integrated Simulation and Optimization, Data Collecting System, Automatic Data Collecting System, and Decision Making with Big Data which are conducted during May to August 2022.

Overall, the ToTs have been attended by 81 participants of six modules. 49 trainees are trained in the ToTs (1 trainee participated 1.67 module by average). The 49 trainees are from 16 institutions which are Asian Institute of Technology (AIT), Chiang Mai University, Chaiyaphum Rajabhat University, Chiang Mai Rajabhat University, Chiang Rai Rajabhat University, CLS SSRU, Far eastern university, Mae Fah Luang University, MCMC, Naresuan University, Rambhai Brani Rajabhat University, Suan Sunandha Rajabhat University, Thai-Nichi Institute of Technology, Universiti Putra Malaysia, Universiti Teknologi Malaysia (UTM), and Valaya Alongkorn Rajabhat University.

Module Title	Number of participants
Introduction to IR 4.0	41
Cloud ERP	7
Integrated Simulation and Optimization	10
Data Collecting System	6
Automatic Data Collecting System	7
Decision Making with Big Data	10
Total	**81**

Institution	Country	Trainees
Asian Institute of Technology (AIT)	Thailand	1
Chaiyaphum Rajabhat University	Thailand	1
Chiang Mai Rajabhat University	Thailand	2
Chiang Mai University	Thailand	12
Chiang Rai Rajabhat University	Thailand	1
Far eastern university	Thailand	1
Kasetsart University	Thailand	1
Mae Fah Luang University	Thailand	4
Malaysian Communications and Multimedia Commission (MCMC)	Malaysia	1
Naresuan University	Thailand	2
Rambhai Barni Rajabhat University	Thailand	2
Suan Sunandha Rajabhat University	Thailand	4
Thai-Nichi Institute of Technology	Thailand	1
Universiti Putra Malaysia (UPM)	Malaysia	6
Universiti Teknologi Malaysia (UTM)	Malaysia	6
Universiti Sains Islam Malaysia	Malaysia	1
Universiti Utara Malaysia	Malaysia	1
Valaya Alongkorn Rajabhat University	Thailand	2
Grand Total		**49**

Module Title	Date of ToT
Introduction to IR 4.0	20,23 Jul 2021 13, 16, 17 Aug 2021
Cloud ERP	2 May 2022
Integrated Simulation and Optimization	27 - 28 Jun 2022
Data Collecting System	29 Jun 2022
Automatic Data Collecting System	30 Jun 2022
Decision Making with Big Data	19 -20 May 2022

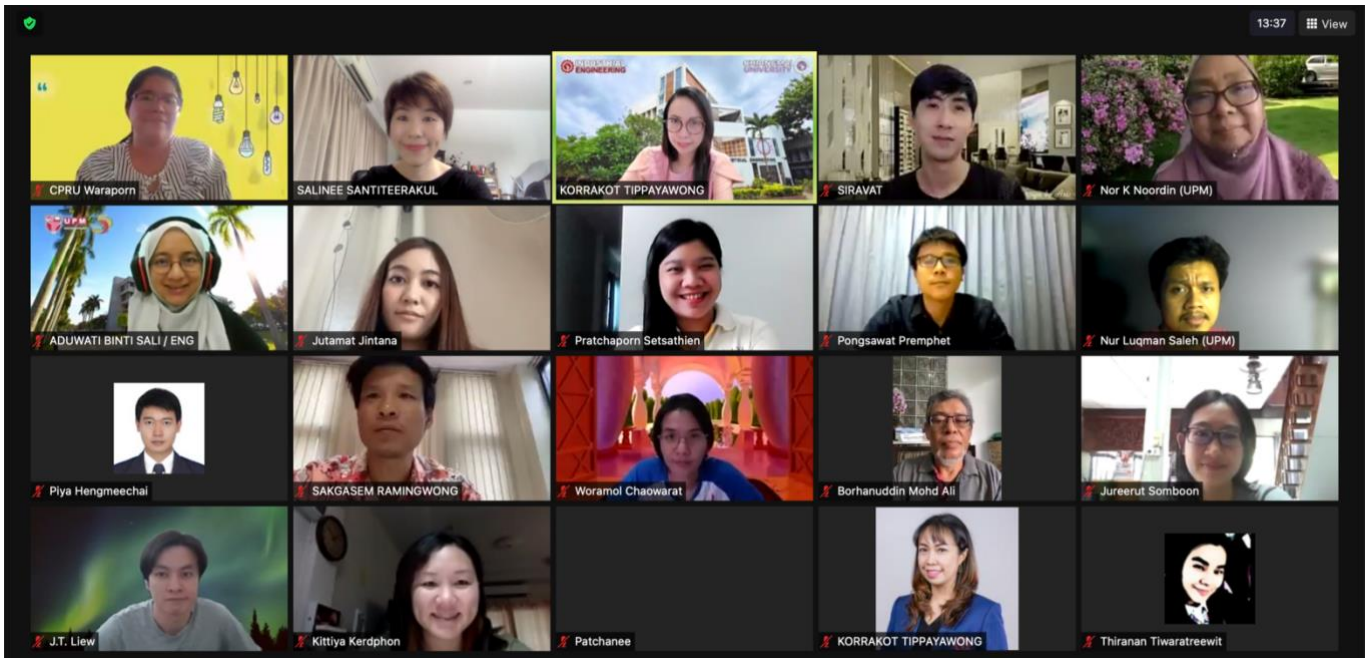
6.1 Introduction to IR4.0

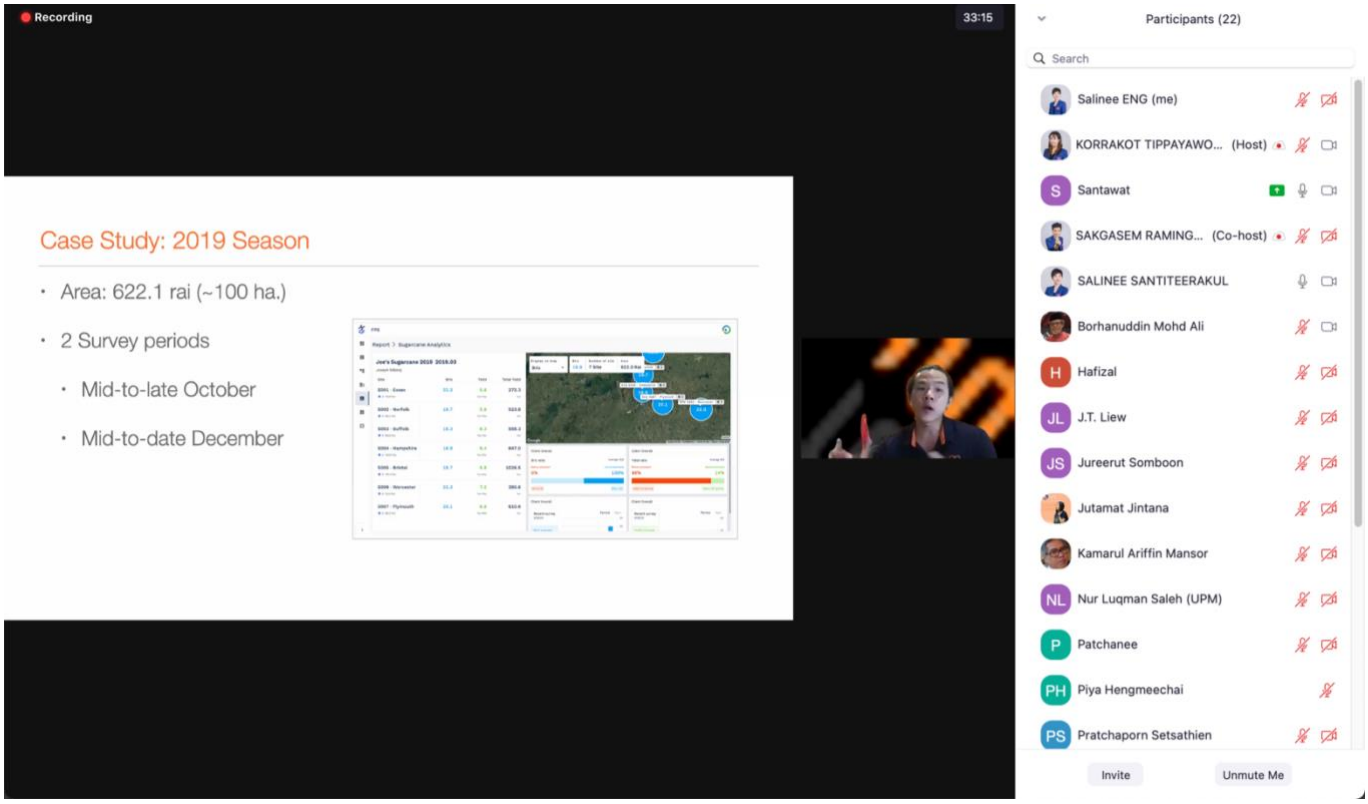
6.1.1 Session 1 description

Introduction to Industry 4.0 begins with a discussion of the industrial revolution, Industry4.0's context, and its environment. The challenges of implementing the I4.0 concept and technology, particularly for small and medium-sized enterprises, are introduced in terms of organization management, information technology, production and operation, and human resource. The implementation framework for SMEs 4.0 is explained through case studies. Industry 4.0 transforms business operations into intelligent factories and digital supply chains. The differences

between data warehouse and big data are elucidated. The evolution of big data and the type of big data utilized in Industry 4.0 are explained. CPS is a system in which cyber and physical systems are tightly integrated across all scales and levels, as opposed to cyber simply being applied to physical. The CPS shifts from a physical to a "Computing as parts" (commodity-based) mentality. The generation of sensors is then described with examples of how to implement various sensors in an Industry 4.0 setting. This module provides an overview of the maturity assessment model as well as preliminary research findings. The data was gathered in Thailand and three additional European countries. Assessment and Maturity Stage Models for Evaluating the Implementation of Industry 4.0 were investigated and presented.

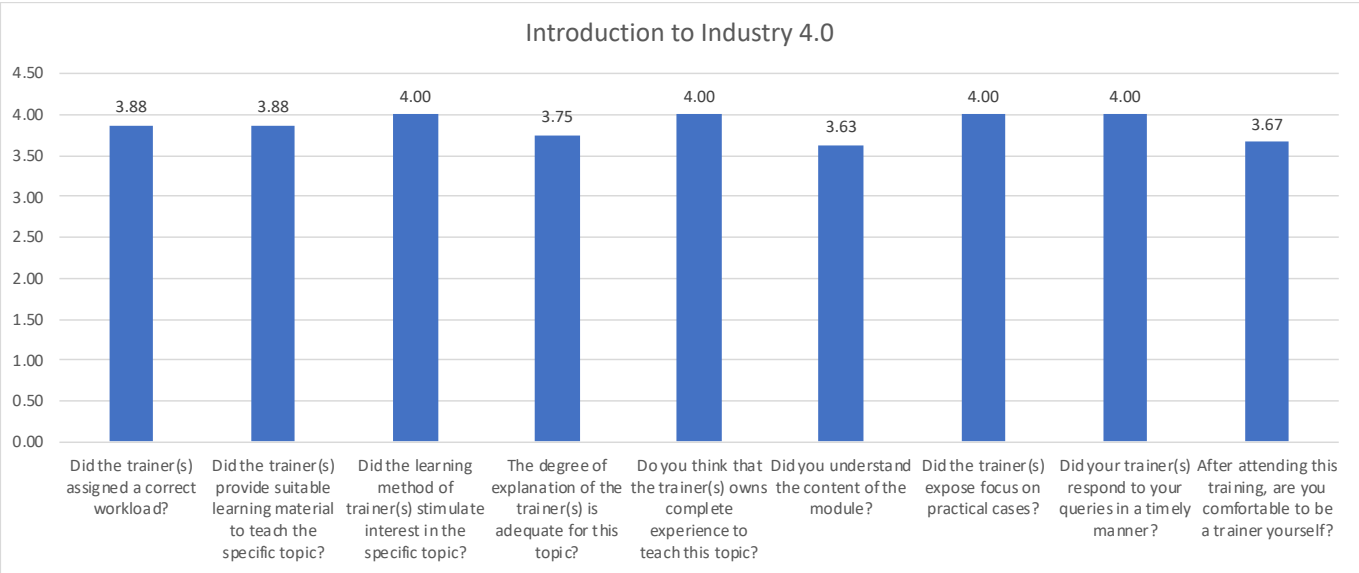
In this session, CMU provided the training of the trainers taught by Dr.Korrakot Tippayawong, Department of Industrial Engineering, Chiang Mai University. This module invited Mr.Kotcharat Srisuk , Logistics Manager at BERNINA THAILAND and Mr.Santawat Santiteerakul, Product Development Manager at HG Robotic to present the case studies of Industry 4.0 implementation. There were 41 participants from 19 institiutes to attend in this class.





6.1.2 Session 1 Feedback

After finishing the training in this module, there were 24 participants (59%) to response the satisfaction questionnaires. The results are presented in the figure below.



6.2 Cloud ERP

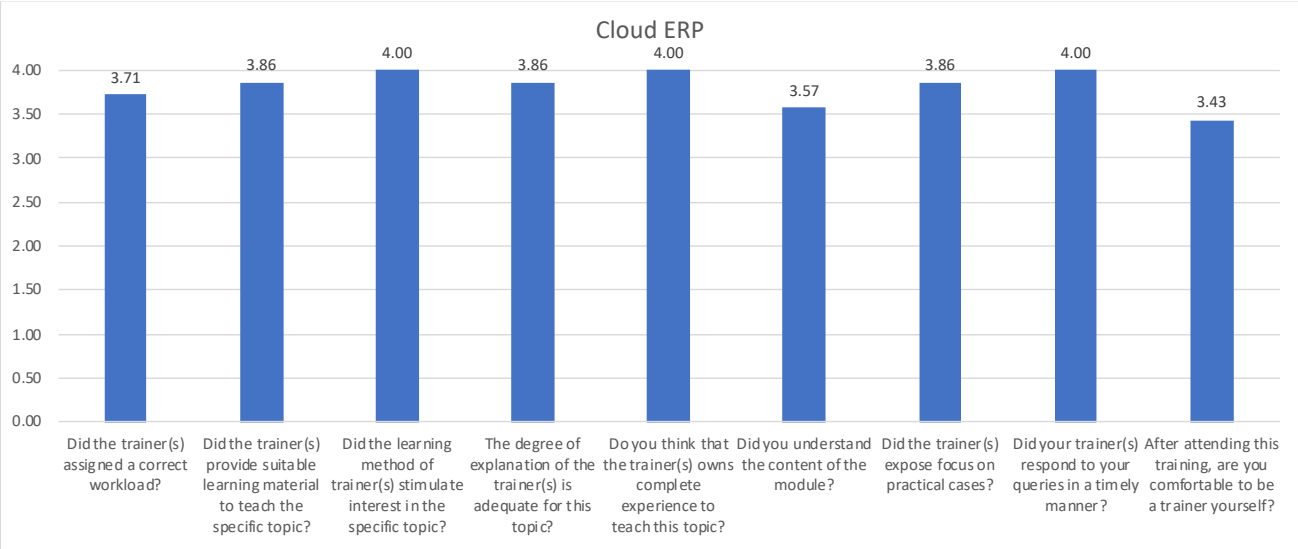
6.2.1 Session 2 description

This module provides an understanding of Enterprise Systems Architecture (also known as Enterprise Resource Planning Systems, or ERPs). Using a case study and simulation game, an ERP concept is introduced. After defining these systems, the advantages of cloud-based enterprise resource planning (ERP) are outlined. Students would be exposed to the various positions and occupations associated with the use and deployment of cloud ERPs. This module offers case studies and data sets for purchase and procurement, production planning, order management, and warehouse management in cloud ERP software implementation. Students will be able to apply cloud ERP to real-world business issues.

In this session, CMU provided the training of the trainers taught by Dr.Wapee Manopiniwes, Department of Industrial Engineering, Chiang Mai University. There were 7 participants from 4 institutes to attend in this class.

6.2.2 Session 2 Feedback

After finish the training in this module, there were 7 participants (100%) to response the satisfaction questionnaires. The results are presented in the figure below.



6.3 Integrated simulation and optimization

6.3.1 Session 3 description

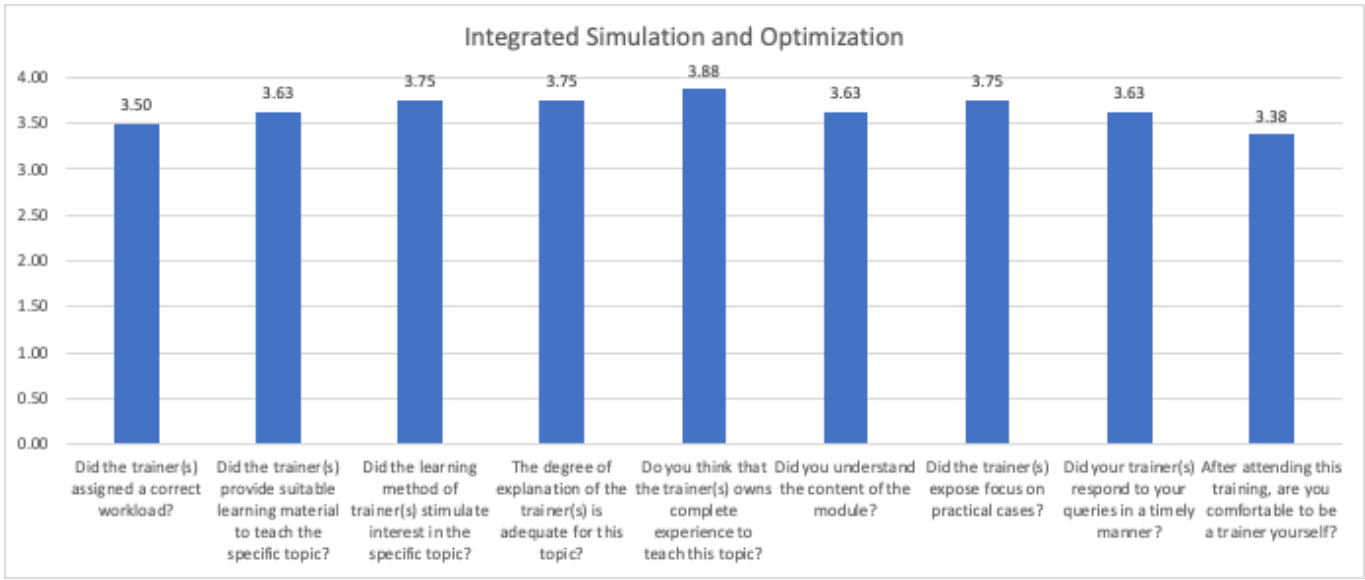
The first section introduces modeling, optimization, and simulation as they pertain to the analysis and study of manufacturing systems for decision support. The introduction of optimization models and algorithms provides a framework for considering many issues that arise in manufacturing systems. A case study demonstrates the advantages of simulation and optimization. This module

offers a data set and simulation software in order to conduct a practical analysis. The second step is to introduce students to a wide range of applications for these methods and models and to integrate this content with their introduction to operations management.

In this session, CMU provided the training of the trainers taught by Dr.Sakgasem Ramingwong and Dr.Apichat Sopadang, Department of Industrial Engineering, Chiang Mai University. There were 10 participants from 6 institutes to attend in this class.

6.3.2 Session 3 Feedback

After finish the training in this module, there were 8 participants (80%) to response the satisfaction questionnaires. The results are presented in the figure below.



