



Erasmus+

Cooperation for innovation and the exchange of good practices sub-programme

TECHNICAL REPORT form

Programme	Erasmus+
Sub-Programme	Cooperation for innovation and the exchange of good practices
Action	Capacity Building in higher education
Sub-Action	Joint Projects
Call for Proposal	EAC-A03-2016
Project number	586137-EPP-1-2017-1-TH-EPPKA2-CBHE-JP
Agreement/decision number	20173515
Project Title	Curriculum Development of Master's Degree Program in Industrial Engineering for Thailand Sustainable Smart Industry
Language used to complete the form	English

Contractual Data

Dates and Beneficiaries

Dates

Project Start: 15/10/2017	Project End: 14/10/2020
Activities Start:	Activities End:
Project Duration(months): 36	

Beneficiary Data

Role	PIC	Name	Country
Co-Beneficiary / Partner	948725961	PRINCE OF SONGKLA UNIVERSITY	Thailand
Co-Beneficiary / Partner	932488064	KHON KAEN UNIVERSITY	Thailand
Co-Beneficiary / Partner	917303005	THAMMASAT UNIVERSITY	Thailand
Co-Beneficiary / Partner	911166494	KING MONGKUT'S UNIVERSITY OF TECHNOLOGY NORTH BANGKOK	Thailand
Co-Beneficiary / Partner	998378030	CHIANG MAI UNIVERSITY	Thailand
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Project Summary and Horizontal Issues

Project Description

English - 1

Horizontal Issues

Previous recommendations/follow-up

We would like to thank the reviewer(s) and respond to some of the concerns.

1. The proposal lacks a more systematic and individualised analysis for each of individual partners, in particular with regard to the engineering courses currently offered and similarities and differences between the HEIs in this respect, and industry stakeholder engagement and international links.

Response: The first year has been dedicated to understanding Institution needs, student needs as well as local needs and their capabilities. The WP1 on the gap analysis, especially its tasks 1.2 and 1.3, has been realized through bottom-up approach by including individual partner data on curriculum, surveying its students, academics and business partners and through individual results getting to more general ones. One recommendation from gap analysis was that implementing flexible formats for thematic learning is highly recommended for the development of the curriculum to allow the partner institutes to serve different local needs as well as to serve different industry sectors with different specific requirements with customized offerings that are also attractive to prospective students who may be at a distance or may not be able to take leave from their job duty, in entering the process without sacrifice of academic quality.

Non-academic partners have been extensively participating in gap analysis tasks, mainly by providing data on their needs concerning MSIE graduates. Additionally, their involvement is crucial in providing industrial visits and important insights for project participants that lead to adjustments in the curriculum. A further step of their participation is anticipated in curriculum and courses verification phase.

Furthermore, Project attempts to address the transnational context of MSIE4.0 by including many transnational companies in the survey sample, and by adding curricula from different universities, not only from Thailand or EU partner countries. Since the courses are being developed in a way to meet globally recognized needs.

2. The proposal does not demonstrate fully convincingly the uniqueness of this inter-disciplinary and pedagogical approach.

Response: Much effort has been taken to introduce new active learning principles and methods to the curriculum, by providing dedicated workshop (Sept. 2018 meeting at UMinho), producing materials and steering the curriculum development process with the active and student-centered approach as a major principle. Innovative pedagogical approach is further highlighted by developing a common framework for the implementation of active learning by combining different models. A new approach for curriculum development that will focus on student learning experience has been developed to support this curriculum development.

3. Plans for dissemination is not distinctively innovative as the proposed activities do not really extend beyond a standardised package.

Response: Specific dissemination plan has been developed for the whole project as well as individual plans has been developed by partners. The dissemination is an ongoing process and eventually, changes or additional events are reported and result in appropriate updates.

4. Concerns on the management of the project such as responsibilities, decision-making mechanism, mitigation

Response: At the kick-off meeting, project management was discussed in length during a project executive committee (PEC) meeting. A project management and communication plan (PMCP) addressing these concerns has been written, shared with all members and implemented. The PMCP is reported in Annex under WP 6 on project management.

