



SWAP

Sustainable solid WASTE management and Policies

DELIVERABLES 3.4

IMPLEMENTATION, MONITORING, AND IMPROVEMENT OF TVET PRODUCTS

Project Acronym	SWAP
Work Package	WP1
Deliverable	D 3.4
Deliverable Lead	P6 - TUAF
Type	Report
Dissemination Level	Public
Contractual delivery date	15.12.22
Actual submission date	13.12.23
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ABSTRACT

Southeast Asia confronts mounting waste management challenges owing to rapid urbanization, burgeoning population, and industrial expansion. The region's surging waste output necessitates effective, sustainable management strategies. Thus, the imperative for well-trained personnel equipped to tackle these issues cannot be overstated. Technical and Vocational Education and Training (TVET) stands as a linchpin in shaping the workforce, propelling economic growth, and fostering social development globally. Its pivotal role in solid waste management (SWM) extends beyond immediate benefits, crucially fostering sustainable development, curbing environmental degradation, and advancing a circular economy. By imparting requisite knowledge and skills, TVET programs not only contribute to cleaner environments but also underpin economic prosperity and social welfare.

This report focuses on implementing TVET programs for Solid Waste Management across Cambodia, Thailand, and Vietnam. It meticulously assesses the preparation, execution, and efficacy of these initiatives. Starting with a synthesis report and subsequent individual reports from partnering institutions including Royal University of Agriculture (RUA), University of Heng Samrin Thbongkhmum (UHST), Chiang Mai University (CMU), Maejo University (MJU), Hue University of Agriculture and Forestry (HUAF), and Thai Nguyen University of Agriculture and Forestry (TUAF). The document delineates TVET's preparatory stages, training commencement, and trainee feedback collection.

The report showcases the outcomes of TVET courses conducted between March and October 2023, attended by 273 diverse trainees, predominantly comprising students (45%), farmers (29%), and industry professionals (16%). Pre- and post-surveys indicated an average satisfaction rate of 92%, accompanied by significant enhancements in trainees' knowledge levels. Partners' experiences highlighted pros such as efficient university resource utilization and addressing the burgeoning interest in waste treatment. Conversely, challenges including remote location hindrances, time constraints, limited awareness, and fundraising hurdles were identified.

Proposed strategies aim at fortifying training quality and sustainability. These strategies encompass curriculum refinement, technological integration, flexible learning modules, expansive outreach, diverse funding models, ongoing evaluation, and collaborative networking. The outlined strategies aim to fortify the effectiveness and sustainability of TVET initiatives, fostering environmental sustainability and a skilled workforce in Southeast Asia.

KEYWORDS

Agricultural Waste, Biogas, Cambodia, Compost, Organic Waste, Solid Waste Management, Southeast Asia, Technical and Vocational Education and Training (TVET), Thailand, Vietnam



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ACKNOWLEDGEMENT

This document is a deliverable of the SWAP project. This project is co-funded by the Erasmus+ Programme of the European Union under the call for proposals EAC/A02/2019 and carries the project n° 618723-EPP-1-2020-1-DE-EPPKA2-CBHE-JP.



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ABBREVIATIONS

CMU: Chiang Mai University

MJU: Maejo University

HUAF: Hue University of Agriculture and Forestry

RUA: Royal University of Agriculture

SWM: Solid waste management

TUAF: Thai Nguyen University of Agriculture and Forestry

TVET: Technical and Vocational Education and Training

UHST: University of Heng Samrin Thbongkhmum



1 Introduction

Southeast Asia faces escalating challenges related to waste management due to rapid urbanization, population growth, and industrialization. The region's increasing waste generation demands effective and sustainable management strategies. Thus, the importance of well-trained personnel equipped with the expertise to handle these challenges cannot be overstated.

Technical and Vocational Education and Training (TVET) holds a crucial position in shaping the workforce, driving economic growth, and fostering social development in nations across the globe. The significance of TVET in solid waste management (SWM) extends beyond immediate benefits. It plays a pivotal role in fostering sustainable development, mitigating environmental degradation, and promoting a circular economy. By equipping individuals with the necessary knowledge and skills, TVET programs contribute not only to cleaner environments but also to economic growth and social welfare.

This report belongs to the Activity 3.4 “the implementation of TVET programs on Solid Waste Management in partners including Royal University of Agriculture (RUA), University of Heng Samrin Thbongkhmum (UHST) in Cambodia, Chiang Mai University (CMU), Maejo University in Thailand, and Hue University of Agriculture and Forestry (HUAF) and Thai Nguyen University of Agriculture and Forestry (TUAF) in Vietnam.

Specifically, this report meticulously reviews the preparation, implementation, and effectiveness of TVET courses. Also the advantages and disadvantages encountered during the Solid Waste Management TVET implementation across Cambodia, Thailand, and Vietnam were presented. Beyond the assessments, the report endeavors to propose sustainable strategies to ensure the enduring efficacy and sustainability of TVET programs in contributing towards environmental sustainability and the development of a skilled workforce.