6.4 Data collecting system

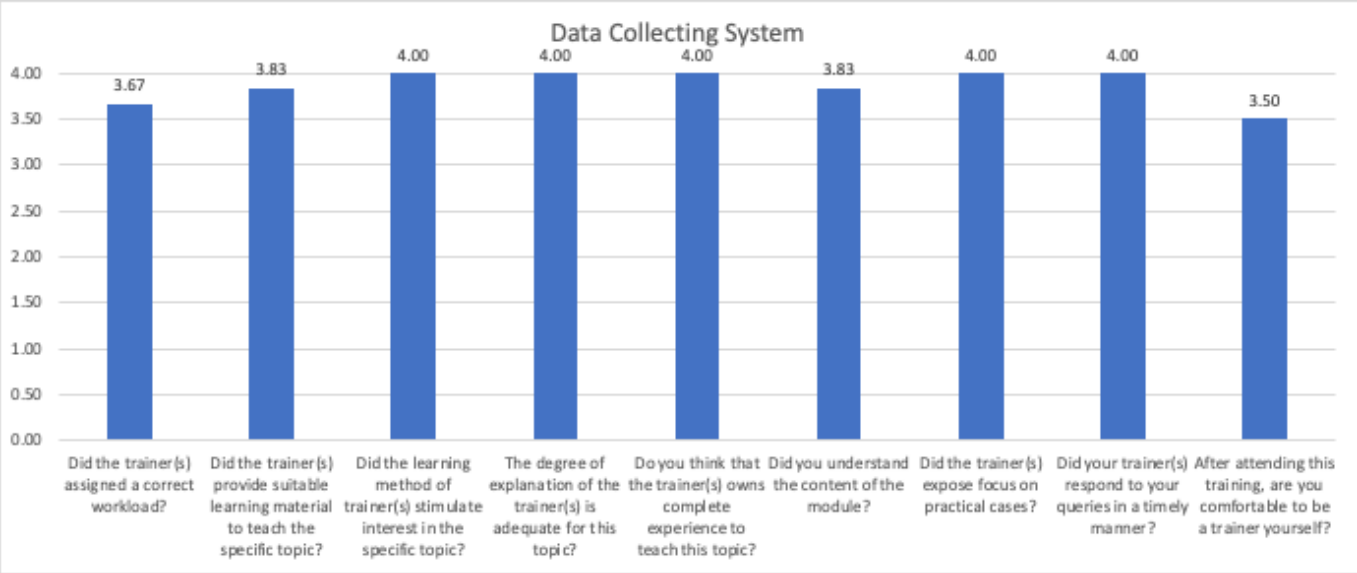
6.4.1 Session 4 description

Variability affects product quality and yield in manufacturing environments. This module will teach students why analysis of manufacturing processes is crucial for diagnosing and correcting operational defects to improve outcomes and reduce costs. Acquire an understanding of the effective methods for collecting, preparing, and analyzing data, as well as the computational platforms that can be used to collect and process data over an extended period. Develop the skills necessary to participate as a member of an advanced analysis team and to provide valuable input on effective implementation. The clearly defined objectives and KPIs of data collecting in the production process is an important step that leads to the effective data collecting system design.

In this session, CMU provided the training of the trainers taught by Mr.Narongsak Nanthagasigorn, Manager at Vernier Thai Co., Ltd. There were 6 participants from Chaing Mai University to attend in this class.

6.4.2 Session 4 Feedback

After finish the training in this module, there were 6 participants (100%) to response the satisfaction questionnaires. The results are presented in the figure below.



6.5 Automatic data collecting system

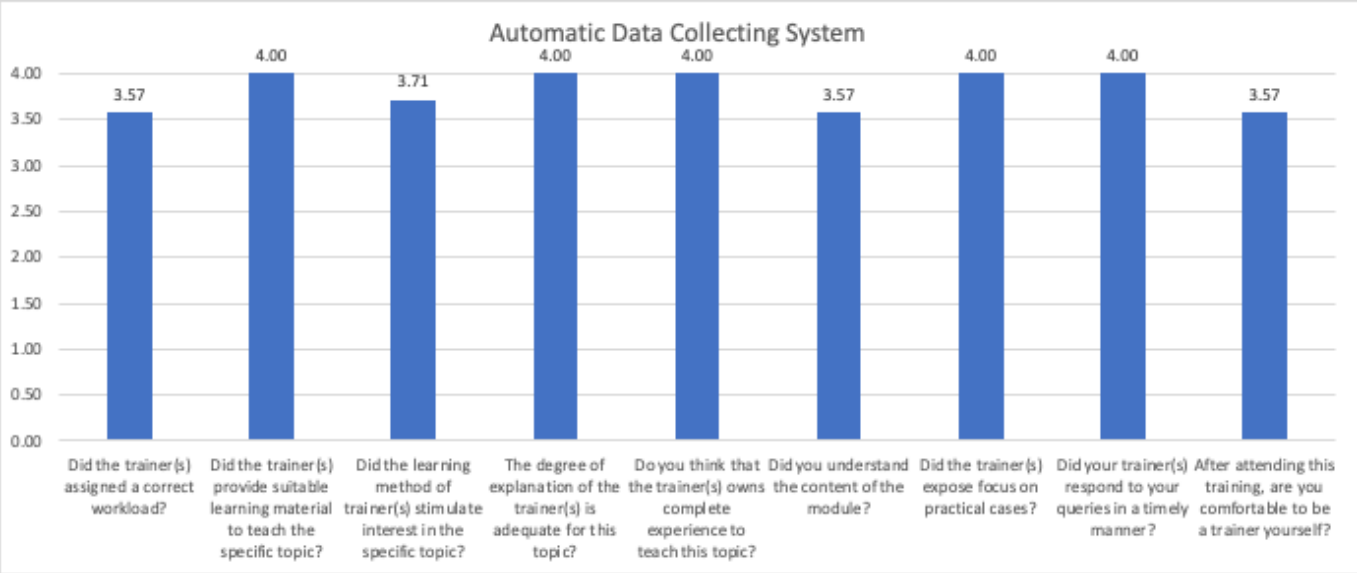
6.5.1 Session 5 description

A significant competitive advantage can be gained by properly collecting and utilizing the enormous amount of data that modern manufacturing processes generate. This information can help organizations improve operational efficiency. Gathering and capturing all of the necessary data during the operational process can be quite difficult. The information in this module covers the different types of data and recording devices, how to identify the data collection point, and some equipment for automating data collection from the manufacturing shop floor. With the aid of a data set and practical tools, students will learn how to design a data collection system. This equipment serves as the intermediary layer of communication between monitoring and analysis systems and machines. Through the practical assignment, students will learn how to gather data from the production process.

In this session, CMU provided the training of the trainers taught by Mr.Narongsak Nanthagasigorn, Manager at Vernier Thai Co., Ltd. There were 7 participants from Chaing Mai University to attend in this class.

6.5.2 Session 5 Feedback

After finish the training in this module, there were 7 participants (100%) to response the satisfaction questionnaires. The results are presented in the figure below.

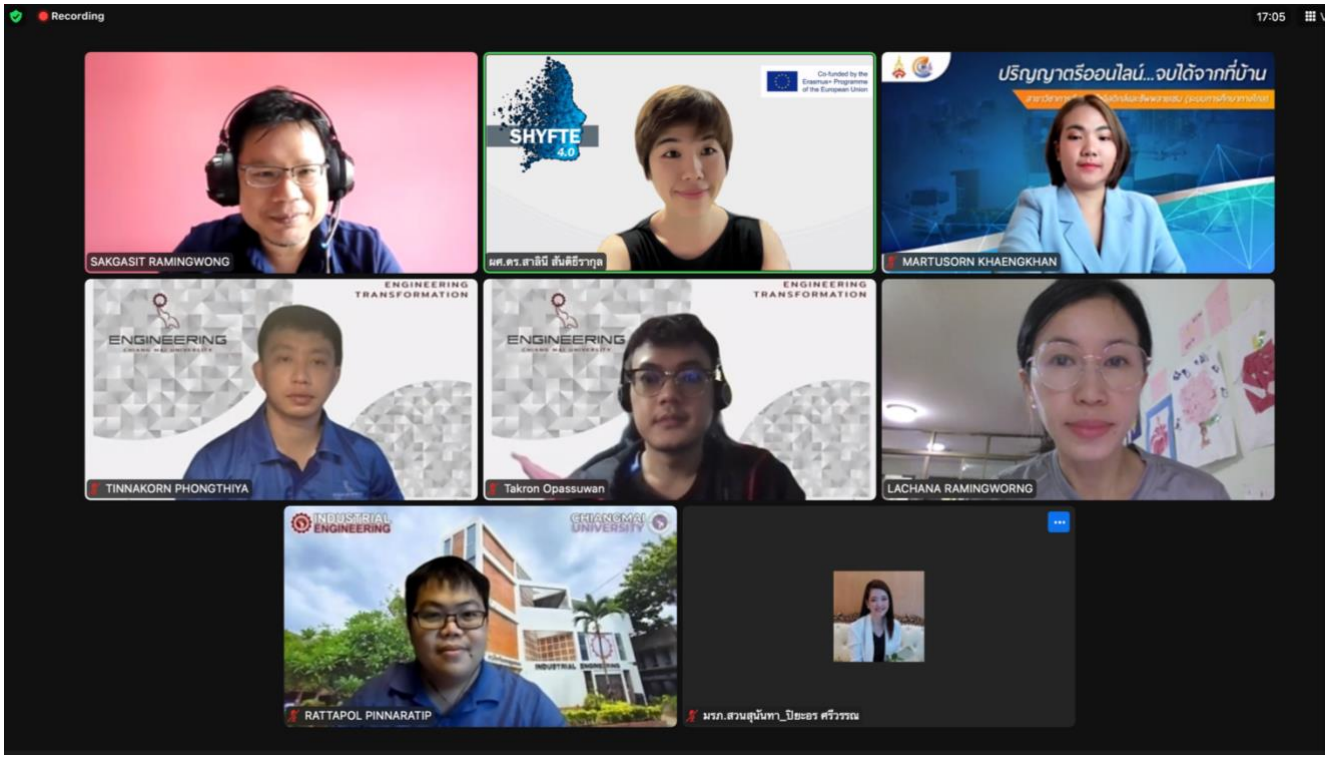


6.6 Decision-making with Big Data

6.6.1 Session 6 description

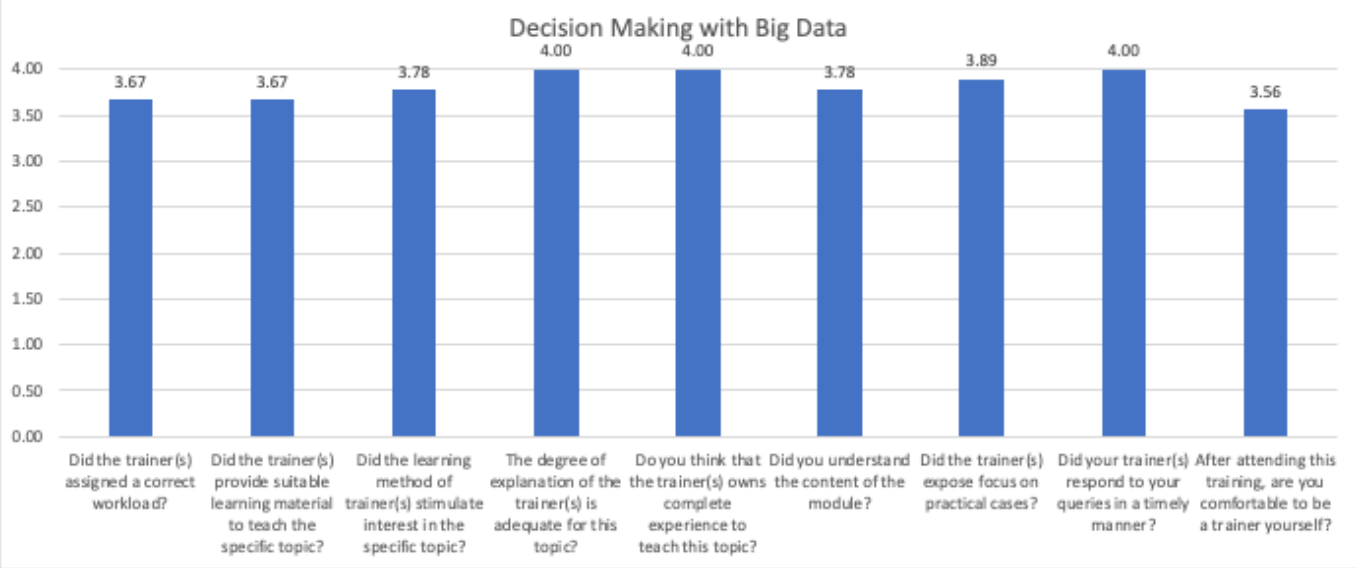
Numerous datasets can help solve significant problems and guide decision-making. However, these datasets are challenging to process and analyze due to their size, complexity, quality, and diversity. An introduction to data analytics is provided in this module. Data and its importance, Data and its relations, Data analytics, and the background required for Data analytics. The six phases of data preparation—discovery, preparation, model planning, model building, communication, and operationalization—are explained. Regression, decision trees, clustering, central tendency and standard deviation, and other data analysis tools and techniques are all explained in this module. In order to demonstrate how to use big data to lead successful business analytics initiatives and make fact-driven decisions includes the analysis, the case studies (CMU traffic management system, a water work enterprise, and a quarry enterprise) are shown in the final section.

In this session, CMU provided the training of the trainers taught by Dr.Sakgasit Ramingwong, Department of Computer Engineering, Chiang Mai University. There were 9 participants from 6 institutes to attend in this class.



6.6.2 Session 6 Feedback

After finish the training in this module, there were 9 participants (90%) to response the satisfaction questionnaires. The results are presented in the figure below.



Part II: Management

Upon the completion of learning materials development and revision, Training of the Trainers (ToT) sessions based on posters are conducted.

We have invited the participant to join the ToT that is relevant to the management and business function, professional & support area or academic filed from public & private university as well as private firms. The dissemination is made through emails and social media platforms to promote groups from Faculty of Business Administration, Faculty of Engineering and related institutes.

For domain 1 regarding the management domain (Part II), the ToT are conducted in 2 parts with each parts covering five modules. For the first part, it involves human resource management for industry 4.0, business intelligence and new product development. Each session was conducted through online platform (Webex) under the Covid-19 pandemic during July - August 2021. In addition, KU has arranged for the training of the trainers in the second part, covering digital communication and role of data for future organization through online platform (Webex) due to the Covid-19 pandemic during January - February 2022.

Overall, the ToTs have been attended by 62 participants in sum to join each module from 11 higher institution (Univeriti Putra Malaysia, Universiti Teknologi Malaysia, Valaya Alongkorn Rajabhat University, Phetchabun Rajabhat University, Kasetsart University, King Mongkut's Institute of Technology Ladkrabang, Burapha University, Sripatum University, Sukhothai Thammathirat Open University, Chiang Mai University, Assumption University) and 5 private firms (Siam Cement Group, BBTV New Media, The Queen Sirikit Department of Sericulture, DD Medicine Co.,Ltd., and freelance in the Regulatory Affairs).

Institution	Country	Trainees
Univeriti Purtra Malaysia	Malaysia	5
Universiti Teknologi Malaysia	Malaysia	2
Valaya Alongkorn Rajabhat University	Thailand	1
Phetchabun Rajabhat University	Thailand	1
Kasetsart University	Thailand	4
King Mongkut's Institute of Technology Ladkrabang	Thailand	2
Burapha University	Thailand	1
Sripatum University	Thailand	1
Sukhothai Thammathirat Open University	Thailand	1
Chiang Mai University	Thailand	1
Assumption University	Thailand	1
Siam Cement Group	Thailand	1
BBTV New Media	Thailand	1
The Queen Sirikit Department of Sericulture	Thailand	1
DD Medicine Co.,Ltd	Thailand	1
freelance in the Regulatory Affairs	Thailand	1
Grand Total		**25**


SHYFTE 4.0
Training of the Trainers (Part 1)
SHYFTE 4.0
SESSSION 1
Business Intelligence
Friday, July 2&9, 2pm-5pm (Thailand Standard Time)
ASST.PROF.DR.WARANPONG BOONSIRITOMACHAI
Department of Management
Kasetsart Business School, Kasetsart University
This session will explain the trainees about business intelligence, which is the process of evaluating data sets and software programs in designed to help businesses in making better business choices.
July 2, 2021
July 9, 2021
webex
SESSION 2
Human Resource Management for Industry 4.0
Friday, July 16&23, 2pm-5pm (Thailand Standard Time)
DR.PANISARA THITATORN
Department of Management
Kasetsart Business School, Kasetsart University
This lesson will instruct the trainees about human resource management in the industry 4.0, which includes a variety of tasks such as the recruitment, selection, and retention of a competent, motivated, and productive workforce dealing with "people-related" challenges.
July 16, 2021
July 23, 2021
webex
KASETSART
Co-funded by the
Erasmus+ Programme
of the European Union


SHYFTE 4.0
Training of the Trainers (Part 1)
SHYFTE 4.0
SESSION 3
New Product Development
Friday, August 20&27, 2pm-5pm (Thailand Standard Time)
DR.JUL THANASRIVANITCHAI
Department of Management
Kasetsart Business School, Kasetsart University
This session will enlighten the trainees on new product development concepts such as creativity, innovation, and open innovation.
August 20, 2021
August 27, 2021
Cisco webex
KASETSART
Co-funded by the
Erasmus+ Programme
of the European Union


SHYFTE 4.0
Training of the Trainers (Part 2)
SHYFTE 4.0
SESSSION 4
Role of Data for Future Organization
Wednesday, January 19&26, 1pm-4pm (Thailand Standard Time)
ASST.PROF.DR.WARANPONG BOONSIRITOMACHAI
Department of Management
Kasetsart Business School, Kasetsart University
This session will explain how to acquire the right quality of data that is suitable for the organization in order to deliver timely insights when required by the managers.
Scan and Join Us on Webex
Cisco webex
SESSION 5
Digital Communication
Wednesday, February 9&16, 1pm-4pm (Thailand Standard Time)
DR.PANISARA THITATORN
Department of Management
Kasetsart Business School, Kasetsart University
This lesson will instruct the trainees about digital communication relating to the science of data visualization with the art of graphic design.
Scan and Join us on Webex
Cisco webex
KASETSART BUSINESS SCHOOL
KU
มหาวิทยาลัยเกษตรศาสตร์
Co-funded by the
Erasmus+ Programme
of the European Union

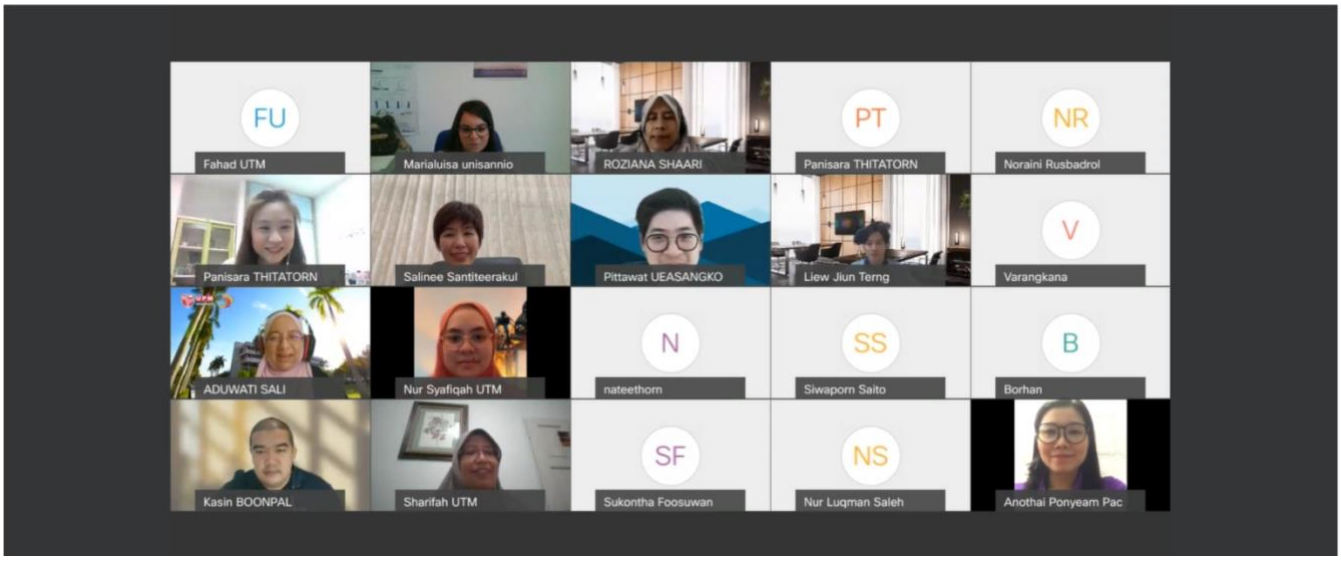
6.7 Human Resource Management for Industry 4.0

6.7.1 Session 7 description

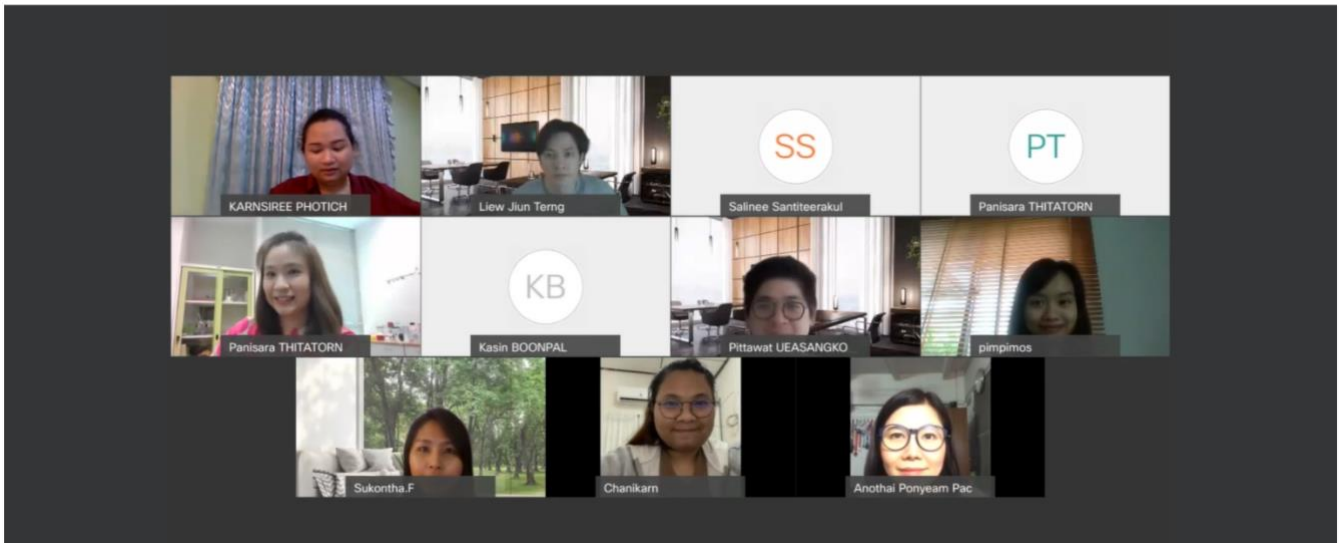
Human Resource Development for Industry 4.0 incorporates the process for acquiring human resource, developing human resource and organization, maintaining human resource and human resource transformation. Job analysis, personal planning and recruiting and employee testing and selection and interviewing candidates are the essential processes for acquiring human resource. Human resource development includes individual development, career development and organization development. Human resource training and development process indicates the steps for determining specific needs, determine specific objectives, select methods and delivery system, implement the program and evaluate the program. The performance management system is required for maintaining human resource. It composes of plan, follow, develop, estimate and reward. In addition, employee relationship management means the relationship between employer and employee both structural and non-structural forms. Finally, human resource 4.0 and human resource transformation is specified as the target to be achieved.