Transversal issues

In this curriculum development project, in order to ensure the sustainability of the developed curriculum, the focuses are not only on providing the IE students with new technical knowledge related to industry 4.0 but also on the development of transversal skills that are needed for the students to deal with various practical problems in the future. The transversal competences are necessary for performing professional activities effectively, and hence, the development of transversal competences is considered an important issue in this MSIE4.0 project. In the list of skills needed for the future, besides the requirements related to mastering new technologies, the soft skills related to creativity, critical thinking, negotiation, teamwork, and so on have also been emphasized in various surveys. Due to this, global higher education systems have addressed the importance of defining the expected transversal competences that IE graduates should develop in their degrees. However, despite this actual need, the analysis of various curricula offered in Thai universities and some EU universities conducted in the first work package of this MSIE4.0 project did not show a clear reference to the development of transversal competences in most current master programs in IE. The only learning outcomes related to transversal competences identified in the analysed curricula are Communication competences (4%), Teamwork competences (1%), Ability to solve problems (1%), Leadership competences (1%), Professional Ethics (1%) and Foreign languages (2%). In our survey conducted with IE students at both Thai universities and some EU universities, it has been detected that most students perceived the importance of the development of transversal competences in the near future, or felt that they should have developed these competences in the past. This result confirms the high level of importance the students assign to transversal competences at present. In our student survey, various transversal skills have been addressed by more than 90% students who participated, i.e., adaptability and ability to change, teamwork, communication skills, social skills, self-management and time management, and knowledge on legal affairs and sustainability. Among the above transversal competences, adaptability and ability to change together with teamwork and communication skills are considered the most important ones. The above results look reasonable. In a very fast changing environment nowadays in most industries, the technical knowledge learned in any course of study may become obsolete soon due to high-speed technology development and due to new requirements of customers about smart products and smart services. To cope with these trends, future MSIE graduates must have the ability to adapt themselves with changes in technology/customer requirements/business environment through self-studying and enhancing their problem-solving skills. Also, in order to work in interdisciplinary teams on various types of project addressing different problems under Industry 4.0 requirements, MSIE graduates should not only equip themselves with knowledge on IE & non-IE technical subjects in order to perform efficiently in the teams, their ability to communicate effectively with other team members/customers or high management level is also in need. In fact, the transversal skills have been incorporated implicitly in traditional IE curricula of various academic institutions. However, in the existence of new and challenging requirements of Industry 4.0, especially in the context of Thailand sustainable smart industry, those transversal skills should be enhanced and incorporated explicitly.

Involvement of people with fewer opportunities

Award Criteria

Typology

Horizontal priorities

Fostering the assessment of transversal skills	<input type="checkbox"/>
Promoting the take-up of practical entrepreneurial experiences in education, training and youth work	<input type="checkbox"/>
Promoting the professional development of staff and youth workers in ICT methodologies	<input checked="" type="checkbox"/>
Supporting the production and adoption of Open Educational Resources in diverse European languages	<input type="checkbox"/>
Facilitating the validation of non-formal and informal learning and its permeability with formal education pathways	<input type="checkbox"/>

Linkages

School education	<input type="checkbox"/>
Higher education	<input checked="" type="checkbox"/>
Adult education	<input type="checkbox"/>
Vocational training	<input type="checkbox"/>
Youth sector	<input type="checkbox"/>
Cross-sector	<input type="checkbox"/>

If cross sector is selected

School education	<input type="checkbox"/>
Higher education	<input type="checkbox"/>
Adult education	<input type="checkbox"/>
Vocational training	<input type="checkbox"/>
Youth sector	<input type="checkbox"/>

CBHE Aims

Support the modernisation, accessibility and internationalisation of the higher education field in the eligible Partner Countries.	<input checked="" type="checkbox"/>
Support eligible Partner Countries to address the challenges facing their higher education institutions and systems, including those of quality, relevance, equity of access, planning, delivery, management, governance.	<input type="checkbox"/>
Promote people to people contacts, intercultural awareness and understanding.	<input type="checkbox"/>
Promote voluntary convergence with EU developments in higher education.	<input type="checkbox"/>
Contribute to the cooperation between the EU and the eligible Partner Countries (and amongst the eligible Partner Countries).	<input checked="" type="checkbox"/>

CBHE Objectives

Improve the quality of higher education and enhance its relevance for the labour market and society.	<input checked="" type="checkbox"/>
Improve the level of competences and skills in HEIs by developing new and innovative education programmes.	<input checked="" type="checkbox"/>
Enhance the management, governance and innovation capacities, as well as the internationalisation of HEIs.	<input type="checkbox"/>
Increase the capacities of national authorities to modernise their higher education systems, by supporting to the definition, implementation and monitoring of reform policies.	<input type="checkbox"/>
Foster regional integration and cooperation across different regions of the world through joint initiatives, sharing of good practices and cooperation	<input type="checkbox"/>

Specific activities

Curriculum development	<input checked="" type="checkbox"/>
Modernisation of governance, management and functioning of HEIs	<input type="checkbox"/>
Strengthening of relations between HEIs and the wider economic and social environment	<input type="checkbox"/>

Type of project

National project	<input checked="" type="checkbox"/>
Multi-country project	<input type="checkbox"/>

Regions involved

Region 1 - Western Balkans	<input type="checkbox"/>
Region 2 - Eastern Partnership Countries	<input type="checkbox"/>
Region 3 - South Mediterranean Countries	<input type="checkbox"/>
Region 4 - Russian Federation	<input type="checkbox"/>
Region 6 - Asia	<input checked="" type="checkbox"/>
Region 7 - Central Asia	<input type="checkbox"/>
Region 8 - Latin America	<input type="checkbox"/>
Region 9 – Iran, Iraq, Yemen	<input type="checkbox"/>
Region 10 - South Africa	<input type="checkbox"/>
Region 11 - ACP	<input type="checkbox"/>
Cross-regional	<input type="checkbox"/>
Regional	<input type="checkbox"/>
National	<input type="checkbox"/>

Special mobility strand

The project contains a Special Mobility Strand	<input type="checkbox"/>
The project does not contains a Special Mobility Strand	<input checked="" type="checkbox"/>

Involvement of people with fewer opportunities

YES/NO	<input type="checkbox"/>
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Assessment Criteria

Relevance of the project

Relevance to the objectives

This MSIE 4.0 project focuses on the modernization of the education of industrial engineering discipline in Thailand by the development of a curriculum for a Master's degree in industrial engineering to sustainable smart industry (Industry 4.0). The curriculum is expected to conform also to the European Qualifications Framework (EQF) and be applicable to EU partner universities. Thus, the project evidently pursues the CBHE aims and objectives related to promoting voluntary convergence with EU developments in higher education and improving skills and competences through the development of innovative programmes.