2 TVET preparation

Pre-implementation in Technical and Vocational Education and Training (TVET) involves several crucial steps to ensure the successful planning, design, and readiness of the program or initiative. Here are steps that partners of project conducted for the pre-implementation in TVET.

- **Needs Assessment and Analysis:** Organize meetings and consultations to identify topics, specific skill gaps, industry demands, and the requirements of the target population.



- **Setting Objectives and Goals:** Define precise objectives and goals for the TVET program that align with identified needs and effectively address skill gaps.
- **Curriculum Development:** Create comprehensive training materials integrating both theoretical knowledge and practical skills relevant to the industry.
- **Resource Allocation:** Allocate necessary resources such as facilities, equipment, teaching materials, and qualified instructors to ensure their availability and sufficiency for effective training delivery.
- **TVET Training Delivery:** Initiate the training process for trainees according to the designed curriculum and program structure.
- **Collect Trainee Feedback:** Gather feedback from trainees to monitor the training's quality and identify areas for improvement.
- **Continuous Improvement of TVET Training:** Utilize trainee feedback and ongoing assessments to enhance the quality and effectiveness of the TVET program continually.

3. TVET implementation

Table 1. TVET courses conducted at University partners of the SWAP project

Partners	Courses conducted	Time	Number of trainees	Students/ graduates	Enterprise/ Industry sector	Govern ment sector	Farmers	Others (e.g. Office worker, jobless)
CMU	Biogas technology: principle, design, and operation	16th July 2023	42	34	8	0	0	0
MJU	Waste utilization non degree module; Organic waste treatment technology	March - April 2023	60	13	27	2	16	2
HUAF	Agricultural waste utilization into organic fertilizer for crop production	17-18 May 2023	36	23	4	5	0	0



TUAF	Waste classification and organic waste treatment	18-21 Sep 2023	72	4	0	2	64	2
RUA	Compost Production for Sustainable Agriculture	10-Mar-23	44	31	4	0	0	4
USTH	Introduction to Solid Waste Management	29 Sep-14 Oct 2023	19	19	0	0	0	0
Total			273	124	43	9	80	8

From March to October 2023, 6 partners of the project in Cambodia, Thailand and Vietnam conducted 7 TVET courses for 273 trainees from different backgrounds, in which students were 124 (accounting 45%), following by farmers (29%) and industry sector (16%). Government sector and free workers made up an equal proportion (3%).

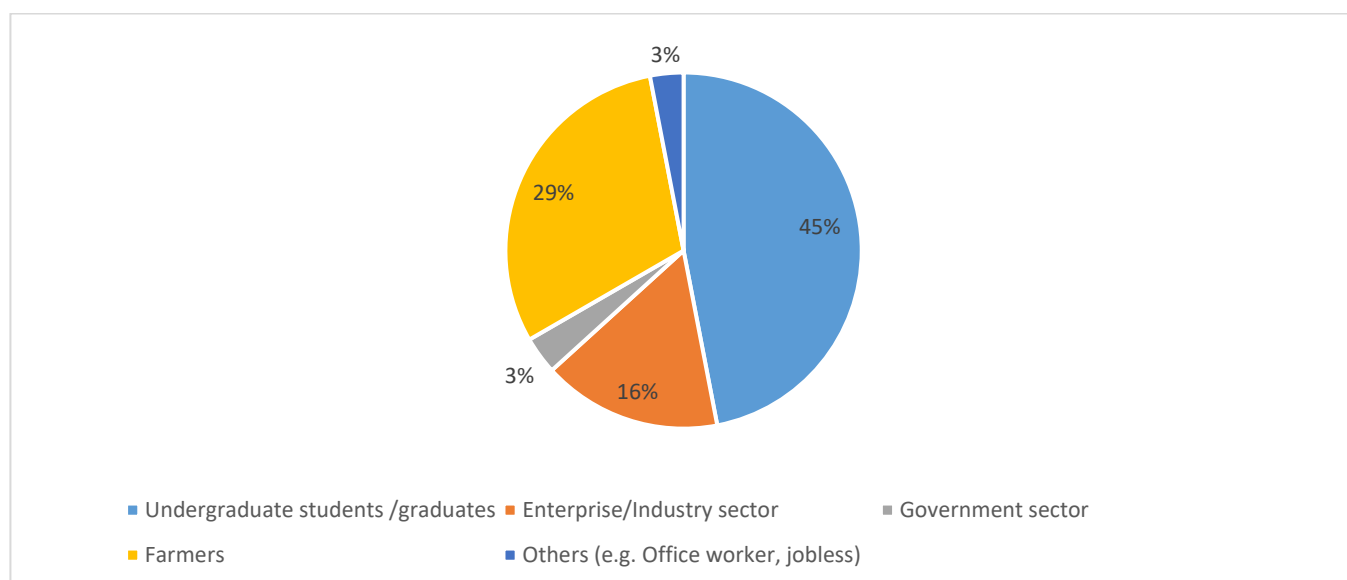


Figure 1. Trainees' background

3. Participant feedback

Pre- and post-surveys conducted in TVET courses garnered positive feedback from participants. On average, 92% of the trainees expressed satisfaction with the course, citing its benefits in enhancing their knowledge and skill set, as illustrated in Figure 2. The comparison of knowledge