In this session, KU provided the training of the trainers taught by Dr.Panisara Thitatorn, Department of Management, Faculty of Business Administration at both July 16 and July 24, 2021 through Webex Online (as pictures below) due to Covid-19 situation. There were 14 participants to attend in this class from Universiti Putra Malaysia, Universiti Teknologi Malaysia, Kasetsart Unviersity, Chiangmai Unviersity, Valaya Alongkorn Rajabhat University, Phetchabun Rajabhat University, BBTV New Media.

ToT Part 1 - Session 2: Human Resource Management for Industry 4.0 (1)

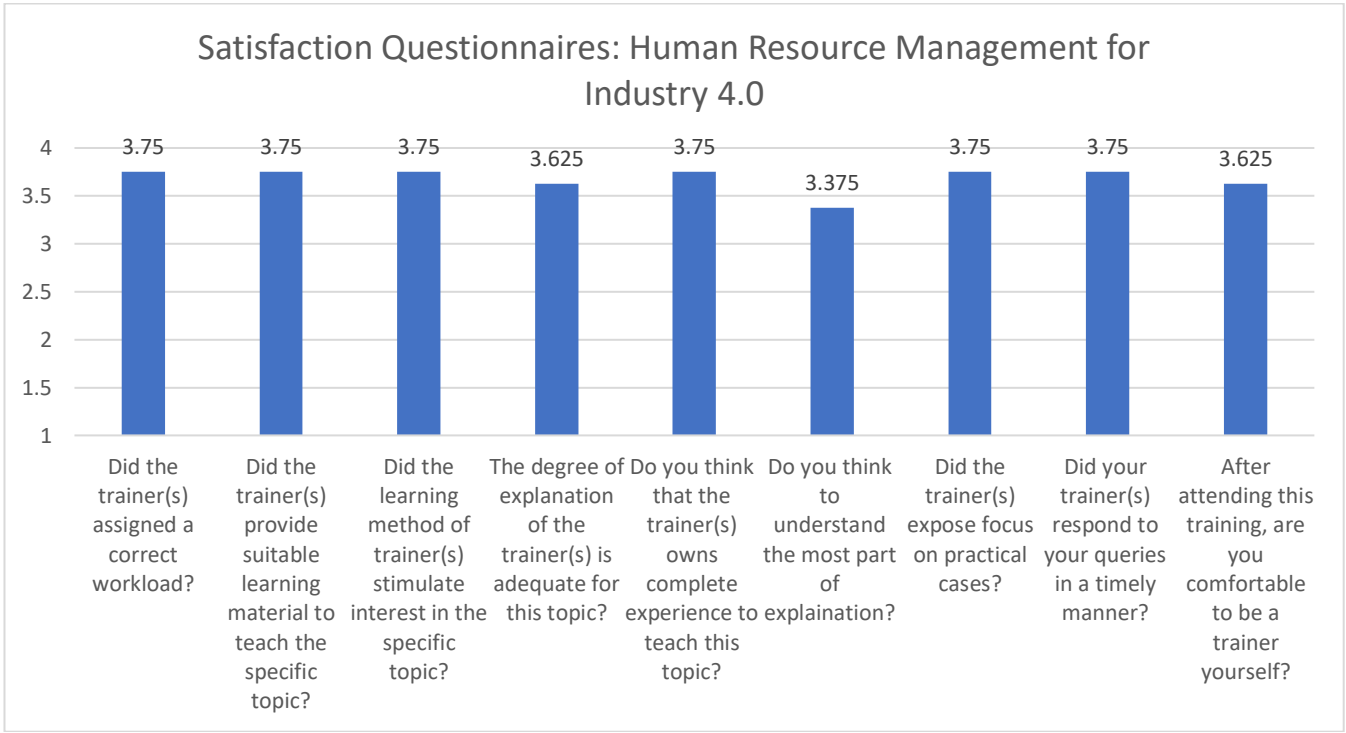


ToT Part 1 - Session 2: Human Resource Management for Industry 4.0 (2)



6.7.2 Session 7 Feedback

After finish the training in this module, there were 8 trainers (57%) to response the satisfaction questionnaires. The results are presented in the figure below. It shows that trainers are very satisfied with the workload, learning materials, learning method, trainer's experience, practical cases and timely manner, followed by trainer's explanation and being comfortable to become trainers in the future. In addition, the results also present those trainers who are respondents understand the most part of explanation at the high level accordingly.

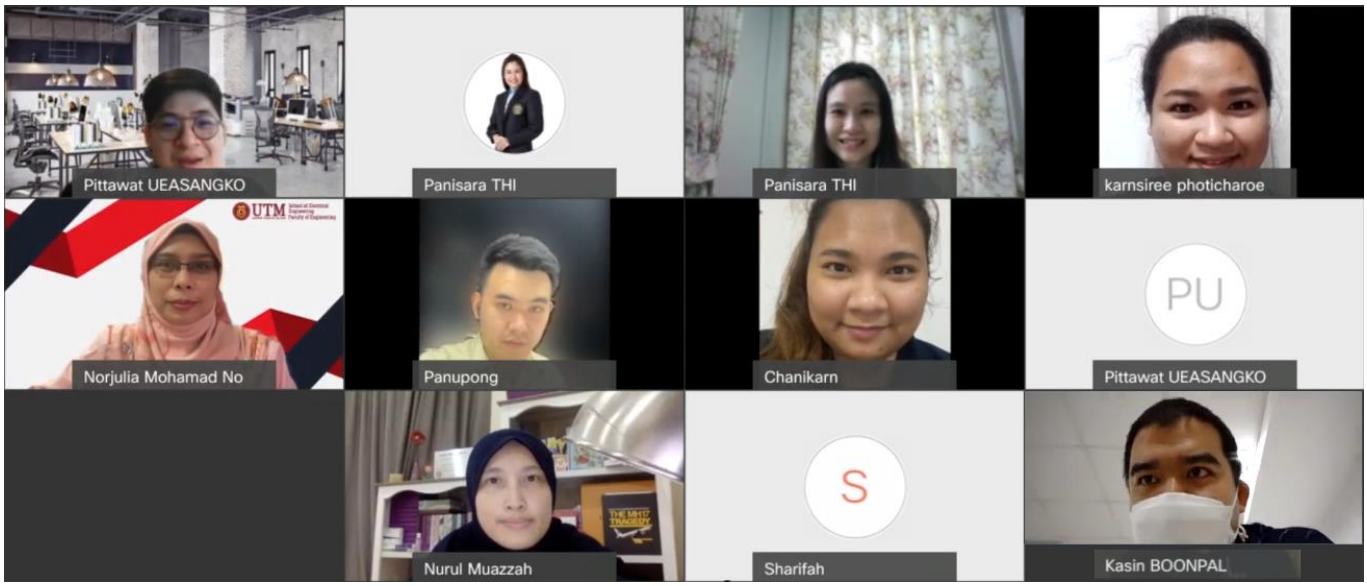


6.8 Digital Communication

6.8.1 Session 8 description

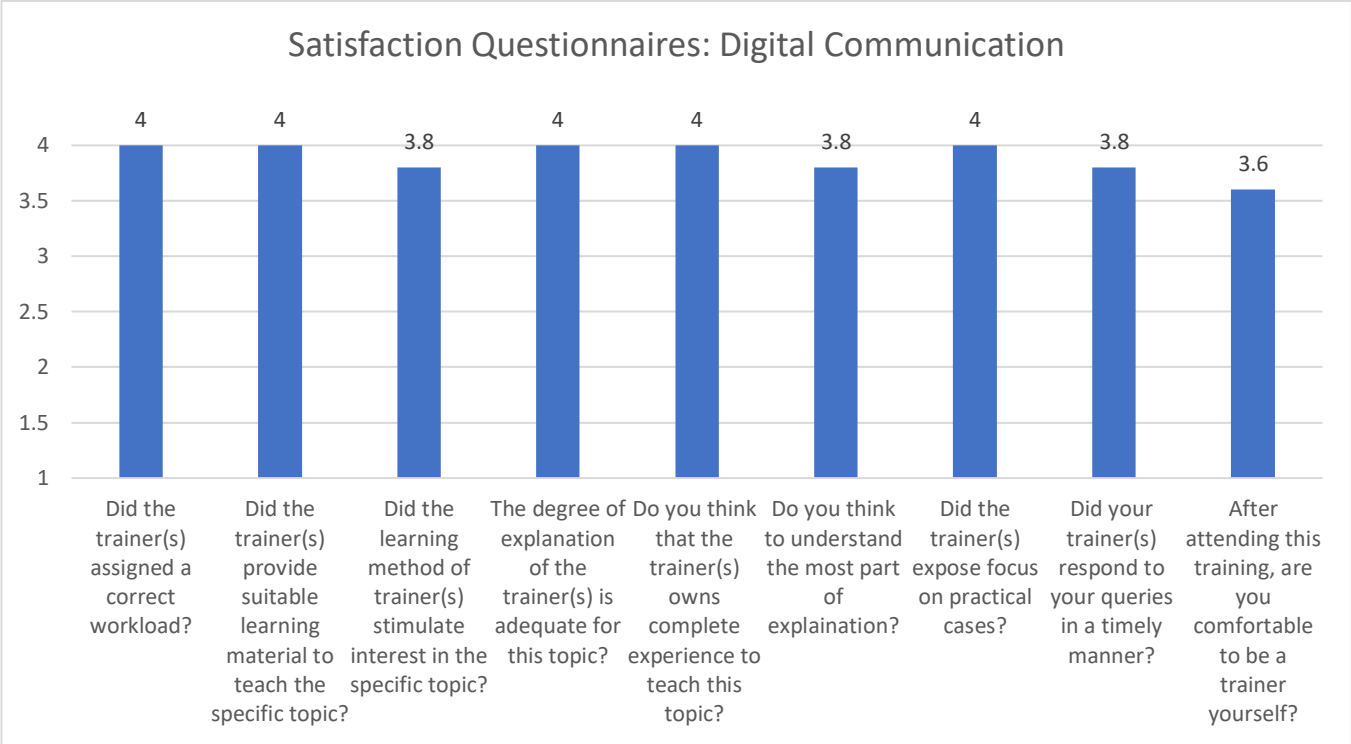
Communication for industry 4.0 starts from functions of communication which are control, motivation, emotional expression and information. Direction of communication becomes downward, upward, horizontal and diagonal communication. Interpersonal communication composes of oral, written and nonverbal communication. Organizational communication includes formal and informal communication network. Sender, media and receiver are integrated in the communication process. The workplace needs to prepare the workforce for industry 4.0, specifically people, environment and tool. For people, workplace should focus on self-awareness, empathy, courage and resilience. Transparency and psychological safety are focal point for environment. In addition, several tools must be applied as assertive communication, recognition and appreciate listening.

In this session, KU provided the training of the trainers taught by Dr.Panisara Thitatorn, Department of Management, Faculty of Business Administration at both February 9 and February 16, 2022 through Webex Online (as pictures below) due to Covid-19 situation. There were 8 participants to attend in this class from Universiti Putra Malaysia, Universiti Teknologi Malaysia, Kasetsart Unviersity, Assumption University, SCG.



6.8.2 Session 8 Feedback

After finish the training in this module, there were 5 trainers (63%) to response the satisfaction questionnaires. The results are presented in the figure below. It shows that trainers are very satisfied with the workload, learning materials, trainer's explanation, trainer's experience, practical cases, followed by learning method, understanding the most part of explanation and timely manner, respectively. In addition, the results also present those trainers who are respondents being comfortable to become trainers in the future at the high level accordingly.



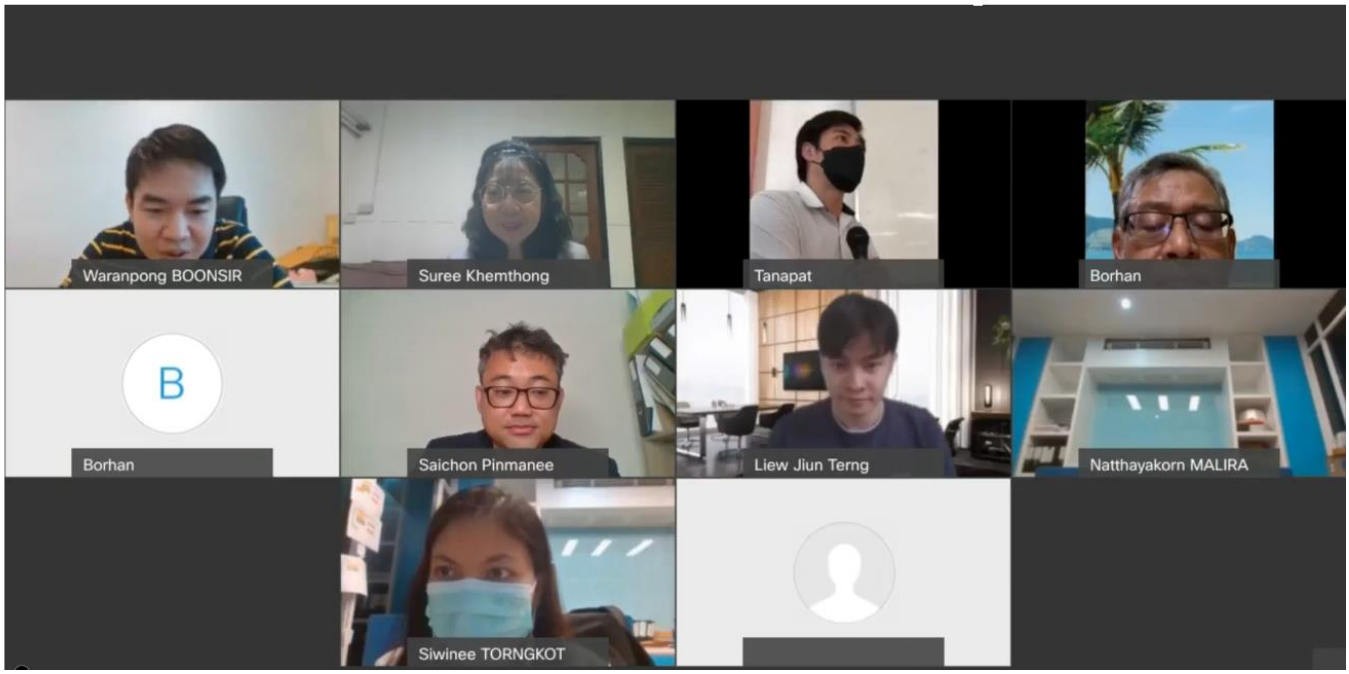
6.9 Role of Data for Future Organization

6.9.1 Session 9 description

Data represent any information, numbers, facts, and instructions which are helpful to understand an object or an entity that exists in a specified environment. Data can drive a company's decision and concerns regarding planning and marketing. ERP is one of the practices of consolidating and enterprise's planning manufacturing, sales and marketing efforts into one management system. ERP combines all databases across departments into a single database, automates the tasks involved in performing a business process and integrates all functions across a company to a single computer system that can serve all those functions' specific needs. A case study of Airways Hotel is shown as ERP systems is a business solution to integrate all hospitality functions from front office to payroll and create a centralized system of operations. The Entity–Relationship model (ER model) describes the structure of a database with diagram, known as Entity Relationship Diagram (ER Diagram). An ER model is a design or blueprint of a database that can later be implemented as a database. The main components of E-R model are entity set, attribute and relationship set. Finally, the example of normalization process is used to make a database table as efficient as possible.

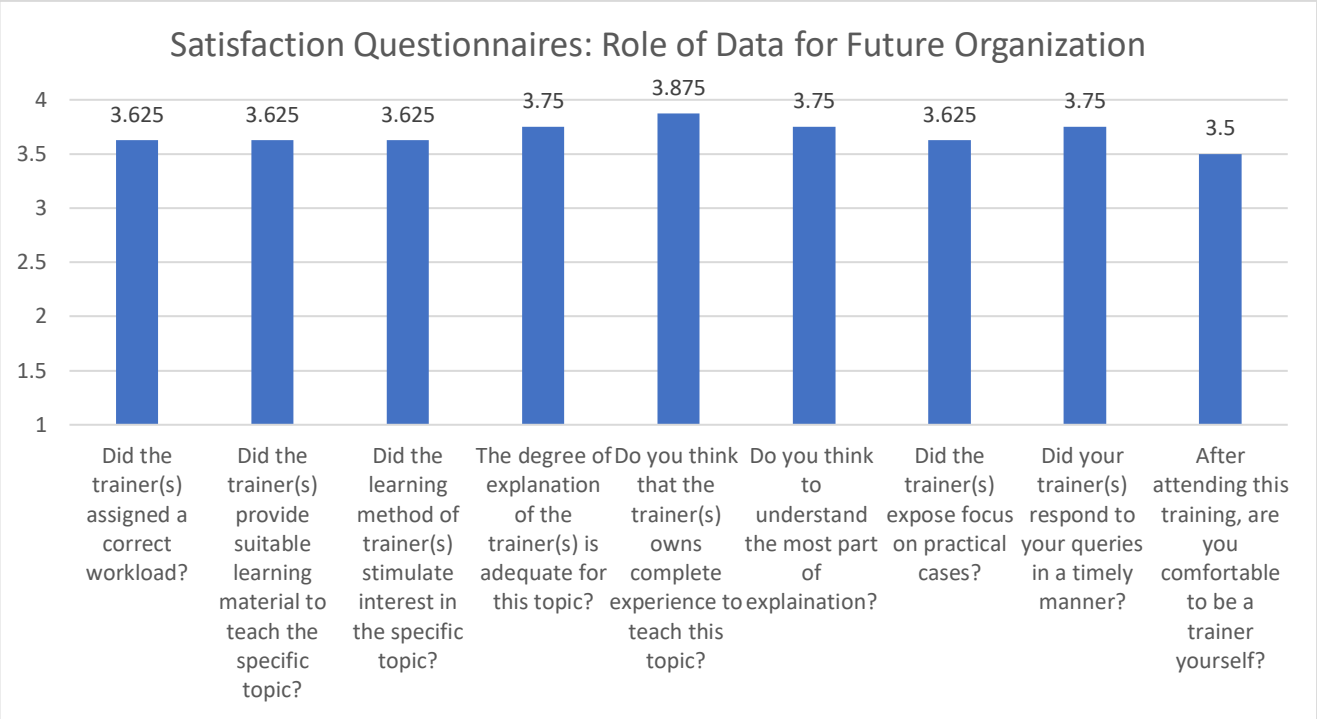
In this session, KU provided the training of the trainers taught by Asst.Prof.Dr.Waranpong Boonsiritomachai, Department of Management, Faculty of Business Administration at both January 19 and January 26, 2022 through Webex Online (as pictures below) due to Covid-19 situation. There were 10 participants to attend in this class from Universiti Putra Malaysia, Universiti Teknologi Malaysia, Kasetsart Unviersity, Sripatum University, Sukhothai Thammathirat Open University, KMITL.