The project fits also with the priorities for Curriculum Development in Asia in the subject area of Engineering and Engineering Trades in Thailand and for the improvement of learning and teaching tools, another CBHE priority for this region, through new methods and approaches supporting student-centred learning.

For Thailand, this CBHE project supports the country's growth strategy towards a value-based economy (Thailand 4.0). Technology and creativity will be new driving forces for the Thai economy. Thai companies will have to focus more on producing innovative products and services. Human resource development for all levels is indispensable for the realization of this strategy. The companies also voiced out the needs for competence staffs. According to the project finding on gap analysis (Workpackage 1), more than 60% companies said that their existing overall employee level of competence is not adequate or non-existent for the implementation of the industry 4.0 covering both technical and transversal competences. They have been making efforts to acquire or develop their employee levels of competences to the needs of Industry 4.0. Different types of programs, e.g., formal educational programs, special training seminars, knowledge transfer systems, coaching and mentoring have been pursued. The companies are looking for employees with competence and transversal skills who can apply knowledge gained from their education to their jobs with less training than these days and be able to communicate and work in team environment. These competences and skills should be obtained while they are attending school. Unfortunately, existing curricula in both undergraduate and postgraduate levels, including in industrial engineering discipline, cannot effectively upkeep this change. This project focuses on developing a competence-based curriculum because it is foreseen that graduates who have exposure to a variety of learning activities are expected to perform much better than those who have gone through the conventional Knowledge focus teacher-centered learning.

EU Education, Cooperation & Development policies

Project aims at adopting EQF rules for defining program and course specific learning outcomes (PLOs and CLOs). The set up of PLOs and CLOs has been introduced with EQF originating guidelines for level 7 (MSc) qualification level. Current development of studying program and course syllabuses is verified with its accordance with EQF. Project has the ambition to contribute to the challenges envisaged in "THE NEW EUROPEAN CONSENSUS ON DEVELOPMENT 'OUR WORLD, OUR DIGNITY, OUR FUTURE'", especially through prioritization of sustainability of curriculum as a major outcome of the project, mutual engagement of Partner and EU based Partners in all of the tasks of the project and giving the appropriate attention to Thailand specific needs, policies, conditions and circumstances while progressing with the project work packages.

Quality of the project implementation

Description of the implemented activities

The following tasks have been implemented

For WP1 on gap analysis, all six tasks have been implemented and completed. WP1 took about 12 months to finish as an initial plan, but because the WP1 officially started after the kick-off meeting in February 2018, we could not finish WP1 in the first year of the project. Lack of communication among partners hindered the progress of the project. The WP moved slowly during the first ten months. Therefore, WP1 leader was changed at the beginning of Dec 2018 and VDO conference meetings were conducted almost every week which have resulted in substantial delivery of outcomes. Our team tried to speed up all activities, but to ensure the quality of the outcomes we could not finish them earlier.

For WP2 on the development of curriculum structure and courses, two tasks have been being implemented.

Task 2.1 Developing curriculum structure and academic program learning outcomes (PLOs)

Task 2.2 Developing courses and course learning outcomes (CLOs) based on a matrix that maps CLOs with PLOs and also teaching and learning methods

Due to the delay of WP1, workplan for WP2 has been revised. Task 2.1 is expected to be approved by PEC by May 31, 2019. The number of courses to be developed has been changed from 15 to 16 to introduce a course focusing on transversal competence development. The development of the 16 courses will be finished in June 2019, instead of March 2019. Weekly VDO conference meetings have become a practice for WP2.

For WP3 on modernisation of teaching methods and tools, three tasks have been being implemented.

Task 3.3 Developing a web-portal for online learning

Task 3.4 Training of staff on new tools and best practice exchange on modern teaching techniques (Training on problem and project-based learning was done at University of Minho, Portugal in 2018)

Task 3.6 Purchasing and installing of teaching equipment (at the stage of the development of the conceptual model of the laboratory)

For Task 3.3, the online learning platform has been developed with nearly all main modules and tested with two courses at AIT. But due to unexpected technical issues, the platform will be relocated to a new server.

For WP4 on quality plan for the implementation of the project, three tasks have been being implemented

Task 4.1 Developing a quality control and monitoring system

Task 4.2 Implementing the internal quality control and monitoring of the project

Task 4.3 Inviting external evaluation of the project results

Task 4.3 started a little late and has taken time longer than expected. The second round of the selection process was conducted to avoid a criticism and to assure independency.