Training of the Trainers: Role of Data for Future Organization-20220119



6.9.2 Session 9 Feedback

After finish the training in this module, there were 8 trainers (80%) to response the satisfaction questionnaires. The results are presented in the figure below. It shows that trainers are very satisfied with trainer's experience at the most level. In addition, the findings indicate that trainers are respondents also very satisfied with trainer's explanation, understanding the most part of explanation, followed by the workload, learning materials, learning method, practical cases, respectively. Moreover, the results also present those trainers being comfortable to become trainers in the future at the high level accordingly.



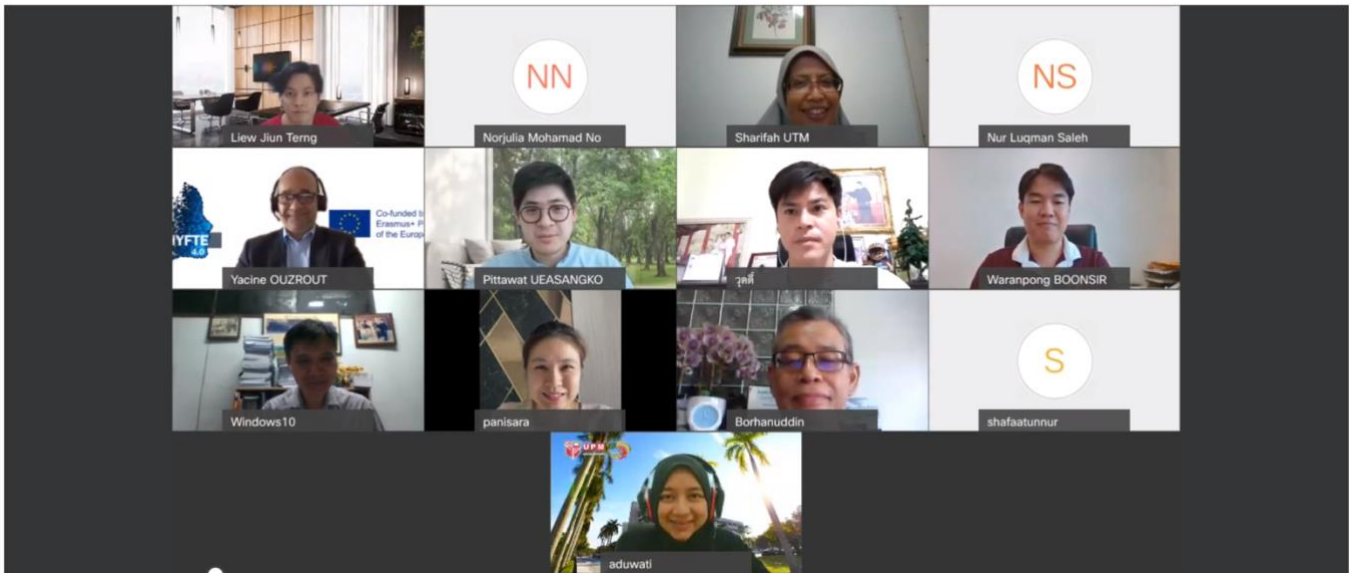
6.10 Business Intelligence

6.10.1 Session 10 description

Business Intelligence is emerging from advanced processing of high-quality data, information and knowledge, and analytical practices that support decision-making and performance measurement. BI incorporates with dashboards, data mining and reporting system. Several vendors are offered, particularly Power BI which is a business analytics service by Microsoft. It aims to provide interactive visualizations and business intelligence capabilities with an interface simple enough for end users to create their own reports and dashboards. Power BI composes of getting data / query editor (power query in excel), data model (relationship), DAX formular (power pivot in excel) and report (power view in excel). Power BI workshop is introduced as the ways of set up Power BI, import data from website and prepare data, save files, sign up and publish, transform data and edit format, Power BI application in mobile phone, create dashboard and create report on Power BI web, import data from excel, filter function and edit interaction, slicer function, sorting, number format and natural language query, refresh data by manual, data type conversion, calculation and measure, extraction and hierarchy and conditional format and DAX function.

In this session, KU provided the training of the trainers taught by Asst.Prof.Dr.Waranpong Boonsiritomachai, Department of Management, Faculty of Business Administration at both July 2 and July 9, 2022 through Webex Online (as pictures below) due to Covid-19 situation. In addition there were three trainers who have trained by watching Video Record. Thus, there were 16 participants to attend in this class from Universiti Putra Malaysia, Universiti Teknologi Malaysia, Kasetsart Unviersity, Sripatum University, Burapha University, The Queen Sirikit Department of Sericulture, DD medicine and Food regulatory Consultant.

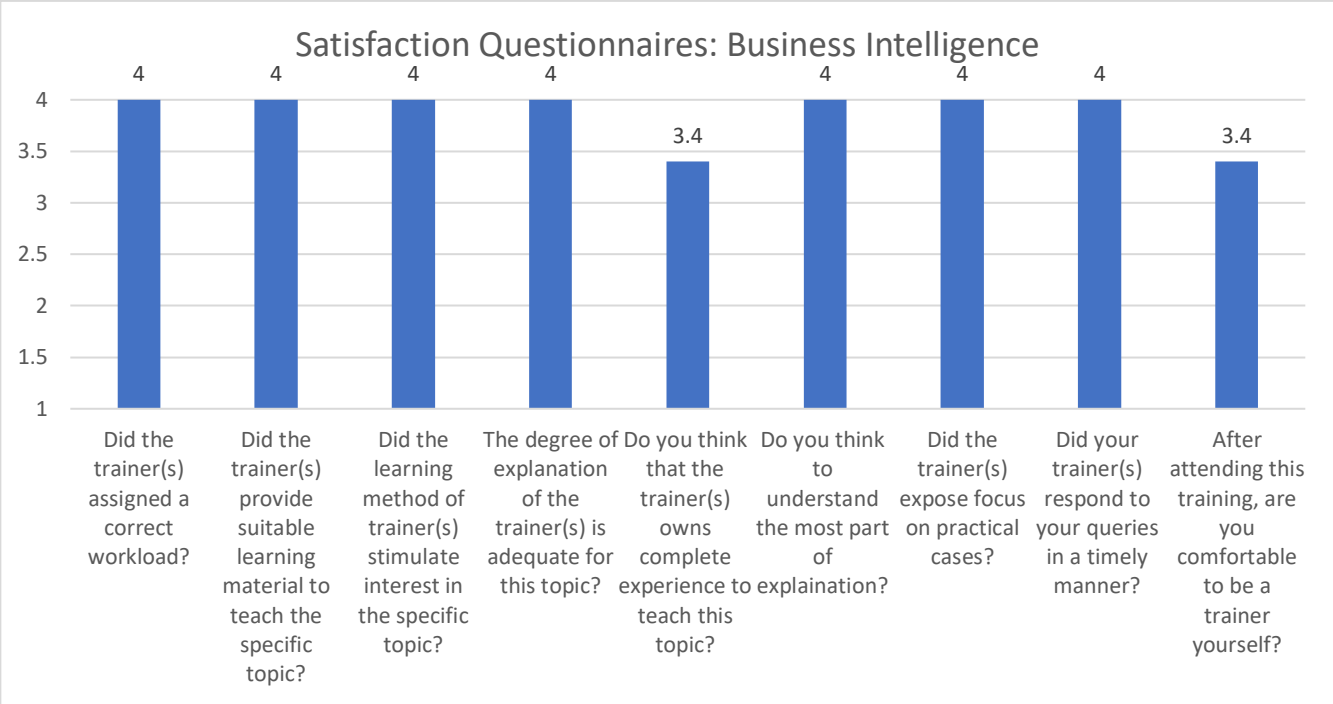
ToT Part 1 - Session 1: Business Intelligence (1)



ToT Part 1 - Session 1: Business Intelligence (2)-20210709

6.10.2 Session 10 Feedback

After finish the training in this module, there were 5 trainers (31%) to response the satisfaction questionnaires. The results are presented in the figure below. It shows that trainers are very satisfied with the workload, learning materials, learning method, trainer's explanation, understanding the most part of explanation, practical cases, and timely manner. In addition, the results also present those trainers who are respondents being comfortable to become trainers in the future as well as trainer's experience at the high level accordingly.

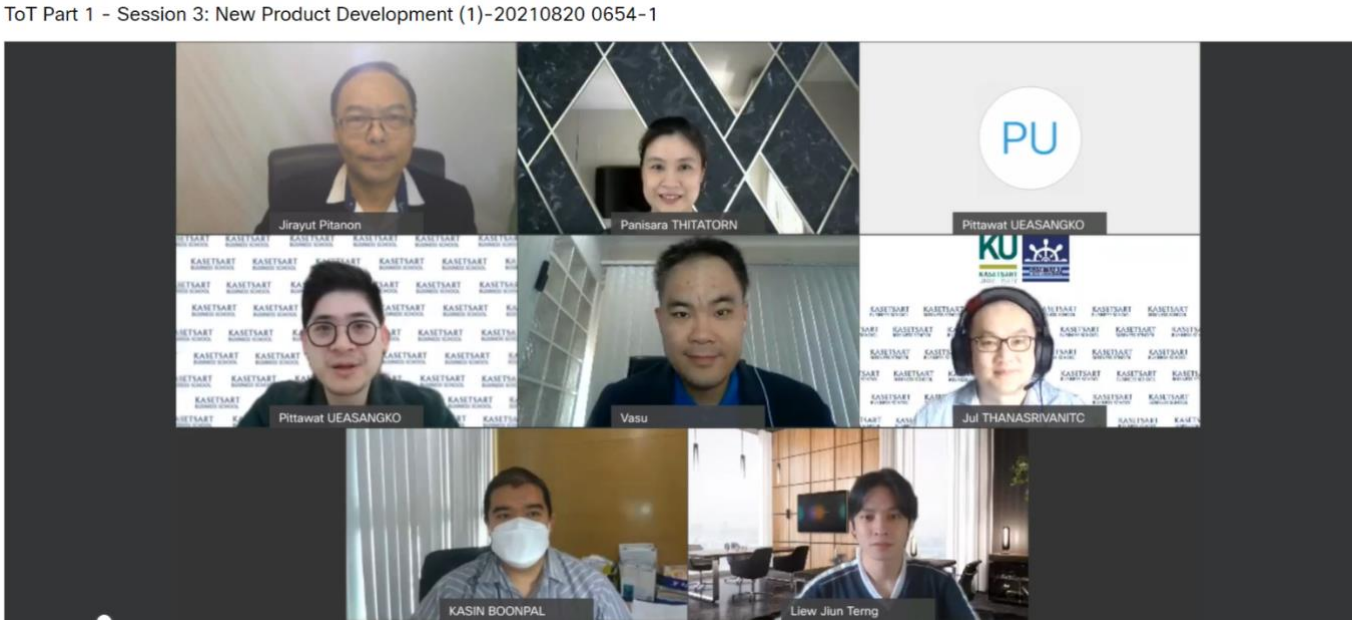


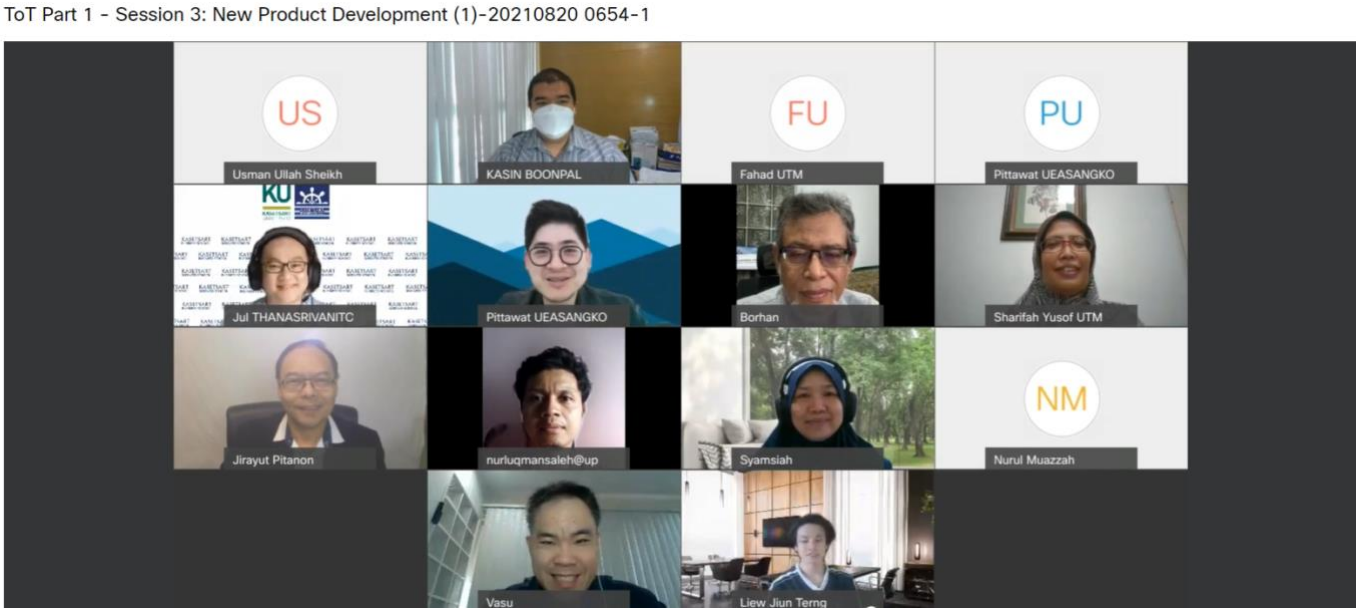
6.11 New Product Development

6.11.1 Session 11 description

New product development begins with the exploration of the relationship between new product and sustainable growth strategies, the wide range of NPD ranging from packaging alterations to new technological research and a network model of NPD. The NPD processes include several stages; idea generation, idea screening, concept testing, business analysis, product development, test marketing, commercialization and monitoring and evaluation. The example of new product development on process of electric car is presented, and the workshop on NPD model with several templates including NPD process, concept development, new service development or service blueprints, business model canvas and new product development plan. The nature of creativity and innovation and their role in organization are introduced. The steps in the creative process are described and identify the four major types of innovation; creative people, creative processes, creative products and creative places. In addition, the nature of open and close innovation and the steps in open innovation process is described.

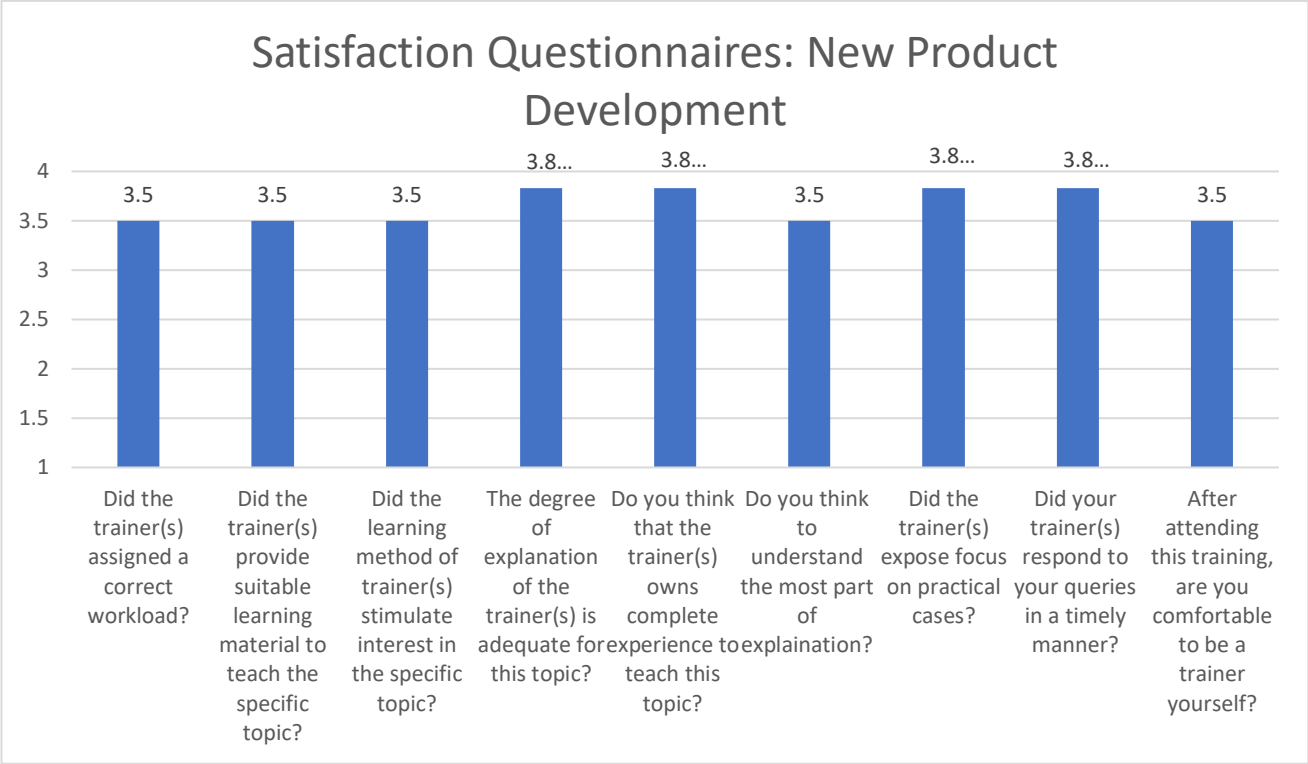
In this session, KU provided the training of the trainers taught by Dr.Jul Thanasrivanitchai, Department of Management, Faculty of Business Administration at both August 20 and August 27, 2022 through Webex Online (as pictures below) due to Covid-19 situation. There were 13 participants to attend in this class from Universiti Putra Malaysia, Universiti Teknologi Malaysia, Kasetsart Unviersity, KMITL.





6.11.2 Session 11 Feedback

After finish the training in this module, there were 6 trainers (46%) to response the satisfaction questionnaires. The results are presented in the figure below. It shows that trainers are very satisfied with trainer's explanation, trainer's experience, practical cases, and timely manner, In addition, the findings indicate that trainers are respondents also very satisfied with the workload, learning materials, learning method, understanding the most part of explanation and being comfortable to become trainers in the future at the high level accordingly.

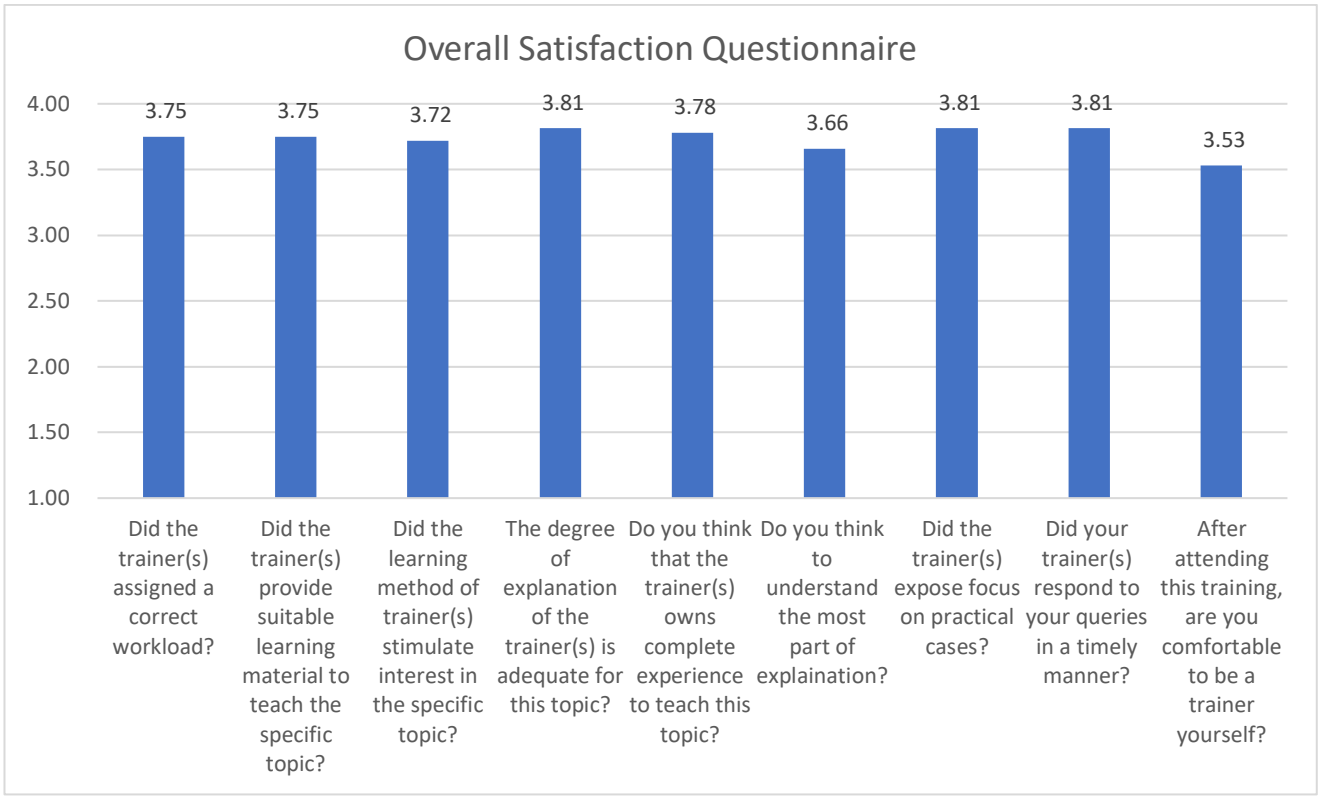


ToT Overall improvement actions

Regarding the overall satisfaction questionnaire, there were total 93 responses (Trainers) to feedback their opinions for improvement in the management domain with five modules. The overall results indicate that most of them are very satisfied with all dimensions. The findings indicate that our trainers can train the participants and provide practical cases to them in a timely manner very well. Moreover, the results point out that trainers in each module have experience in their field with proper learning material and learning method.

While workload of each module assigned by trainers for participants as trainers is correct that leads trainer to understand the most part of explanation. Although the level of satisfaction regarding being comfortable to be a trainers is at very high, however, it is the lowest level compared to other dimensions. Thus, for further improvement, we need to guide and provide more suggestions for trainers to become the trainers yourself.

With the session of the training of the trainers, the course should include the open session or Q&A session for participants to discuss with trainers in terms of limitation, obstacle and benefits. This will support this training of trainer in the management domain to improve the level of being comfortable to be trainer efficiently. While, the summary of the overall satisfaction is presented as figure below :


Overall Satisfaction Questionnaire
4.00
3.50
3.00
2.50
2.00
1.50
1.00
3.75
3.75
3.72
3.81
3.78
3.66
3.81
3.81
3.53
Did the trainer(s) assigned a correct workload?
Did the trainer(s) provide suitable learning material to teach the specific topic?
Did the learning method of trainer(s) stimulate interest in the specific topic?
The degree of explanation of the trainer(s) is adequate for this topic?
Do you think that the trainer(s) owns complete experience to teach this topic?
Do you think to understand the most part of explaination?
Did the trainer(s) expose focus on practical cases?
Did your trainer(s) respond to your queries in a timely manner?
After attending this training, are you comfortable to be a trainer yourself?

7. Training of the Students Sessions

Training of Students (ToS) sessions were held from June to August 2022 for all six modules, including Introduction to IR4.0, Cloud ERP, Integrated Simulation and Optimization, Data Collecting System, Automatic Data Collecting System, and Decision Making with Big Data. CMU chose students with either a bachelor's or master's degree in industrial engineering, industrial management and logistics engineering and supply chain management to help them improve their skills in all six modules. The total participants in all six modules are 162 participants from 94 students. There are 69 bachelor students in the industrial engineering program and 25 master students in the logistics engineering and supply chain management program and the industrial management program. Also, 10 master's students are working in industrial companies.

Module Title	Number of participants
Introduction to IR 4.0	45
Cloud ERP	40
Integrated Simulation and Optimization	17
Data Collecting System	15
Automatic Data Collecting System	15
Decision Making with Big Data	30
Total	**162**

Student Profile	Number of students
Bachelor of Engineering Program in Industrial Engineer	69
Master of Science Program in Industrial Management	12
Master of Engineering Program in Logistics Engineering and Supply Chain Management	13
Total	**94**

The communication of ToS was implemented in several channels. The social media, specifically line group was used to inform the students. Moreover, ToS sessions were informed to all lecturers in the virtual departmental meeting so they would announce and encourage the students to participate. The schedules of ToS are shown in the table below.

Module Title	Date of ToS
Introduction to IR 4.0	28, 30 Jun and 30 Jul
Cloud ERP	15 – 17 Aug 2022
Integrated Simulation and Optimization	21, 27 Jul 2022
Data Collecting System	8- 9 Jul 2022
Automatic Data Collecting System	12 – 13 Jul 2022
Decision Making with Big Data	25 – 26 Jul 2022

7.1 Introduction to IR4.0

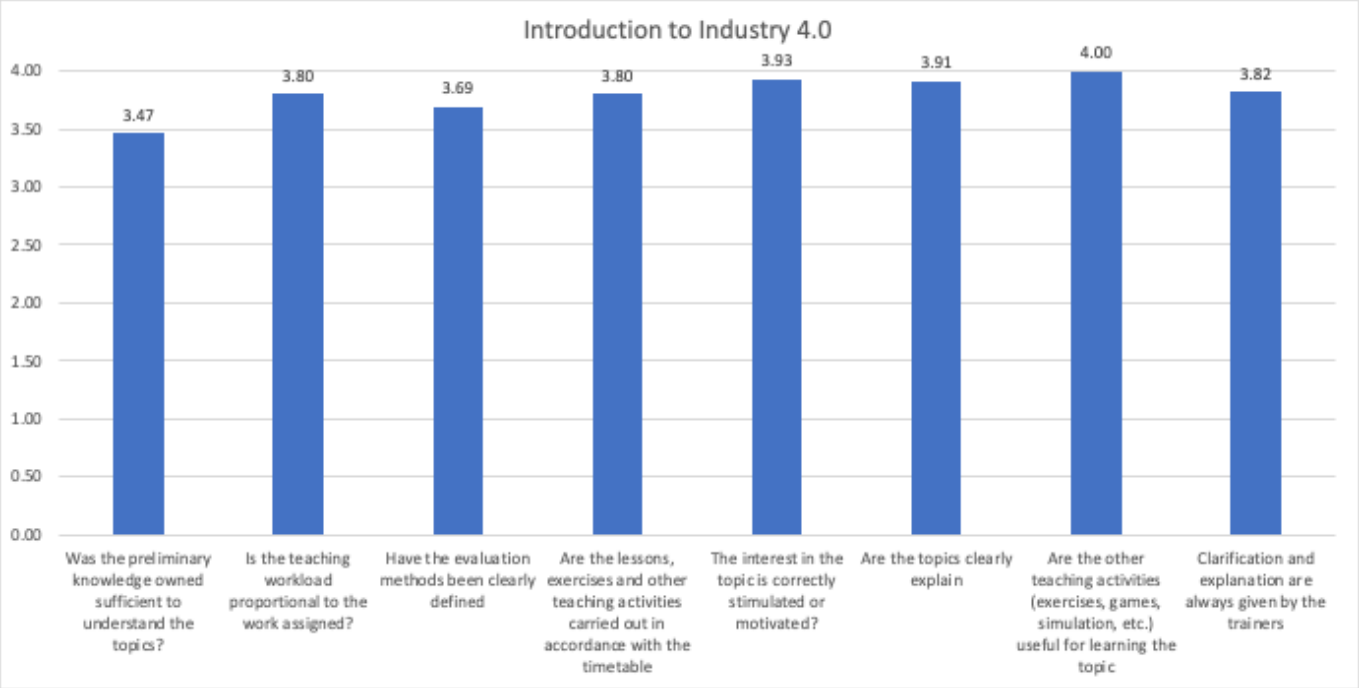
7.1.1 Session 1 description

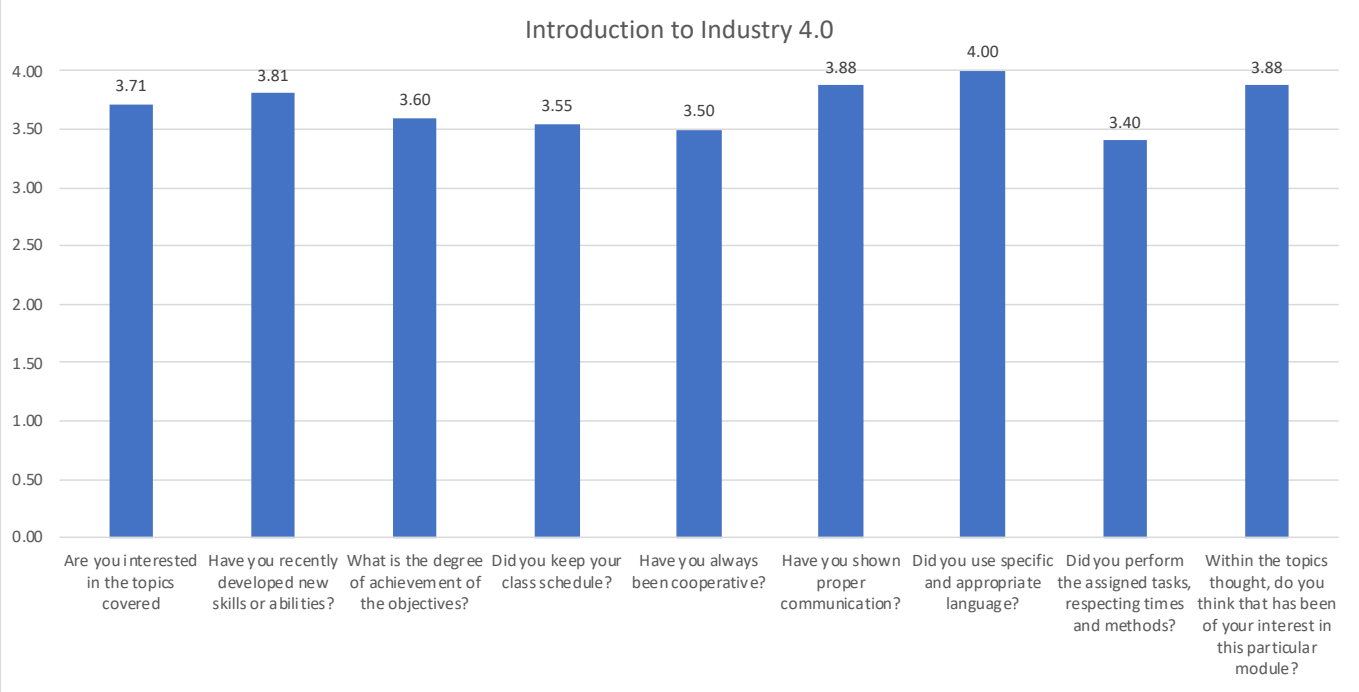
Introduction to Industry 4.0 begins with a discussion of the industrial revolution, Industry4.0's context, and its environment. The challenges of implementing the I4.0 concept and technology, particularly for small and medium-sized enterprises, are introduced in terms of organization management, information technology, production and operation, and human resource. The implementation framework for SMEs 4.0 is explained through case studies. Industry 4.0 transforms business operations into intelligent factories and digital supply chains. The differences between data warehouse and big data are elucidated. The evolution of big data and the type of big data utilized in Industry 4.0 are explained. CPS is a system in which cyber and physical systems are tightly integrated across all scales and levels, as opposed to cyber simply being applied to physical. The CPS shifts from a physical to a "Computing as parts" (commodity-based) mentality. The generation of sensors is then described with examples of how to implement various sensors in an Industry 4.0 setting. This module provides an overview of the maturity assessment model as well as preliminary research findings. The data was gathered in Thailand and three additional European countries. Assessment and Maturity Stage Models for Evaluating the Implementation of Industry 4.0 were investigated and presented

In this session, CMU provided the training of the trainers taught by Dr. Korrakot Tippayawong, Department of Industrial Engineering, Chiang Mai University. This module invited Mr. Kotcharat Srisuk, Logistics Manager at BERNINA THAILAND and Mr. Santawat Santiteerakul, Product Development Manager at HG Robotic to present the case studies of Industry 4.0 implementation. There were 45 students from undergraduate and graduate level participate in this class.

7.1.2 Session 1 Feedback

This module is participated by 45 students. There are 42 students (93%) who responded to the satisfaction survey. The satisfaction rating has fluctuated between 1 and 4. There are 17 questions for module management and student self-assessment. The results of ToS comments are as follows:





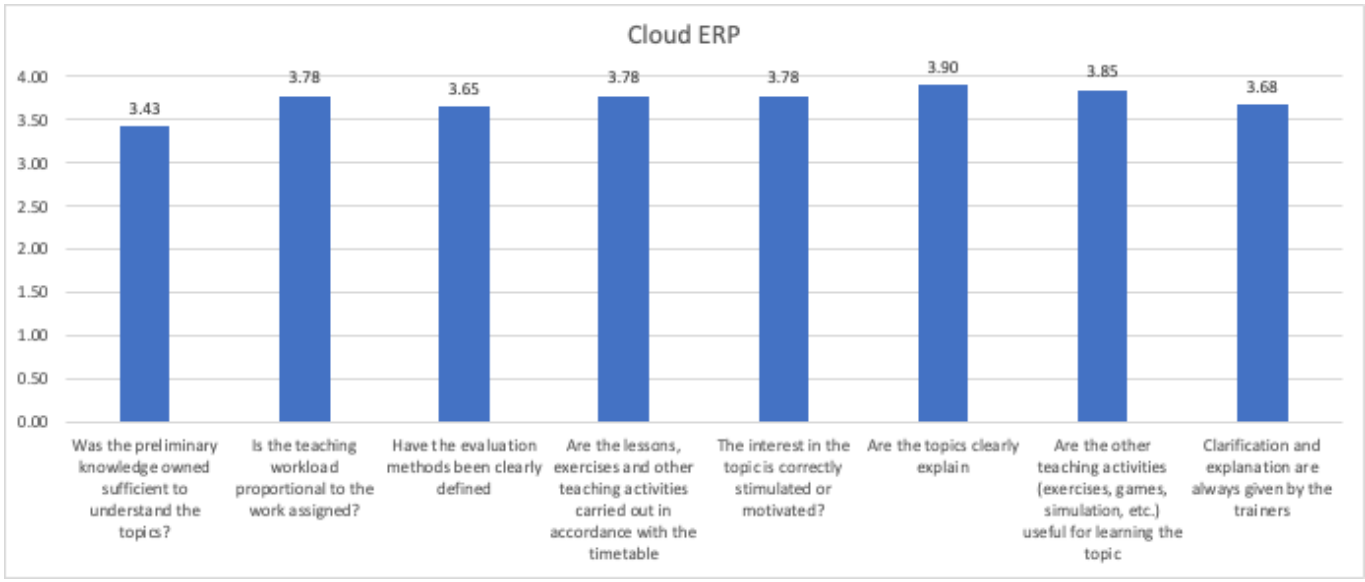
7.2 Cloud ERP

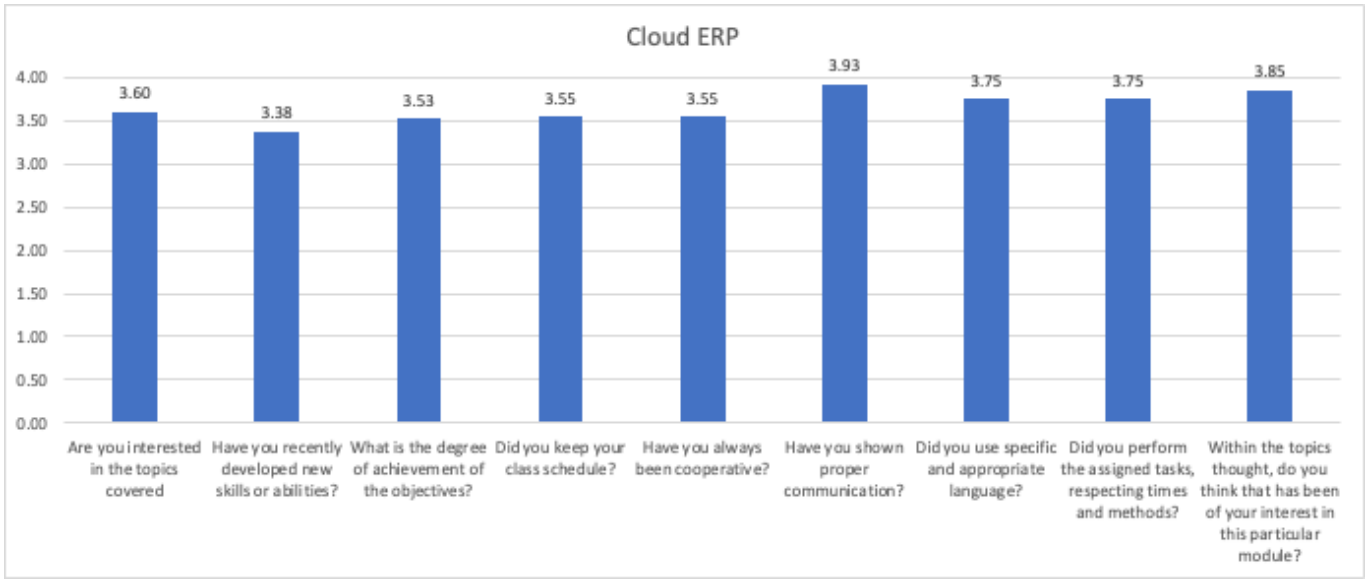
7.2.1 Session 2 description

This module provides an understanding of Enterprise Systems Architecture (also known as Enterprise Resource Planning Systems, or ERPs). Using a case study and simulation game, an ERP concept is introduced. After defining these systems, the advantages of cloud-based enterprise resource planning (ERP) are outlined. Students would be exposed to the various positions and occupations associated with the use and deployment of cloud ERPs. This module offers case studies and data sets for purchase and procurement, production planning, order management, and warehouse management in cloud ERP software implementation. Students will be able to apply cloud ERP to real-world business issues.