For WP5 on dissemination and exploitation of project results, five tasks have been being implemented.

Task 5.1 Development of a Dissemination, Exploitation and Sustainable plan (DESP)

Task 5.2 Creating a project website to support the dissemination strategy, and communication and collaboration among partners

Task 5.3 Production and dissemination of project materials (12 occasions for public presentation of the project)

Task 5.4 Publications in professional journals, newspapers, magazines, brochures, and social media (12 publications)

Task 5.6 Organizing dissemination events with relevant stakeholders (organized 7 public seminars)

The approval of DESP has been delayed due to miscommunication and misunderstanding of the WP leader and co-leader. The plan will be approved by PEC before the end of May.

For WP6 on project management, three tasks have been being implemented

Task 6.1 Finalizing management structure

Task 6.2 Organizing kick-off and regular consortium meetings

Task 6.3 Monitoring and controlling the project

Quality assurance

Quality assurance is considered to be an essential task to ensure that the project objectives and results defined in the project proposal can be achieved and delivered within the project implementation period at a high-quality level. Therefore, quality control mechanisms and procedures required to be followed throughout the whole project implementation by all partners have been developed.

In this project, a Quality Control and Monitoring Plan (QCMP) has been developed by Work Package 4 (WP4) leader from University POLITEHNICA of Bucharest (UPB), and co-leader from Prince of Songkla University (PSU) in consultation with all other partners. The following tasks have been addressed in the QCMP:

1. defines the quality expectations for project deliverables (outcomes and outputs)
2. defines the internal monitoring and quality management
3. defines the content, format, review and approval process of the project deliverables;
4. defines the responsibilities of the project partners regarding those deliverables.
5. identifies all the different tools and means to be applied throughout the project duration
6. provides guidelines for adequate implementation and thereby assure that certain quality standards in the performance of our tasks are fulfilled.
7. define the quality requirements that must be obtained throughout the project lifecycle, those that the deliverables, actions, and results must conform to.

In order to ensure the quality of project implementation, evaluations are conducted for various deliverables/outcomes of the project. The aim of the evaluation is to support the project coordinator and WP leaders in ensuring the highest quality of project outcomes as well as in improving project performance. When a task is considered completed by the members who get involved in performing the task, the outcome will be submitted from the task leader to work package leader, and the work package leader will then submit the task outcome to Quality Control and Monitoring Board (QCMB) for evaluation. The evaluation process will be performed by a group of assigned members from all partners in QCMB. Based on a set of predefined evaluation criteria for the task, members of QCMB will give comments and suggest changes to the task leaders using a delivery evaluation form before receiving approval from QCMB. The approved report will then be sent to the Project Executive Committee (PCB) for final approval.

It is noted that before the task leader submits the task outcome to QCMB, the report will be pre-checked by an internal quality control member (QCM).

QCMP is available at

https://msie4.ait.ac.th/wp-content/uploads/sites/5/2018/10/QCMP-Quality-Control-and-Monitoring-Plan-v3_2018.10.12-2.pdf

Visibility

Activities conducted under MSIE 4.0 project has received substantial visibility. Several channels of communication have been created to create awareness of the project, and to disseminate the project results. They will be applied also for the exploitation of the project outcomes.

Project website (<https://msie4.ait.ac.th>) was created and launched in January 2018 prior to the kick-off meeting. The website provides information about the project, the source of funding support, consortium, activities, news and events and gallery. The website is updated on a regular basis. The new information will appear on the front page. There is also a password-protected area for internal communication among the project members. Members can find and/or upload documents for all six WPs. As of April 13, 2019, the number of visitors was 36,655.

Project Facebook (<https://m.facebook.com/MSIE4Thailand/>) was also created in February 2018. As of April 13, 2019, the number of like and follow are 1018 and 1029

MSIE 4.0 Youtube (<https://youtube.com/channel/UCZjqUrH6bOwCHGAsC9nnTA>) was launched at the beginning of March 2019. Eleven VDO clips have been created and posted. The number of subscribers is 30.

The graphic logo of Erasmus + programme of the European Union is displayed clearly and stand out on all published media.

For publication, the Erasmus + programme of the European Union is acknowledged
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Electronic links to info and support materials for visibility

Reports on Dissemination of project materials are available at <https://msie4.ait.ac.th/reports-on-dissemination-of-project-materials/>

Publication reports are available at <https://msie4.ait.ac.th/publications-reports/>

Reports on organising dissemination events are available at <https://msie4.ait.ac.th/activities-events-reports/>

Project poster in 4 languages (Thai, English, Romanian, Polish): <https://msie4.ait.ac.th/3995-2/>

Official project Facebook page: <https://m.facebook.com/MSIE4Thailand/>

MSIE 4.0 Channel: <https://www.youtube.com/channel/UCZjqUrH6bOwCHGAsC9nnTA>

List of VDO clips on MSIE 4.0 Channel

Playlist 1: Welcome to MSIE 4.0 Project

Welcome to MSIE 4.0 Project [VDO 1 / 2]: <https://youtu.be/5V65ea7GocE>

Welcome to MSIE 4.0 Project [VDO 2 / 2]: <https://youtu.be/4xRZ9tGr-ws>

Playlist 2: WP1 Gap Analysis

WP1- 1 / 5 Data collection: <https://youtu.be/wDJCwA3EoJ4>

WP1- 2 / 5 Review on current curricula: <https://youtu.be/16NdJwfrEVU>

WP1- 3 / 5 Analysis on industry needs & student needs: <https://youtu.be/CL70bqLIIMk>

WP1- 4 / 5 Gap analysis: https://youtu.be/gyC8nF_g5GI

WP1- 5 / 5 Competitive factor & recommendations: https://youtu.be/5QL_NLScrJI

Playlist 3: MSIE 4.0 Public Seminar

MSIE 4.0 Public Seminar at KKU: <https://youtu.be/sNRz7OKxJOI>

Playlist 4: MSIE 4.0 Activity

INTED 2019, Valencia, Spain: <https://youtu.be/DVWM9nOC31c>

Others

WP1 Behind the scenes: https://youtu.be/4_whVStsLXQ

Happy Songkran 2019: <https://youtu.be/BE9IZvXEkiO>

Equipment

Equipment for this project can be classified into two groups. The first one is to support curriculum development and dissemination purposes. The second one is for a laboratory with online remote access.

Equipment already acquired by the project are six multifunction laser printers needed for processing documents and six video conference cameras for conducting video conference group meetings that are essential for moving the project forward. They have been sent to all Thai partners. In addition, a camera was also acquired to support the production of project video clips. The inventory system has been developed for recording the equipment for the project. The list of equipment already acquired is available at <https://msie4.ait.ac.th/equipments/>.

Purchase of two servers is in process. The two servers will be installed at AIT to support. One of them will be assigned for laboratory online access and another for an online learning platform.

The purchases of equipment for a laboratory with online remote access will be done after the design of the laboratory is finalized. The purchases will be for sensors, data acquisition units, controllers, software, networking equipment for remote connectivity, robotic arm, automatic guided vehicle, machines, and materials such as aluminum profile and accessories. This laboratory will be built at AIT.

The project includes activities relating to curriculum development

Yes

HIGHER EDUCATION: Promoting internationalisation, recognition and mobility, supporting changes in line with Bologna principles and tools.

The project should contribute to the objectives of Bologna process by proposing flexible learning paths within MSIE4.0 curriculum, enhancing employability, lifelong learning, and entrepreneurial skills, and as a possible impact creating new mobility opportunities for Thai and EU partners with the development of following Erasmus+ KA1 projects. Since the ECTS system cannot be completely adopted in its complexity for the curriculum due to legal constraints, the project aims at keeping the proportions between the ECTS and Thai systems and keep the same valuation of courses and student workloads. The ECTS system is going to be somehow adapted as a measure of learning workload for the Thai partners. Each course will have 5 hours of contact per week, with different typologies, from lecture, workshop, and lab. Additionally, for each course it will be possible to identify the autonomous number of learning hours, that can include, individual study, teamwork, and evaluation. For example, a 7 ECTS course should have 7×25 total hours = 175 total hours in one semester. From these, it should be 5 hours of contact per week, in a total of $5 \text{ h} \times 15 \text{ w} = 75$ hours of contact in the semester. The other 100 hours should be for individual study, teamwork, project work and evaluation.

New/updated courses

Group work was organized during the 3rd MSIE 4.0 meeting at CMU at the end of January 2019 with all the participants practiced writing course learning outcomes (CLOs), and selecting teaching and learning methods. 16 course were identified during VDO conference meetings and allocated to the partners based on their competences. 16 course development teams of partners were formed. The course objectives and CLOs for the 16 courses were drafted. The teams are working on course assessment. The 16 courses are presented below and additional detail is available at <https://msie4.ait.ac.th/wp-content/uploads/sites/5/2019/04/Unofficial-Note-for-Task-2.2.pdf>.

1. Enterprise Management in Digital Economy
2. Project Management for Industry 4.0
3. Smart Operations Management
4. Quality Management for Extended Enterprise
5. Sustainable Supply Chain Management
6. Digital Factory
7. Advanced Optimization: Techniques and Industrial Applications
8. Intelligent Decision Support Systems
9. Applied Data Analytics
10. Cyber-Physical Industrial Systems
11. Collaborative Manufacturing Systems
12. Additive Manufacturing for Industry 4.0
13. Innovative Product Design and Development
14. Human-Centric Design for Operator 4.0
15. Customer Experience-Driven Design
16. Leadership Communication and People Development in Digital Era

No

Teaching / Training Activities

Yes

No

Quality of cooperation

Project management

The signings of the 8 partnership agreements were completed within 4 months with no obstruction after the signing of the grant agreement between EACEA and AIT.

To run the project systematically, a project management flow was created and shared with all members. All operational tasks are initiated by WP Leaders (WPLs) who allocate the tasks to the task members nominated by the partner leaders (PLs). WPLs are responsible for updating PC the status of ongoing tasks on a monthly basis. For each completed task, the responsible WPL will submit deliverable to QCMB for endorsement and to PEC via PC for final approval. In case of rejection at any stage, the WPL will be informed immediately.