7.2.2 Session 2 feedback

This module is participated by 40 students. There are 40 students (100%) who responded to the satisfaction survey. The satisfaction rating has fluctuated between 1 and 4. There are 17 questions for module management and student self-assessment. The results of ToS comments are as follows:





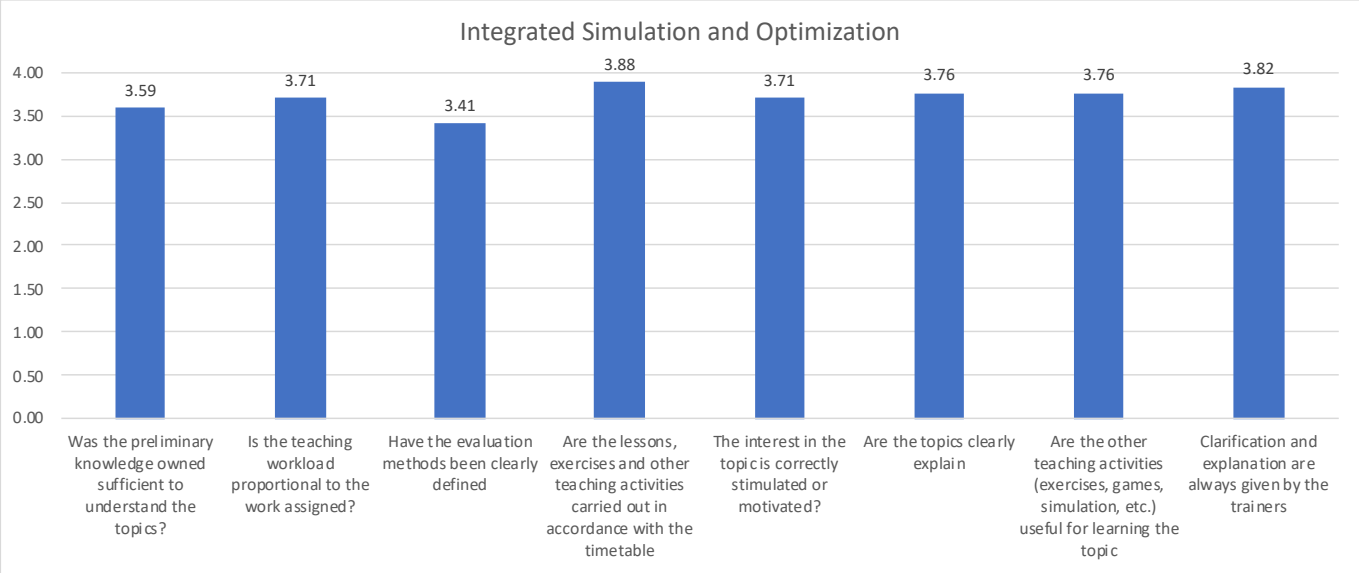
7.3 Integrated simulation and optimization

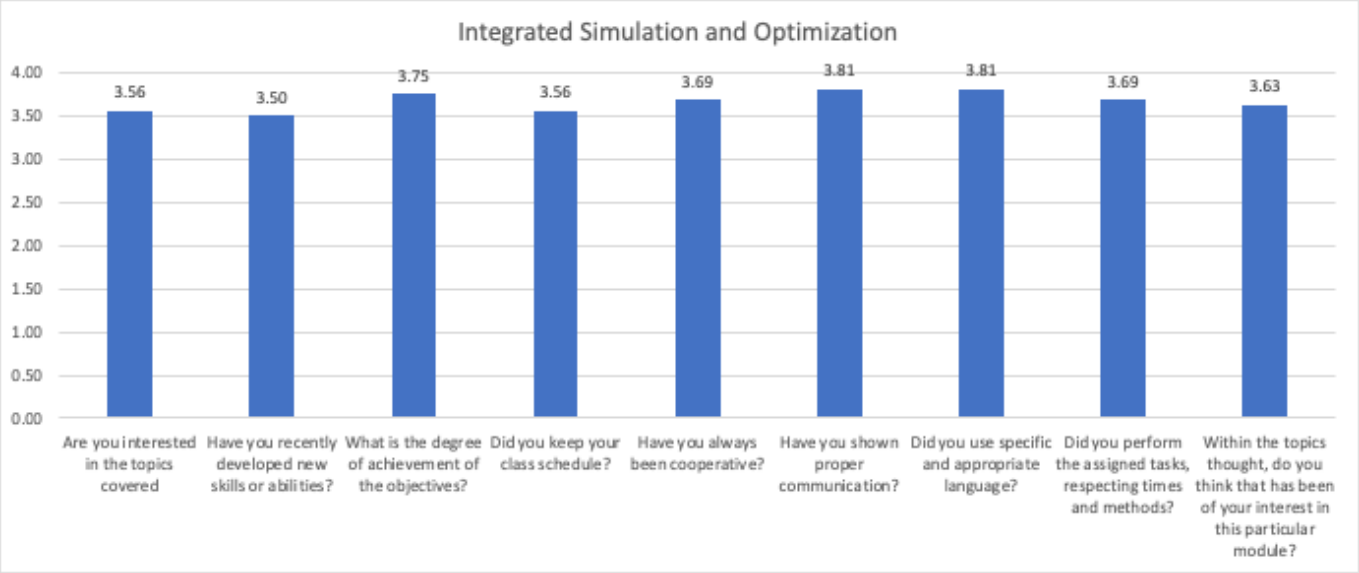
7.3.1 Session 3 description

The first section introduces modeling, optimization, and simulation as they pertain to the analysis and study of manufacturing systems for decision support. The introduction of optimization models and algorithms provides a framework for considering many issues that arise in manufacturing systems. A case study demonstrates the advantages of simulation and optimization. This module offers a data set and simulation software in order to conduct a practical analysis. The second step is to introduce students to a wide range of applications for these methods and models and to integrate this content with their introduction to operations management.

7.3.2 Session 3 Feedback

This module is participated by 17 students. There are 16 students (94%) who responded to the satisfaction survey. The satisfaction rating has fluctuated between 1 and 4. There are 17 questions for module management and student self-assessment. The results of ToS comments are as follows:





7.4 Data collecting system

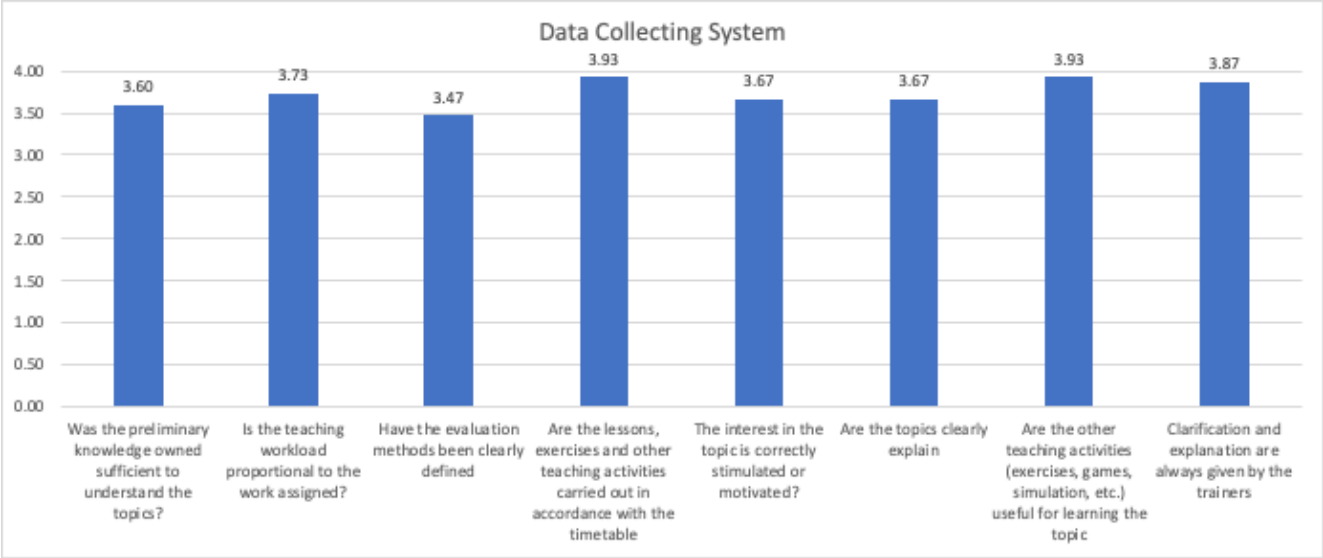
7.4.1 Session 4 description

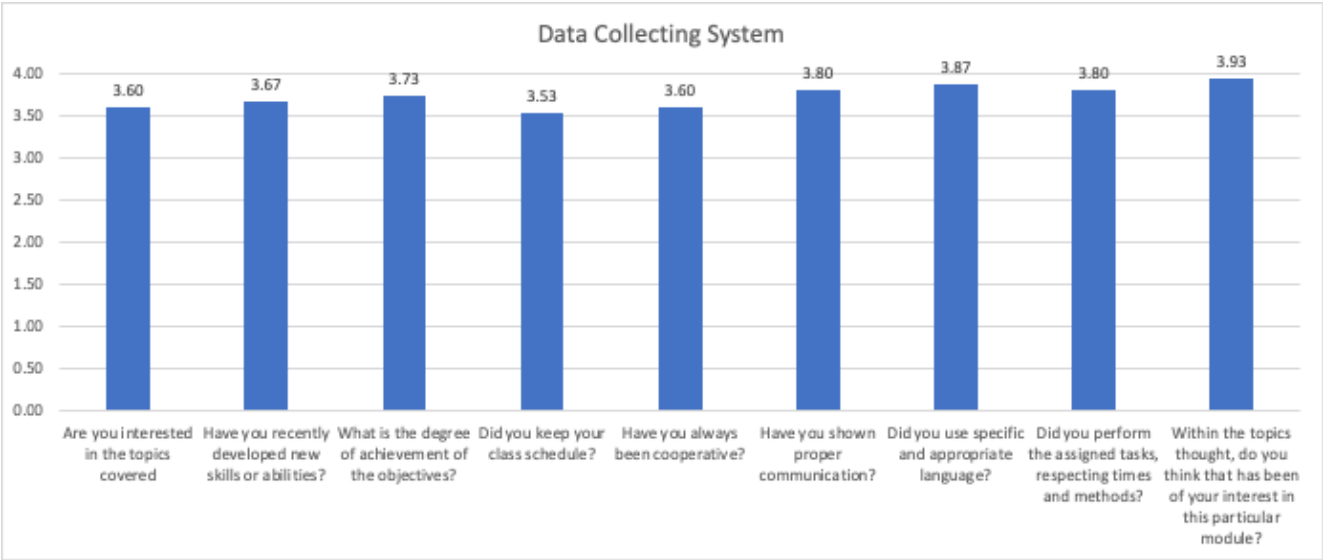
Variability affects product quality and yield in manufacturing environments. This module will teach students why analysis of manufacturing processes is crucial for diagnosing and correcting

operational defects to improve outcomes and reduce costs. Acquire an understanding of the effective methods for collecting, preparing, and analyzing data, as well as the computational platforms that can be used to collect and process data over an extended period. Develop the skills necessary to participate as a member of an advanced analysis team and to provide valuable input on effective implementation. The clearly defined objectives and KPIs of data collecting in the production process is an important step that leads to the effective data collecting system design

7.4.2 Session 4 Feedback

This module is participated by 15 students. There are 15 students (100%) who responded to the satisfaction survey. The satisfaction rating has fluctuated between 1 and 4. There are 17 questions for module management and student self-assessment. The results of ToS comments are as follows





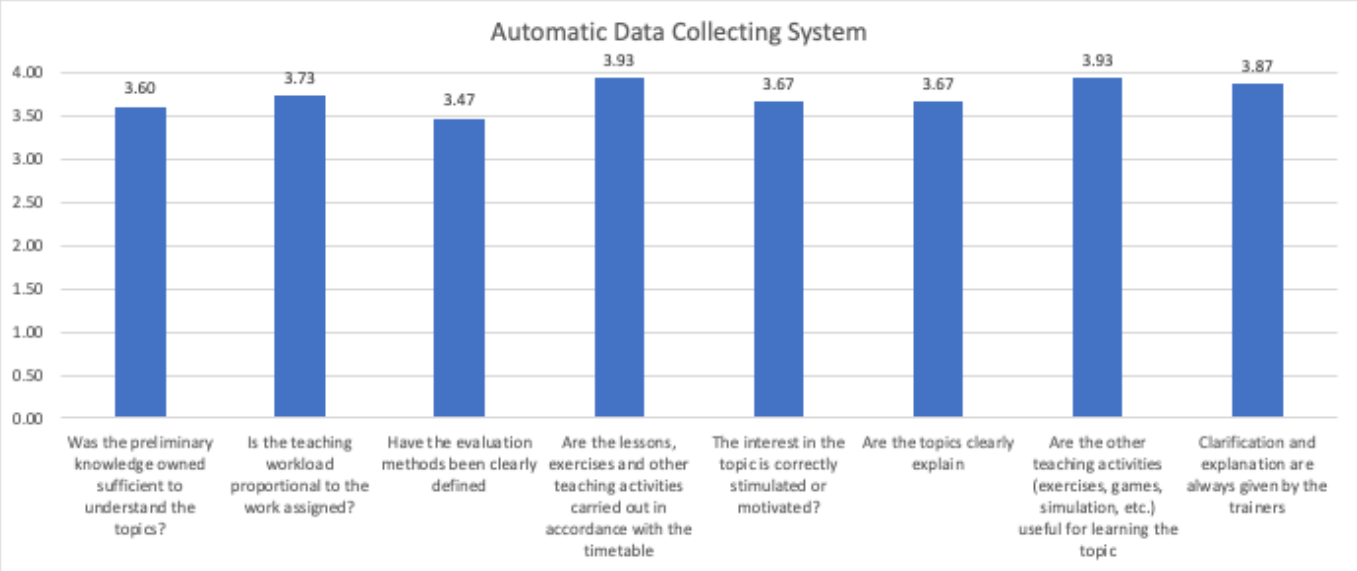
7.5 Automatic data collecting system

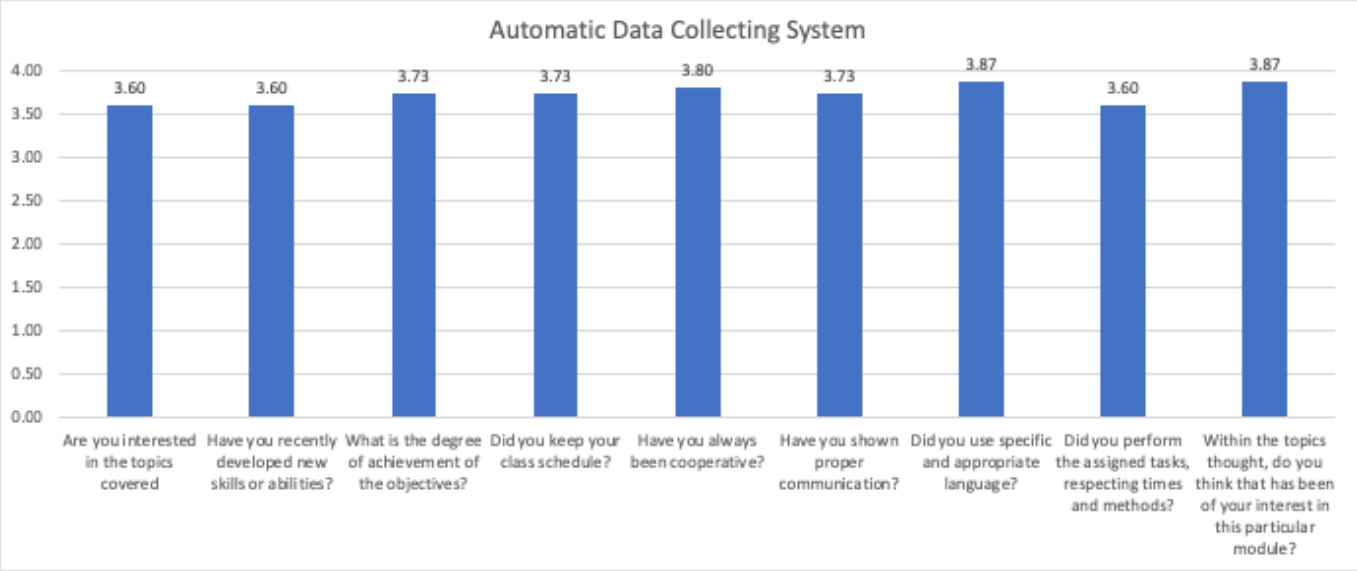
7.5.1 Session 5 description

A significant competitive advantage can be gained by properly collecting and utilizing the enormous amount of data that modern manufacturing processes generate. This information can help organizations improve operational efficiency. Gathering and capturing all of the necessary data during the operational process can be quite difficult. The information in this module covers the different types of data and recording devices, how to identify the data collection point, and some equipment for automating data collection from the manufacturing shop floor. With the aid of a data set and practical tools, students will learn how to design a data collection system. This equipment serves as the intermediary layer of communication between monitoring and analysis systems and machines. Through the practical assignment, students will learn how to gather data from the production process.

7.5.2 Session 5 Feedback

This module is participated by 15 students. There are 15 students (100%) who responded to the satisfaction survey. The satisfaction rating has fluctuated between 1 and 4. There are 17 questions for module management and student self-assessment. The results of ToS comments are as follows:





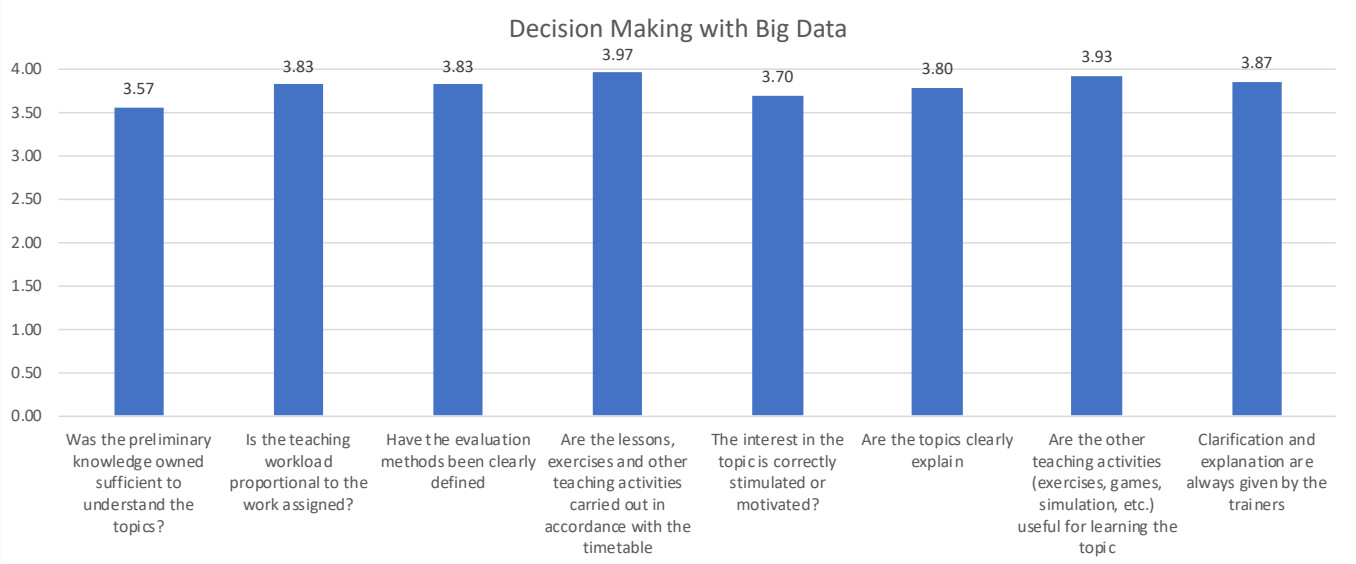
7.6 Decision-making with Big Data

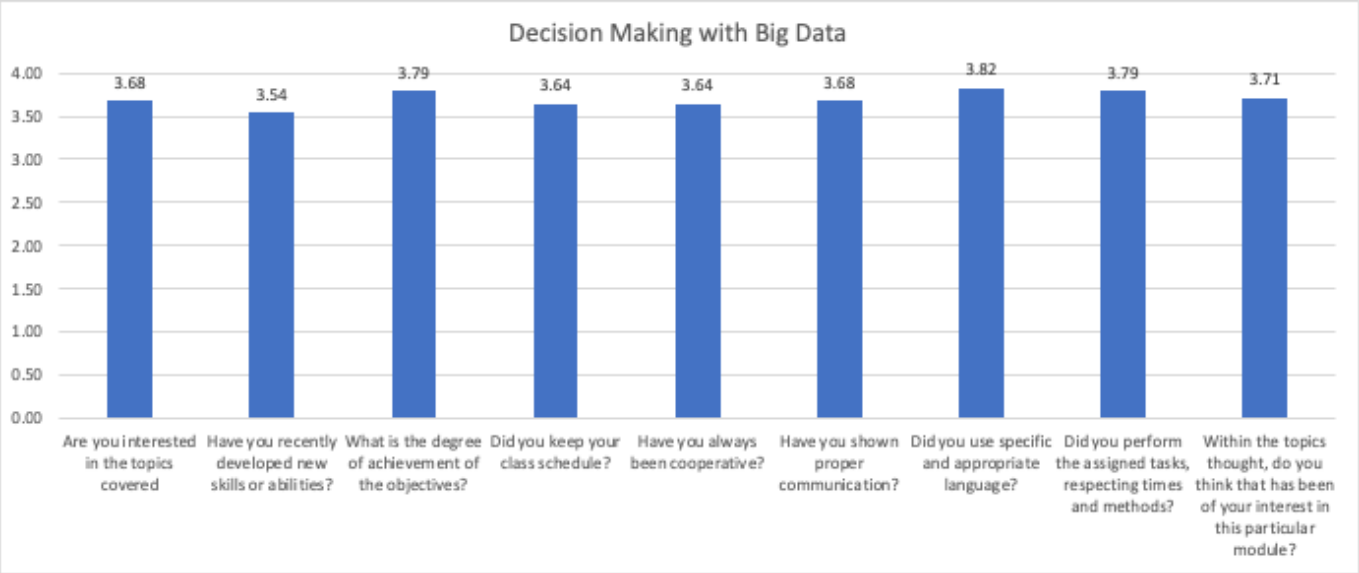
7.6.1 Session 1 description

Numerous datasets can help solve significant problems and guide decision-making. However, these datasets are challenging to process and analyze due to their size, complexity, quality, and diversity. An introduction to data analytics is provided in this module. Data and its importance, Data and its relations, Data analytics, and the background required for Data analytics. The six phases of data preparation—discovery, preparation, model planning, model building, communication, and operationalization—are explained. Regression, decision trees, clustering, central tendency and standard deviation, and other data analysis tools and techniques are all explained in this module. In order to demonstrate how to use big data to lead successful business analytics initiatives and make fact-driven decisions includes the analysis, the case studies (CMU traffic management system, a water work enterprise, and a quarry enterprise) are shown in the final section.