Internal communication channels were established and communication has been highly encouraged among members at all levels. Various channels, including regular face-to-face meeting, video conference meeting, email, and social media such as WhatsApp and Line, have been exploited to make communication effective.

Document templates for managing the project were available to all members at <https://msie4.ait.ac.th/category/resources/wp6/wp6-forms/>. The detail of project management is in a Project Management and Communication Plan (PMCP) available at <https://msie4.ait.ac.th/project-management-and-communication-plan-pmcp/>.

Managing an international project like MSIE 4.0 is interesting and challenging as diversity exists in terms of culture, language, experience, an internal procedure at each partner institute, etc. Our members, especially Thais, were new to the procedures for use of the grant and had a tendency to apply our previous experience which were incorrect on several occasions. One common mistake was about reporting their tasks under different categories on the financial documents. Besides, the internal procedures for some partners are strict while the others are flexible. As a result, the completion of document submission can take more time than expected. To make the processing of the document more systematic, dates for submission are set for the members, the partner leaders, WPLs, and the PC.

Moving the members away from their comfort zones was very challenging and setting a positive mindset toward the project is probably the most difficult task. A limited number of communication among partners was observed, especially between Thai and EU partners. Unfortunately, some tasks required rework because the members were not familiar with the tasks. The progress was unavoidably slow. Discussion among the member was essential in order to move the project forward quickly. Therefore, since December 2018, VDO conference meetings among partners have been conducted almost every week which have resulted in substantial delivery of outcomes. Additionally, there was an increasing use of Google docs and Google sheets as a way to involve the partners in brainstorming and collaborative discussions. Perception of many members has changed in a positive way. More importantly, the members have understood each other more and seen the value of the collaboration. Many more members have joined the meeting. The establishment of a strong relationship has become visible.

However, there is still room for improvement, especially on active participation in discussion from Thai members. The success of the project also requires the members to leave their status quo and some members have shown that sign of change. One last important thing is psychological inertia. Almost all members have been with knowledge-focused teacher-centered learning. It is easy for them to keep developing their course along with that direction although they try to improve the curriculum. Feedback and discussion during the weekly VDO conference are expected to improve the situation.

Involvement of partners and stakeholders

First active involvement of all partners in the project began during the preparation of the project proposal when all partner leaders were asked to express their interests in tasks identified for all workpackages (WPs). The selection of the WP leaders partly was based on their selected contributions and their team readiness. Additional responsibilities were given to the partners with fewer contributions to make their contributions visible to the public. To create strong collaboration, all WPs, except WP6, have co-leaders. Ones are Thai and other ones are from EU partners. Responsibilities and resources allocations of all partners are presented in section 4.2 of PMCP available at <https://msie4.ait.ac.th/project-management-and-communication-plan-pmcp/>.

The success of all tasks and of the project relies on strong collaboration and communication among partners. Therefore, all partner leaders were asked to identify their contact persons for all tasks which is made available online to all leaders. Relevant members have involved in their WP planning. All 9 partners involved in collecting curriculum information from 22 Higher Education Institutions (HEI).

The involvement was extended to stakeholders. Representatives from some of the associated partners participated in the kick-off meeting to share their experience and to voice out their needs. 72 companies and 450 master students, based in both Europe and Thailand, participated in the WP1 survey for gap analysis. This phase of data collection required a high level of involvement of HEI, companies, and students as the main stakeholders of these project.

After the data collection phases, the WP1 team started increasing the interaction for data analysis and interpretation. Moreover, all partners gave their inputs for the definition of the most important aspects of the data analysis and for the comparison of the results with current implemented practices in IE curricula. This involvement of the partners was essential for the Gap Analysis main task and for the definition of competitive factors and recommendations for the curriculum. Some pieces of evidence of this involvement are the total number of 34 versions for the 7 reports, which are a result of the interactions and revisions made by the partners. An increase in the level of interaction was noticed with the Zoom distance meetings. The consortium developed 10 Zoom meetings between the UMinho and the CMU meetings and this practice is also being implemented by the WP2 team.

Moreover, the project and quality management plans defined a workflow showing two main aspects: clear leadership responsibility and several steps of approval involving different teams and project members. Thus, each outcome must be approved initially by the work package team. After that, it must be approved by the quality control board and every member of the board must read the outcome and fill in an evaluation form. Finally, the project management board must also read and approve of the outcome. All these steps contributed to creating a high level of involvement of the partners.

It is clear now that the partners are engaging in the process of development of the courses and teaching and learning materials. The defined process of involving three to four partners for the development of each course will help to strengthen the involvement of partners. During and after the development of the courses for the master program, companies, teachers, and students will help the consortium with the development and evaluation of the courses. It is becoming evident that the partners will create bounds that will nurture beyond the project limits.

Management of the grant

The financial rules for the management of the grant to provide support to the project partners were established and incorporated into the project management and communication plan (PMCP) so that they can perform the local financial management in an efficient and successful way and provide all documents necessary for financial monitoring, reporting, and audits. It offers the detailed definitions of eligible and ineligible costs, instructions for preparing financial tables, a list of required supporting documents to justify incurred costs, etc. Some definitions and rules are taken in the original forms from the EU COMMISSION Guidelines for the Use of the Grant, in order to avoid any misinterpretation.

Procedures for budget transfer and for reimbursement have been developed to support financial management. For the budget transfer, a partner leader initiates the process by completing a payment request form and obtains the signature of a legal representative of the partner institute before submitting it along with supporting documents to the project coordinator (PC) to process the payment. The transfers are made in five payments. The transfers to Thai partners are in Thai Baht at the exchange rate AIT received. The transfers to EU partners are in Euro. The amounts are as indicated in the partnership agreement with the individual partners. The report on budget transfer is available at <https://msie4.ait.ac.th/pre-financing-reports/>.

For reimbursement, an individual member initiates the process by completing a monthly timesheet and update a project timesheet for different categories performed. A partner leader collects timesheets and update financial statement of the partner institutions and submit them to the PC to update the financial status of the project.

The PC informed the project executive committees (PEC) and the members during the kick-off meetings on resource and budget allocations, co-funding concept, funding rules, costs categories, and penalty.

As aforementioned, our members, especially Thais, were new to the procedures for use of the grant and had a tendency to apply our previous experience which was incorrect on several occasions. The members were not familiar with co-funding concept and filling in timesheet seems to be difficult for many members. One common question was about budgets for organising events which are embedded under staff costs. One common mistake was about reporting their tasks under different categories on the financial documents as they striced to the initial role assigned, not the activities they performed.

To make the processing of the financial document more systematic, the members, the partner leader, and the PC have been asked to collect and submit the financial document on the 7th, 14th and 21st of the following month respectively.

IMPACT AND SUSTAINABILITY

Awareness raising, dissemination, sustainability and exploitation of the project results

The first action took at the beginning of the project was to launch a project website to be the main channel to communicate with the public as well as among the members. Facebook was another channel created for quick communication. At the early stage when the project started. The focus was on creating awareness of the presence of the project. Materials produced during this period were about the background, motivation, objectives, introduction of partners and of members, what to expect from the project and timeline. Posters were also created in 4 different languages to promote at all partner institutes. 7 main public events were organised mainly in Thailand in all parts of the country where instructors, students, representatives from the industry were attending. There were also many small events like in the classrooms. After one year of work, project results are available. The focus has been turned to the dissemination of the project results. The official reports were updated on the project website immediately after they were available. Video clips for the introduction of the project and dissemination of WP1 results were produced and published on both the project Facebook page and on an MSIE 4.0 Youtube channel launched in March 2019 to support the dissemination of the results and to be ready for the exploitation of the results. The statistics indicators have improved significantly after the dissemination of the outcomes of WP1. A plan is set for promotion of the MSIE 4.0 curriculum and its 16 courses. Besides, a 4.5m*2.0 m exhibition board was created to illustrate the project results in the Exhibition of Science and Modern Technology at KMUTNB where Her Royal Highness Princess Maha Chakri Sirindhorn visited the display during the opening ceremony. Publications and presentations of the project outcomes have been produced on a regular basis. All these activities will be continued and at the beginning of October 2019, short course training will be developed and offered to the industry at Thai partner institutes. An engineering education conference will be organized by AIT at the end of August 2020 before the closing of the project. It is expected to be another venue to create visibility of the project to both the national and international communities. A tentative dissemination plan for the project is available at https://msie4.ait.ac.th/wp-content/uploads/sites/5/2019/04/WP5-Activity_timeline.pdf.

All activities mentioned were the outcomes of the collaboration of all partners contributed in different capacities. KKU and UPB are the leader and co-leader of WP5. All Thai partners have organised and/or will organise public events. So far AIT has played its role in developing channels for dissemination and producing dissemination materials. All EU partners have actively participated in content development and distributed the dissemination materials.

Since the project was initiated from the need of the country for a sustainable smart industry which is in need for the industry, it is expected that the curriculum will be well accepted by prospective students and industry. Many professionals representing companies expressed their interests in the curriculum. Other Thai universities after knowing about the project have also expressed their interests in joining the activities. EU partners have also started thinking about seeking funding for the collaborative implementation of the curriculum in their institutes.