7.6.2 Session 1 Feedback

This module is participated by 30 students. There are 28 students (93%) who responded to the satisfaction survey. The satisfaction rating has fluctuated between 1 and 4. There are 17 questions for module management and student self-assessment. The results of ToS comments are as follows





Part II: Management

The Training of Students (ToS) sessions based on posters was conducted for all five modules including Human Resource Management for Industry 4.0, Digital Communication, Business Intelligence, Role of Data for Future Organization and New Product Development during January, 2022 to February, 2022 through online classroom (Webex platform). KU selected student either bachelor students and master students relating business management background for skill development in all five modules. The total of the participants is 43 average students per module (38 bachelor students, 7 master students), who are the bachelor & master students from Department of Management, Faculty of Business Administration, and also the master students from Department of Agro-industrial Technology, Faculty of Agro-Industry, Kasetsart University.

The communication of ToS was implemented in several channels. The poster and information were posted in google classroom of seminar and special problems class. The social media, specifically line group was used to inform the students. Moreover, ToS sessions were informed to all lecturers in the virtual departmental meeting so they would announce and encourage the students to participate. The poster and information are shown in the figure below. In addition, for description of each session regarding the management domain, they are summarized in details as the following:

BUILDING SKILLS 4.0 THROUGH UNIVERSITY AND ENTERPRISE COLLABORATION

SHYFTE 4.0

Shyfte aims to develop Skills 4.0 in association with HEIs and industrial SMEs by adopting state-of-the art technologies to improve the working environments and to valorize the human working content.

From Training of Trainers to Training of Students (TOS)

Co-funded by the
Erasmus+ Programme
of the European Union

TOS SESSION IN KASETSART UNIVERSITY

Seminar & Special Problem

NO	TOPICS	DATE AND TIME (TIME IN THAILAND)	INSTRUCTORS	METHOD
1	Human Resource Management for Industry 4.0	14 Jan 2022 13.00-16.00	Dr.Panisara Thitatorn	Webex (Online)
2	Business Intelligence	28 Jan 2022 13.00-16.00	Asst. Prof. Dr.Waranpong Boonsiritomachai	Webex (Online)
3	New Product Development	11 Feb 2022 13.00-16.00	Dr.Jul Thanasrivanitchai	Webex (Online)
4	Role of Data for Future Organization	18 Feb 2022 13.00-16.00	Asst. Prof. Dr.Waranpong Boonsiritomachai	Webex (Online)
5	Digital Communication	25 Feb 2022 13.00-16.00	Dr.Panisara Thitatorn	Webex (Online)

Dr.Panisara Thitatorn

Asst. Prof. Dr.Waranpong Boonsiritomachai

Dr.Jul Thanasrivanitchai

SCAN AND JOIN US ON WEBEX!

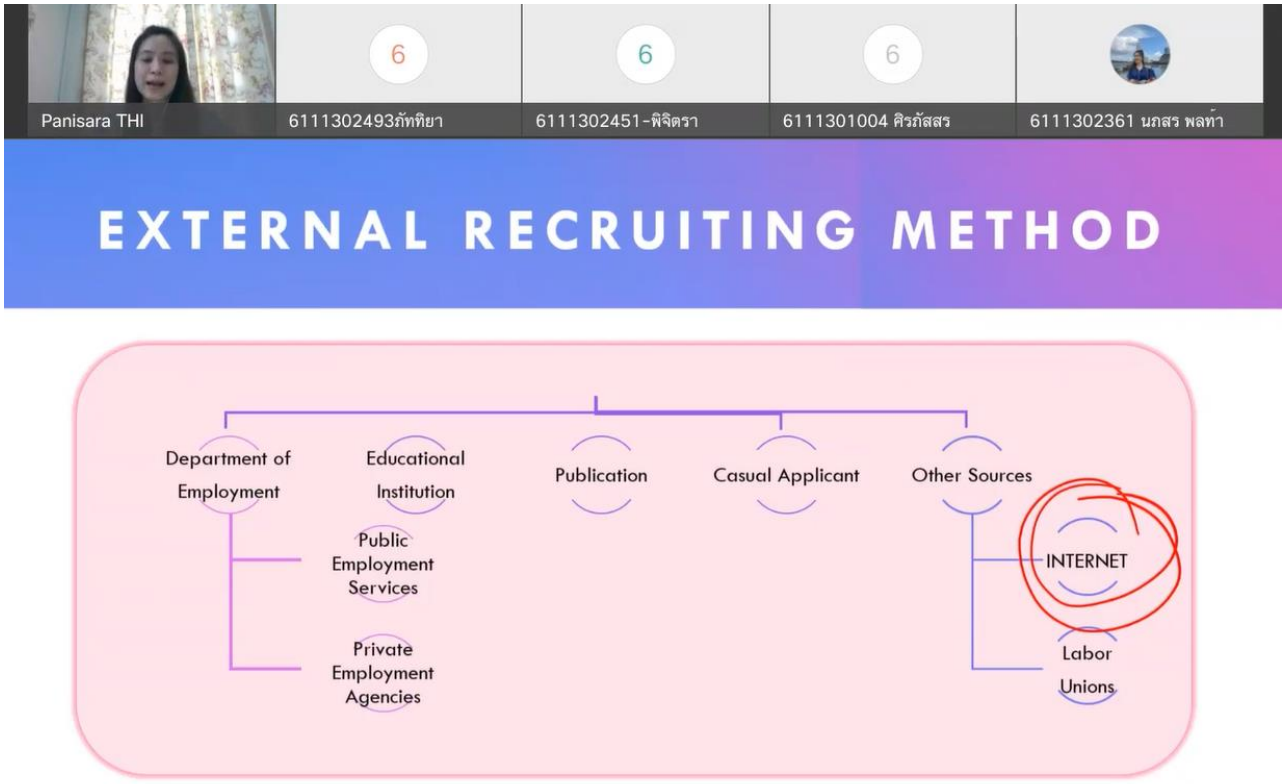
Department of Management
Kasetsart Business School

7.7 Human Resource Management for Industry 4.0

The module of Human Resource Management for Industry 4.0 was attended by a total of 41 students, 34 of bachelor students and 7 of master students.

7.7.1 Session 1 description

This course involves a specialization within the field of Management that encompasses several functions including the recruitment, selection, and maintenance of a qualified, motivated, and productive workforce dealing with "people-related" issues, it is important that you are introduced to the major topics associated with managing people in the context for Industry 4.0. Furthermore, this course will be useful no matter what career path you pursue since it addresses issues that will have an impact on you in the workplace for Industry 4.0. The online class has been proposed for students through Webex platform as presented below:



7.7.2 Session 1 Feedback

There are 34 students who have done the pre-test and post-test evaluation. The pre-test average score for all 34 students is 7.11 and the post-test average score is 8.29. We can distinguish all the students into each maturity level. For pre-test, the majority of the students, 22 students are in medium level. There are 2 students in very low maturity level, 3 in low level, 5 in high level and 2 in very high level. For post-test, the knowledge of the students has significantly increased since

there are none of students in very low and low maturity level. There are 23 students in medium level, 9 students in high level and 2 students in very high maturity level.

Regarding the satisfaction analysis from the questionnaire, there are 7 students who gave the responses. The satisfaction score has ranged between 1 to 4. There are 22 questions for the overall of management modules.

The average score for each question can be divided into 2 groups ; less agree (the average score is less than 3.0) and more agree (the average score is 3.0 and above). The less agree are the preliminary knowledge that sufficient to understand the topic (2.71), the student keep the class schedule (2.85), the student have got cooperatives (2.57), and the student shows proper communication (2.71). For more agree, the student is interested in the topic (3.00), the proportion of teaching workload and work assigned (3.42), the suitability of teaching material (3.57), the clearly defined evaluation method (3.14), the timetable is in accordance with the lessons (3.42), the teacher stimulates the interest in the topic (3.42), the teacher explains the topic clearly (3.57), the teaching activities is useful for learning (3.42), the teacher is available for explanation (3.71), the student think they can develop the new skills (3.57), the achievement of the learning objective (3.57), the student use of appropriate language (3.14), and the student perform the assigned task respecting the time and method (3.00).

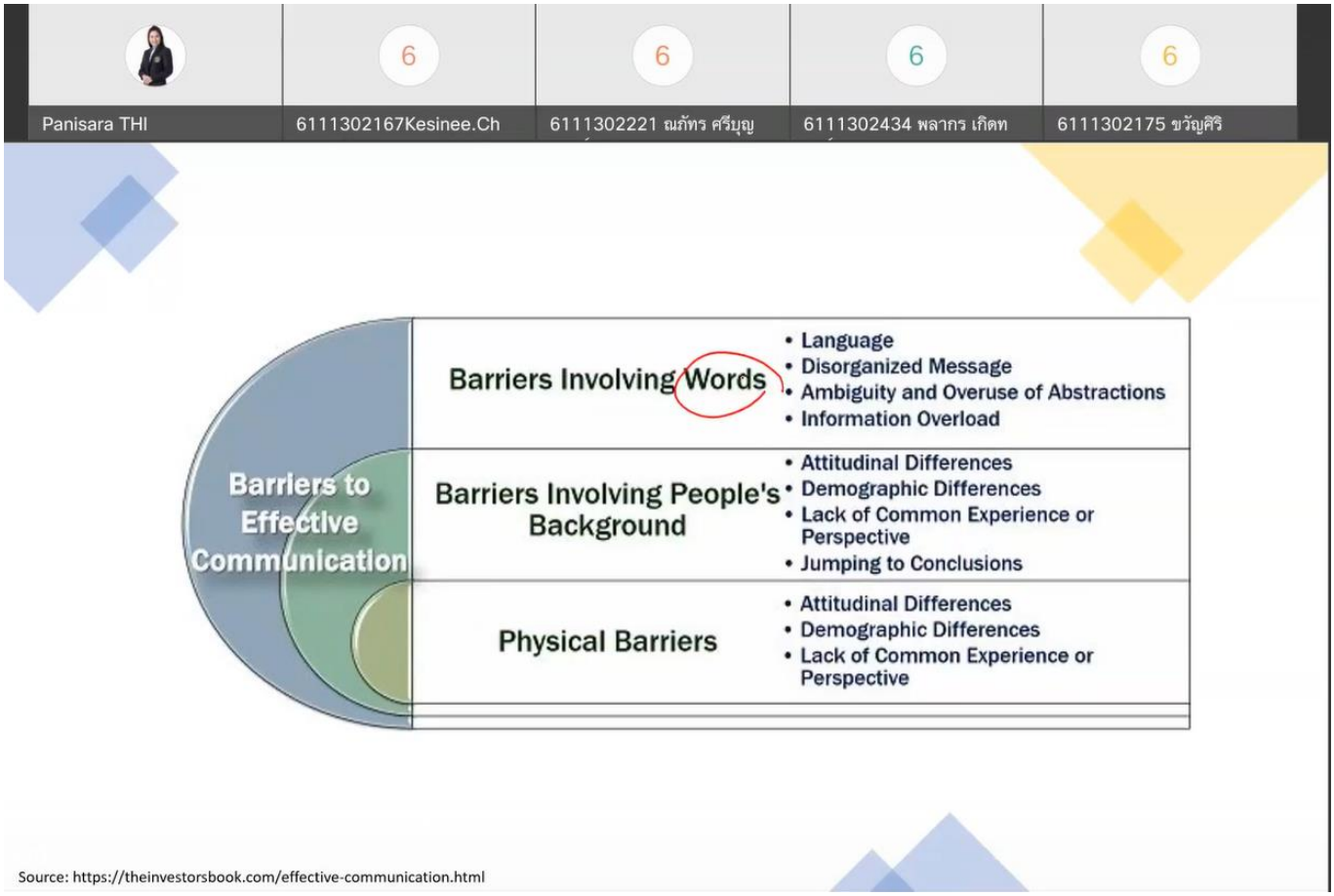
7.8 Digital Communication

The module of Digital Communication was attended by a total of 41 students, 34 of bachelor students and 7 of master students

7.8.1 Session 1 description

Communication for Industry 4.0, which is essentially a focus on communication within two-person relationships. This course presents concepts essential to understanding the complex dynamics that go into constructing and maintaining our relationships, offering a multitude of research-based insights that will help students better understand themselves, their relationship partners, and relationship dynamics.

The concepts presented here can be applied to relationships of all types--personal and professional: family, friends, romantic partners, co-workers, and supervisors. This module combines the science of data visualization with the art of graphic design to help you communicate complex information more accurately and electively. By transforming data sets into visual graphics. The online class has been proposed for students through Webex platform as presented below:



7.8.2 Session 1 Feedback

There are 34 students who have done the pre-test and 32 students who have done the post-test evaluation. The maximum score for pre-test and post-test is 14. The pre-test average score for all 34 students is 10.05 and the post-test average score is 11.87. We can distinguish all the students into each maturity level. For pre-test, there are none of students in very low maturity level, 1 student in low level, 6 students in medium level, 10 students in high level and most students, 17 are in very high maturity level. For post-test, the knowledge of the students has significantly increased since there are none of students in very low and low maturity level. There are 3 students in medium level, 4 students in high level and most students, 25 are in very high maturity level. It can be concluded that the majority of the students show very high maturity level after participating in this module.

Regarding the satisfaction analysis from the questionnaire, there are 7 students who gave the responses. The satisfaction score has ranged between 1 to 4. There are 22 questions for the overall of management modules. The average score for each question can be divided into 2 groups ; less agree (the average score is less than 3.0) and more agree (the average score is 3.0 and above). The less agree are the preliminary knowledge that sufficient to understand the topic (2.71), the student keep the class schedule (2.85), the student have got cooperatives (2.57), and the student shows proper communication (2.71). For more agree, the student is interested in the topic (3.00), the proportion of teaching workload and work assigned (3.42), the suitability of teaching material (3.57), the clearly defined evaluation method (3.14), the timetable is in

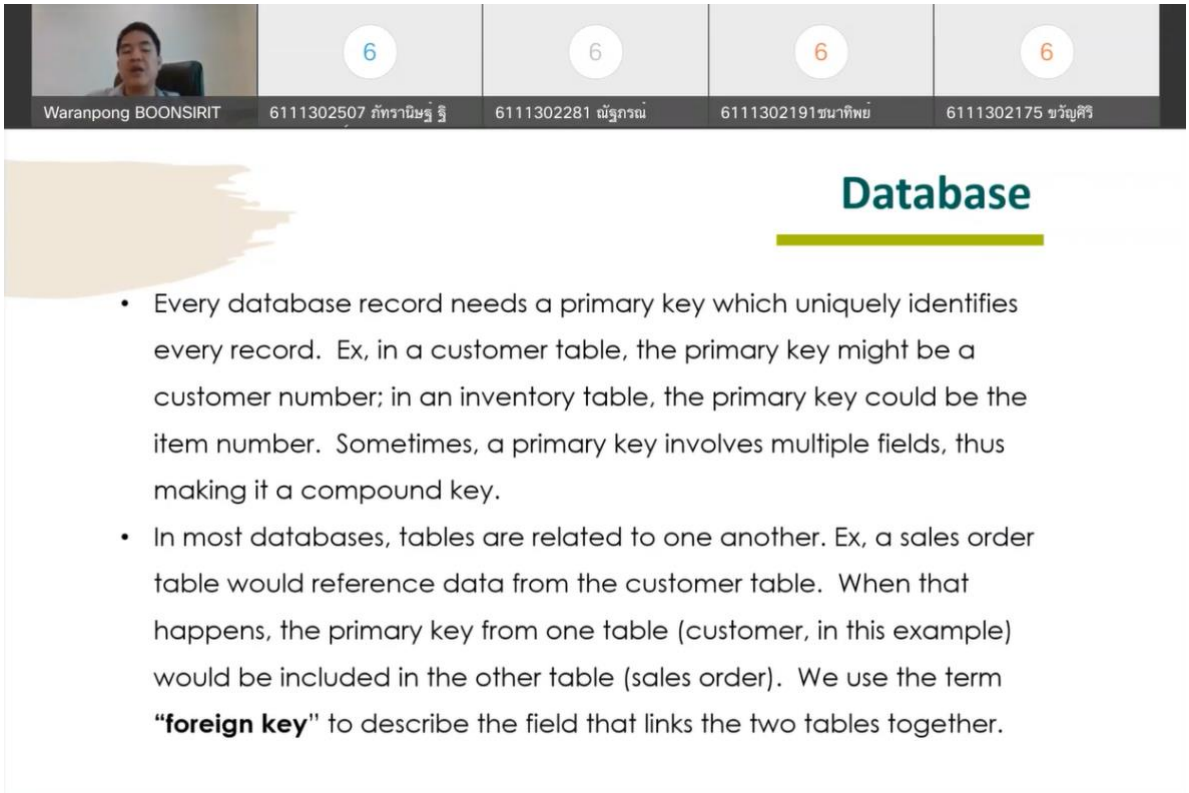
accordance with the lessons (3.42), the teacher stimulates the interest in the topic (3.42), the teacher explains the topic clearly (3.57), the teaching activities is useful for learning (3.42), the teacher is available for explanation (3.71), the student think they can develop the new skills (3.57), the achèvement of the learning objective (3.57), the student use of appropriate language (3.14), and the student perform the assigned task respecting the time and method (3.00).

7.9 Role of Data for Future Organization

The module of Role of Data for Future Organization was attended by a total of 45 students, 38 of bachelor students and 7 of master students.

7.9.1 Session 1 description

Data is critical for effective and efficient business operations, and managers need to understand why they need data and how data impacts the business. This module will explain how to acquire the right quality of data that is suitable for the organization in order to deliver timely insights when required by the managers. Also, this module will allow students to understand how to design databases and basic functions of SQL. The online class has been proposed for students through Webex platform as presented below:



7.9.2 Session 1 Feedback

There are 38 students who have done the pre-test and 34 students who have done the post-test evaluation. The maximum score for each pre-test and post-test is 10. The pre-test average score for all 38 students is 2.57 and the post-test average score is 5.11. We can distinguish all the

students into each maturity level. For pre-test, the majority of the students, 23 students, are in very low maturity level, 12 students in low level, 2 students in medium level. There is only 1 student in high level and none of student in very high level. For post-test, the knowledge of the students has increased since there are 10 students in very low and 5 students in low maturity level. There are 7 students in medium, 5 students in high and 5 students in very high maturity level.

Regarding the satisfaction analysis from the questionnaire, there are 7 students who gave the responses. The satisfaction score has ranged between 1 to 4. There are 22 questions for the overall of management modules. The average score for each question can be divided into 2 groups ; less agree (the average score is less than 3.0) and more agree (the average score is 3.0 and above).