Statistics and Indicators

Type of equipment:

- books and pedagogic material
- audio-visual equipment
- Computers and software

lab material

Other

For Curriculum Development projects

Yes

Courses updated
(/developed/accredited) in line
with Bologna principles.

not applicable

Number of new/updated courses
DEVELOPED

16

Number of new/updated courses
RECOGNISED/ACCREDITED

0

Number of new/updated courses
IMPLEMENTED/DELIVERED

0

Level of new/updated courses:

- Short cycle
- 1st Cycle (e.g. Bachelor)
- 2nd Cycle (e.g. Master)
- 3rd Cycle (e.g. Doctoral)
- Vocational Education and Training

Type of recognition:

- HEI Degree
- National degree
- Multiple Degree
- Joint Degree

Volume (in ECTS) of new/updated
courses

120

The new study programme includes:

Placements/internships for students

Career orientation service

Career development measures

Number of learners / trainees enrolled (per intake / course delivery)

10

Type of skills/competence developed:

Transversal/behavioural skills

Technical /academic /scientific / research skills

Linguistic competences

% of the new curriculum taught in foreign language of the the total of new curriculum developed by the project

100

For Training/Mobility Activities

Number of partner country "HEIs' students" trained

0

Number of partner country "HEIs' academic staff" trained

30

Number of partner country "HEIs' administrative staff" trained

0

Number of partner country "non-HEI individuals" trained (priv. sector, NGOs, civil servants, etc.)

0

IMPACT AND SUSTAINABILITY

Impact at individual level

Extent of attention given to vulnerable groups

not applicable

Number of direct beneficiaries in the Partner country(ies) per year: academic staff from HEIs

20

Number of direct beneficiaries in the PCs (/year): administrative staff from HEIs

0

Number of direct beneficiaries in the PCs (/year): HE students

90

Number of direct beneficiaries in the PCs (/year): non HE individuals

60

Impact at institutional level

Extent of impact at institutional level: for instance new courses / strategies (policies, regulations) / services (units, centres)

to a very high extent

Potential of planned project measures to contribute to new national cooperation activities in the Partner countries HEIs as a result of the project (Memorandum of Understanding /research projects / joint publications /participation in networks or associations etc.)

to a very high extent

Potential of project to contribute to new international cooperation activities in the Partner countries HEIs as a result of the project (international agreements / Memorandum of Understanding / research projects / joint publications / participation in networks or associations, etc.)

to a very high extent

Impact on the HE Sector

Potential of project to contribute to new (/updated) national or regional policies / laws / regulations in HE

to a very high extent

Potential of project to contribute to the establishment (/ further development) of external bodies (/associations /agencies)

to a very high extent

Potential of project to contribute to improve the excellence / competitiveness / attractiveness of the Higher Education institutions

to a very high extent

Innovative character of the planned results (i.e. the courses developed; the new tools, services, procedures delivered; the strategies implemented for reaching the target groups; etc.)

to a very high extent

Impact on the society as a whole

Potential of the project to pay particular attention to least developed countries

to a very high extent

Potential of the project to engage Partner Countries HEIs in new means of cooperation with employers and other stakeholders (e.g. NGOs, associations, etc.)

to a very high extent

Measures contributing to improving lifelong learning approaches in the Partner Country HEIs

to a very high extent

Sustainability

Institutional support for Partner Country HEIs to sustain project results

to a very high extent

Measures to collect Sources of financial (/logistic) support for sustaining the project results from:

- Partner HEIs
- Public authorities in Partner countries
- NGOs
- Private sector
- European Union
- Other

QUALITY OF PARTNERSHIP & COOPERATION

Involvement of students in the project implementation

to a very high extent

Involvement of non-educational stakeholders in the project implementation

to a high extent

RELEVANCE in relation to project objectives

To what extent the project contributes to the policy objectives of the Partner Countries

to a very high extent

Project potential to promote EU's horizontal policies

- Agriculture, fisheries and foods
- Business

Climate action

- Cross-cutting policies
- Culture, education and youth
- Economy, finance and tax
- Employment and social rights
- Energy and natural resources
- Environment, consumers and health
- External relations and foreign affairs
- Justice, home affairs and citizens' rights
- Regions and local development
- Science and technology
- Transport and travel

Meetings, Training and Mobilities

Meetings, Trainings and Mobilities

Estimated dates of consortium meetings until the end of the projects

Venue country	Venue city	Date of Meeting
Thailand	Pathumthani	12/02/2018
Portugal	Guimaraes	10/09/2018
Thailand	Chiang Mai	30/01/2019
Poland	Czestochowa	03/06/2019
Thailand	Khon Kaen	16/12/2019
Romania	Bucharest	15/04/2019
Thailand	Pathumthani	28/08/2020

Training and Mobilities

Event	Purpose	Type of participants	Gender	Number	Country of Origin	Country of destination	Duration (in weeks)	%compared to objectives
1	Training	Academic staff – teaching	Number Male	24	Thailand	Portugal	0,5	33,3

2	Training	Academic staff – teaching	Number Male	24	Thailand	Poland	0,5	33,3
3	Training	Academic staff – teaching	Number Male	24	Thailand	Romania	0,5	33,3

Attachments

Type of File	Name of the File
Budget Table	financial_statements for MSIE 4.0 as of March 2019 for Midterm Submission.xlsm
Declaration of Honour	Declaration of Honor.pdf
Table of achieved results	Final annex_c_table_of_achieved_planned_results_for MSIE 4.0.pdf
Dissemination/Exploitation Plan	WP5 Activity_timeline.pdf
Quality Assurance Plan	QCMP-Quality-Control-and-Monitoring-Plan-v3_2018.10.12-2.pdf
Report Special Mobility Strand	AknowldgmentOfReceipt.txt
Request for Payment	