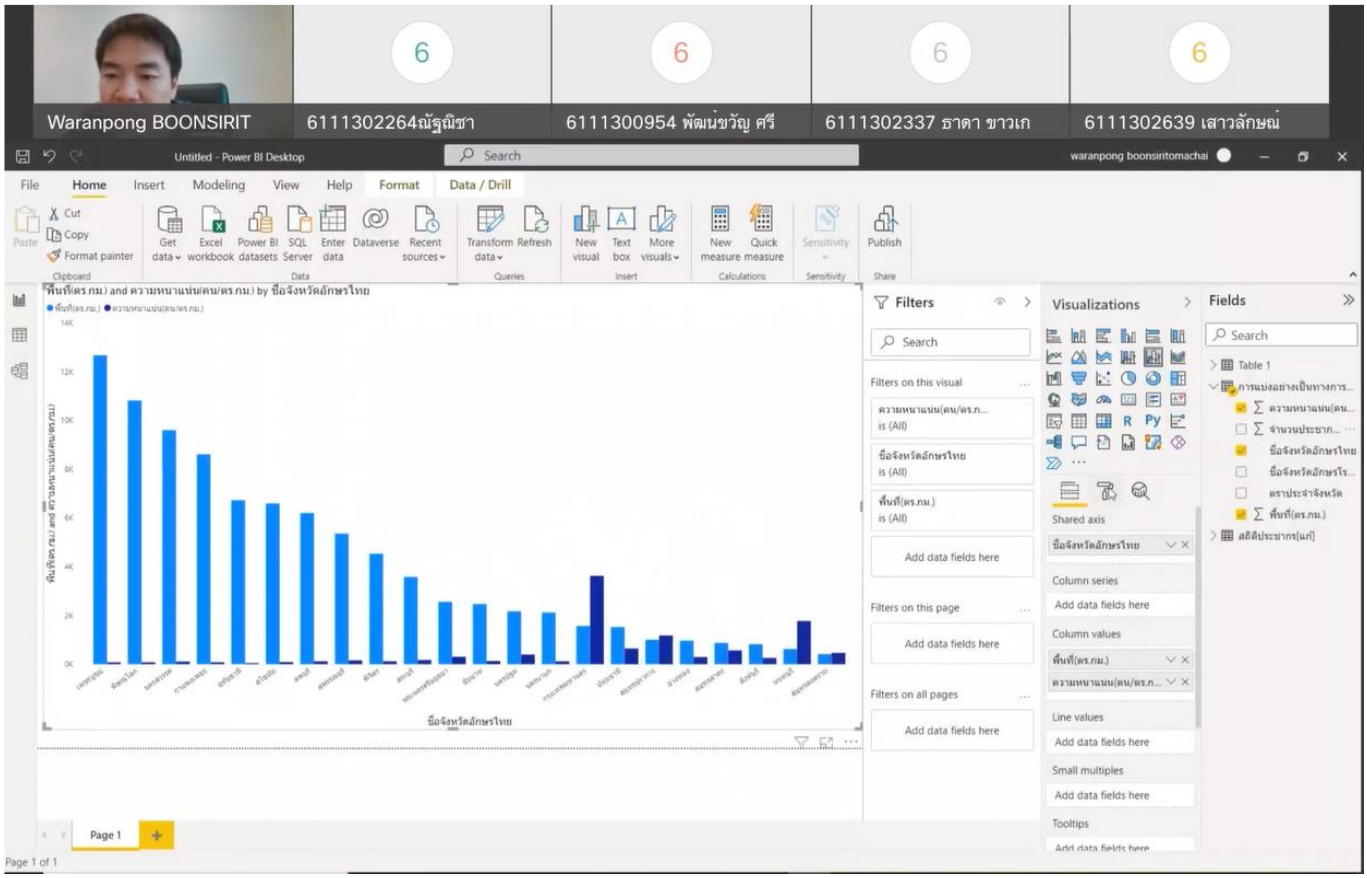
The less agree are the preliminary knowledge that sufficient to understand the topic (2.71), the student keep the class schedule (2.85), the student have got cooperatives (2.57), and the student shows proper communication (2.71). For more agree, the student is interested in the topic (3.00), the proportion of teaching workload and work assigned (3.42), the suitability of teaching material (3.57), the clearly defined evaluation method (3.14), the timetable is in accordance with the lessons (3.42), the teacher stimulates the interest in the topic (3.42), the teacher explains the topic clearly (3.57), the teaching activities is useful for learning (3.42), the teacher is available for explanation (3.71), the student think they can develop the new skills (3.57), the achievement of the learning objective (3.57), the student use of appropriate language (3.14), and the student perform the assigned task respecting the time and method (3.00).

7.10 Business Intelligence

The module of Business Intelligence was attended by a total of 43 students, 36 of bachelor students and 7 of master students.

7.10.1 Session 1 description

Business intelligence involves analyzing data sets and software programs to help organizations make better business decisions. In this module, the student will understand the concept of Business Intelligence and the different types of Business Intelligence tools in the current market. Also, they will familiarize with “Power BI” (Business Intelligence software) to make effective decisions for companies based on data. The online class has been proposed for students through Webex platform as presented below:



7.10.2 Session 1 Feedback

There are 35 students who have done the pre-test and 36 students who have done the post-test evaluation. The maximum score for each pre-test and post-test is 10. The pre-test average score for all 35 students is 5.02 and the post-test average score for 36 students is 8.72. We can distinguish all the students into each maturity level. For pre-test, the majority of the students, 2 students, are in very low maturity level, 17 in low level and 12 students in medium level. There is only 4 students in high level and none of student in very high level. For post-test, the knowledge of the students has notably increased since the majority of students, 15 students are in high level and 18 students are in very high level. There are only 2 students in low maturity level and 1 student in medium level. None of the student is in very low maturity level after participating in this module.

Regarding the satisfaction analysis from the questionnaire, there are 7 students who gave the responses. The satisfaction score has ranged between 1 to 4. There are 22 questions for the overall of management modules. The average score for each question can be divided into 2 groups ; less agree (the average score is less than 3.0) and more agree (the average score is 3.0 and above). The less agree are the preliminary knowledge that sufficient to understand the topic (2.71), the student keep the class schedule (2.85), the student have got cooperatives (2.57), and the student shows proper communication (2.71). For more agree, the student is interested in the topic (3.00), the proportion of teaching workload and work assigned (3.42), the suitability of teaching material (3.57), the clearly defined evaluation method (3.14), the timetable is in accordance with the lessons (3.42), the teacher stimulates the interest in the topic (3.42), the

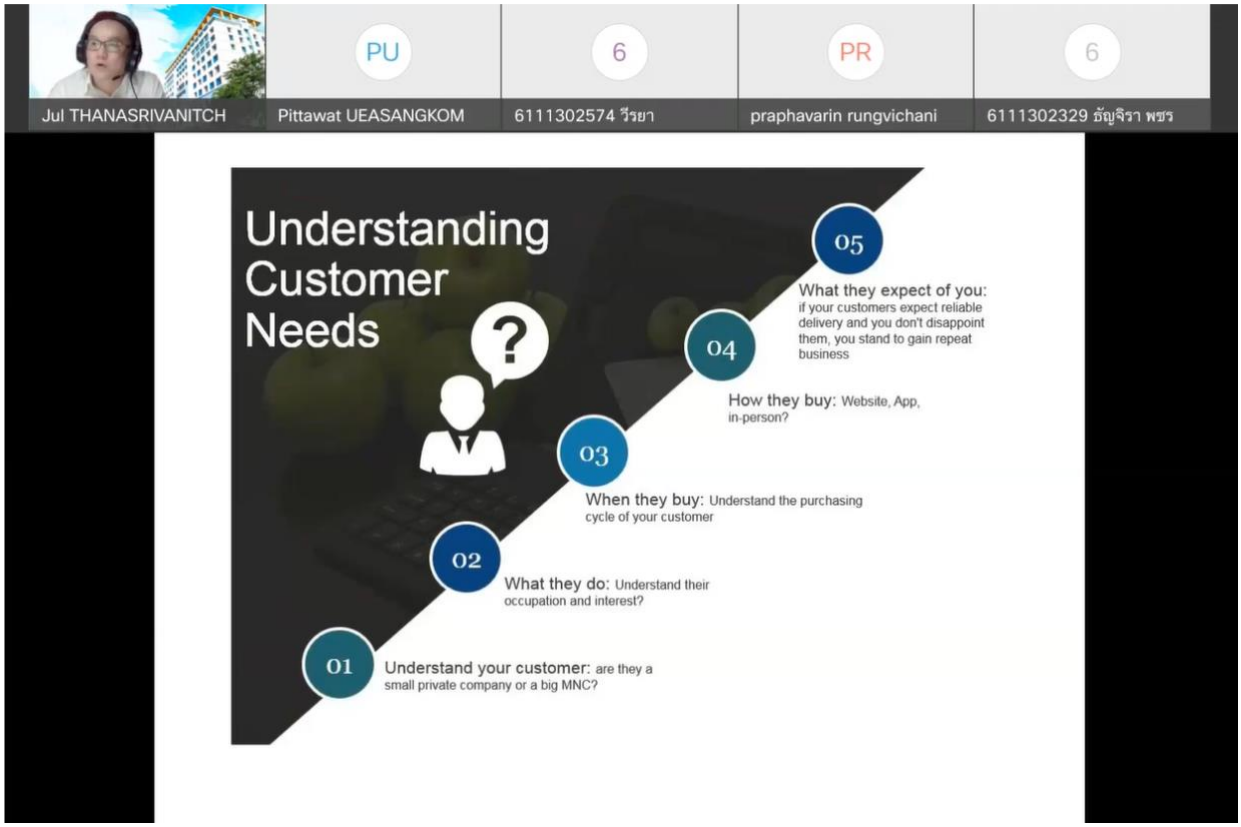
teacher explains the topic clearly (3.57), the teaching activities is useful for learning (3.42), the teacher is available for explanation (3.71), the student think they can develop the new skills (3.57), the achievement of the learning objective (3.57), the student use of appropriate language (3.14), and the student perform the assigned task respecting the time and method (3.00).

7.11 New Product Development

The module of New Product Development was attended by a total of 46 students, 39 of bachelor students and 7 of master students.

7.11.1 Session 1 description

This module will provide the knowledge of new product development including creativity and innovation and open innovation. The online class has been proposed for students through Webex platform as presented below:



7.11.2 Session 1 Feedback

There are 39 students who have done the pre-test and the post-test evaluation. The maximum score for each pre-test and post-test is 10. The pre-test average score for all 39 students is 3.53 and the post-test average score for 39 students is 8. We can distinguish all the students into each maturity level. For pre-test, the majority of the students, 20 students are in very low maturity level. There are 7 students in low maturity level, 9 students in medium level, 2 students in high level and only 1 student in very high level. For post-test, the knowledge of the students has significantly increased since the majority of students, 24 students are in very high maturity level.

There are only 2 students in very low level, 4 students in low level, 4 students in medium level and 5 students in high level.

Regarding the satisfaction analysis from the questionnaire, there are 7 students who gave the responses. The satisfaction score has ranged between 1 to 4. There are 22 questions for the overall of management modules. The average score for each question can be divided into 2 groups ; less agree (the average score is less than 3.0) and more agree (the average score is 3.0 and above).

The less agree are the preliminary knowledge that sufficient to understand the topic (2.71), the student keep the class schedule (2.85), the student have got cooperatives (2.57), and the student shows proper communication (2.71). For more agree, the student is interested in the topic (3.00), the proportion of teaching workload and work assigned (3.42), the suitability of teaching material (3.57), the clearly defined evaluation method (3.14), the timetable is in accordance with the lessons (3.42), the teacher stimulates the interest in the topic (3.42), the teacher explains the topic clearly (3.57), the teaching activities is useful for learning (3.42), the teacher is available for explanation (3.71), the student think they can develop the new skills (3.57), the achèvement of the learning objective (3.57), the student use of appropriate language (3.14), and the student perform the assigned task respecting the time and method (3.00).

7.3 Tos Overall improvement actions

From Training of student (Tos) session, it can be concluded that the students who participated in the 11 modules of industrial engineering and management, have shown the significant increasing in knowledge and skills for Industry 4.0. The pre-test and post-test evaluation become an evidence that all the students who have learned in each module showing the better performance from the average scores. In addition, the satisfaction analysis will become a guideline for overall improvement, particularly the topics that are less agree by the students. Regarding the preliminary knowledge that may not sufficient to understand the topic, we can recommend on the additional source of information or references for the student to obtain more self-studying. The problem that the student cannot keep the class schedule can be improved by scheduling the course in advance and make an announcement to the students via several channels. The problem that the student have not got sufficient cooperatives can be improved by conducting the activities or assignments in a form of group work. Finally, the lecturer need to stimulate or motivate the student to participate in the class to create more proper communication.

In industrial engineering section, comparing among 6 modules, the students are interested in “Introduction to IR4.0” (3.71) and “Decision Making with Big Data” (3.68) which are higher score than “Cloud ERP” (3.60), “Data Collecting System” (3.60), “Automatic Data Collecting System” (3.60), and “Integrated Simulation and Optimization” (3.56).

When comparing among all 5 modules, the student are interested in the topic of “New Product Development” (3.57), “Role of Data for Future Organization” (3.57) and “Digital Communication” (3.57), which are relatively higher score than “Human Resource Management for Industry 4.0” (3.28) and “Business Intelligence” (3.28). Furthermore, There are 2 questions specifically relate to this module. The student interested in “Human Resource Management for Industry 4.0” indicated an average score of 3.57, and the student satisfies with this course indicated an average score of 3.71.

8. Resources for Learning Materials

There are two categories of resources: public and private materials. Case study and some YouTube content are made public, while private files are uploaded to Owncloud and Google drive. The following table provides a comprehensive listing of the available resources.

No	Training Module	Resource Link
1	Introduction to IR 4.0	Private : 1. https://disp-ds.univ-lyon2.fr/owncloud/f/1118695
2	Cloud ERP	Public : 1. https://youtu.be/-e0wUNem_aY Private : 1. https://disp-ds.univ-lyon2.fr/owncloud/f/1384608
3	Integrated Simulation and Optimization	Private : 1. https://disp-ds.univ-lyon2.fr/owncloud/f/1384611
4	Data Collecting System	Private : 1. https://disp-ds.univ-lyon2.fr/owncloud/f/1384609
5	Automatic Data Collecting System	Private : 1. https://disp-ds.univ-lyon2.fr/owncloud/f/1384607
6	Decision Making with Big Data	Private : 1. https://disp-ds.univ-lyon2.fr/owncloud/f/1384610
7	Human Resource Management for Industry 4.0	Private : 1. https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing
8	Digital Communication	Private : https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing

No	Training Module	Resource Link
9	Role of Data for Future Organization	Private : https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing
10	Business Intelligence	Private : https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing
11	New Product Development	Private : https://drive.google.com/drive/folders/1MLCJzpi2oCUNXzEU0SusyVIH7UBNrDOZ?usp=sharing

9. Deviations or Mitigation Actions

There have been deviations and preventative measures taken throughout the course of the project's execution and completion. Because of COVID-19, a number of activities that were planned but never carried out as intended, particularly training modules that required hands-on instruction with specific equipment. It is made worse by the movement control order, which makes employment on campus illegal.

Students were required to participate in online classes that deviated from the original plan from November 2020 through March 2022. On the other hand, because the pandemic situation was improving in 2022, the ToS training in domain 1 was changed to onsite training so that students could get hands-on experience with the various pieces of equipment that they would be learning to use.

CMU and KU also have to do ToS without the help of EU partners, who were supposed to help with the training for 20 days. But the feedback from both internal and external EU reviewers, as well as from ToT, helped CMU and KU improve how training for ToS was done.

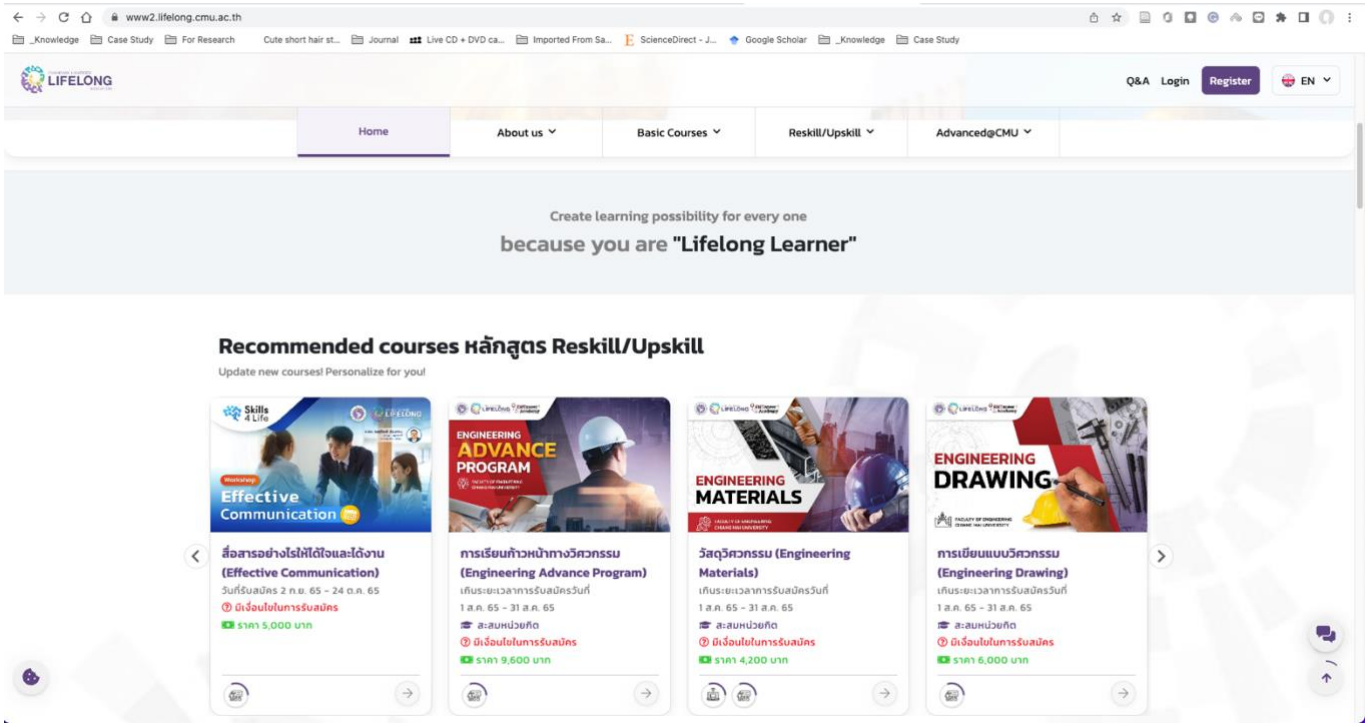
10. Sustainability of SHYFTE Learnings Materials

To become sustainable SHYFTE learning materials, we have planned to execute in two approaches as details follows:

1. Establishment of SHYFTE learning center to Lifelong Education (LE) platform of CMU
2. Development of short-course training and use in the undergraduates and post graduates program.

10.1 Establishment of lifelong learning center

CMU created the LE platform to promote lifelong learning education for all people (students, employees in private and public companies, retirement people, etc.). The LE platform enables anyone interested in available courses to register as a learner and attend a training course. Basic Courses, Reskill/Upskill Courses, and Advanced@CMU are available through CMU's CMU-Lifelong Education platform.



During the SHYFTE meeting in Chiang Mai, we discussed with Associate Professor Dr. Pradthana Jaipong, the director of the CMU School of Lifelong Education, how we plan to register the SHYFTE modules in domain 1 to the LE platform and use this platform as a channel to connect to the SHYFTE learning center in all modules (domain 1 – domain 4). Thai students who participate in training modules through the LE platform can collect credits and transfer them to an individual credit bank. They can use these credits as part of their study program if they enroll in any university program (however, it depends on the criteria of curriculum of their program)

10.2 Development of short-course training

We plan to initiate the short courses for the student and SMEs practitioners to attend in these courses. In the short courses, we aim for re-skills and up-skills of the participants regarding Industry 4.0 with two main parts : 1) Industrial Engineering and 2) Management. For the first part, they will be involved with 6 modules (Introduction to IR4.0, Cloud ERP, Integrated simulation and optimization, Data collecting system, Automatic data collecting system, Decision-making with Big Data).

While the second part, they will be related to 5 modules (Human resource management for industry 4.0, Digital communication, Role of data for future organization, Business intelligence, and New product development). In addition, the modules may be added upon the current situation and prospective attendant's customization.

11. Conclusions

Regarding the domain 1, relating industrial engineering and management area, we have completed this project by developing learning materials for 11 new modules (6 modules for part I – industrial engineering, provided by CMU and 5 modules for part II – management, provided by KU). In this module, we aim to enhance the skill sets of participants in these kind of area (110 trainers and 137 students, 22 practitioners).

We have conducted the training of the trainers (TOT) during July 2021 to July 2022 either onsite and online classes to assure the sustainability of the training and to develop teaching skills and their capability. While training of the students (TOS) has been conducted for students from CMU and KU during January 2022 to August 2022 either onsite and online classes to enhance their future skills for industry 4.0.

For dissemination, we have many events to communicate with practitioners, academic researcher and students, for example: Europe-Chiang Mai Connect 2020 Symposium, A webinar of Skill Development for Industry 4.0: An Innovation Perspective 2022. Furthermore, In 2020, this project has been awarded as one of the outstanding research project proposed by National Research University Network (RUN).

Moreover, we realize the important of sustainability of SHYFTE learnings materials, thus we have planned to execute the learning path with two approaches: 1) Establishment of lifelong learning center and 2) Development of short-course training, accordingly.

The Learning Center will be the showcase and access point for these training courses. For companies, a link will be made from the Lifelong website of the University to access the courses offered by the Learning Center. In the same way, we will communicate during the seminars that we do with companies to continue to make the Learning Center known and to make sure that it becomes a real center of expertise and innovation for companies, and in particular for SME's. For students, they will be able to register for courses from the Learning Center, either as part of existing programs or as optional modules.

Finally, we believe that learners from university and SMEs in domain 1 will gain the benefits from these learning materials for re-skills and up-skills in order to achieve their skill development for industry 4.0.

http://www.shyfte.eu/