levels before and after the training also exhibited a positive shift among trainees. For instance, at TUAF, the knowledge levels surged from approximately 2 (indicative of a low level) in pre-survey to around 4 (indicative of a high level) post-training, as detailed in the TUAF report.

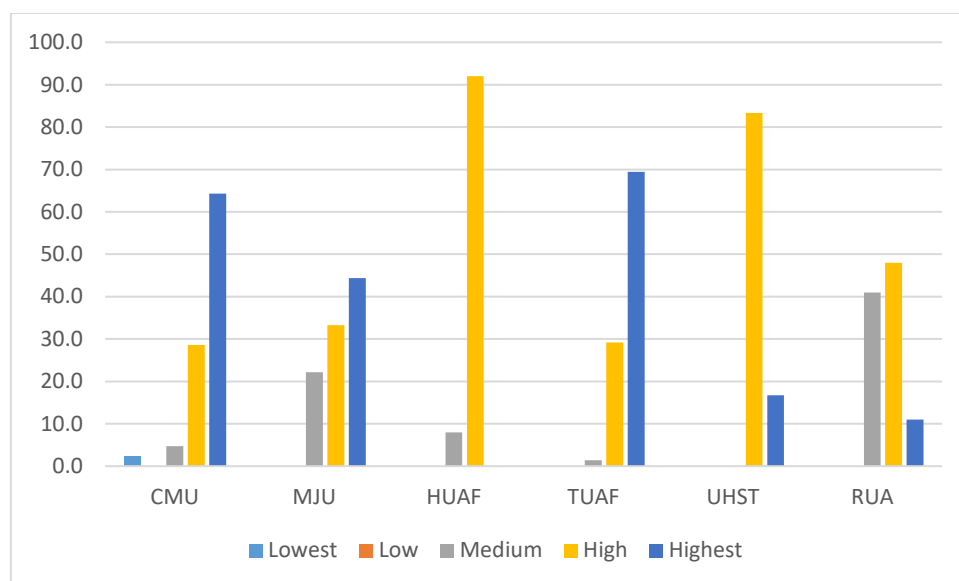


Figure 2. Knowledge and skill gained from the training

Moreover, an encouraging aspect was the willingness of over 90% of the trainees to apply and disseminate the acquired knowledge in their daily lives or workplaces, as depicted in Figure 3.

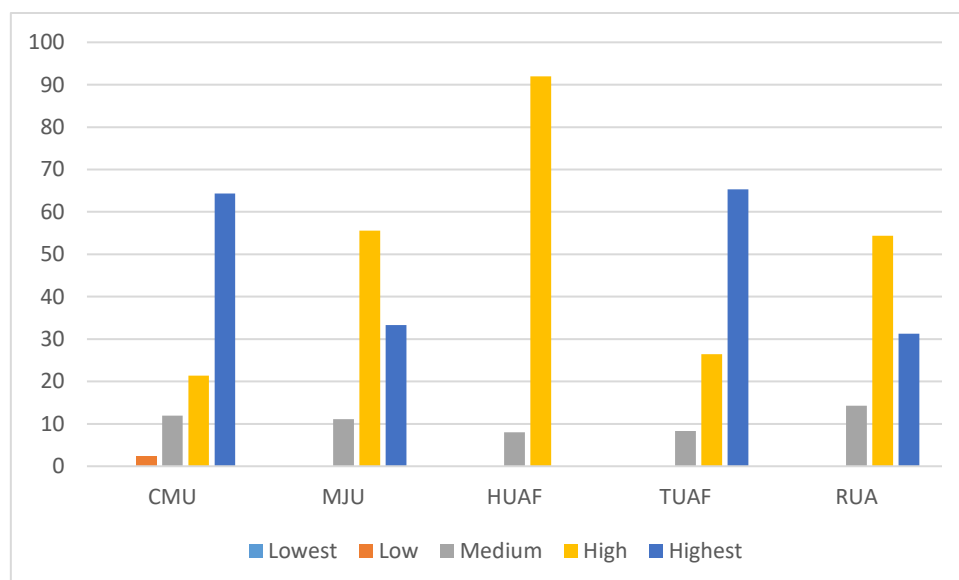


Figure 3. Willingness to apply what learned from TVET courses



4. Advantages and Disadvantages of TVET

Through report of partners, some of pros and cons for TVET implementation were summarised.

Advantages

- **Utilization of University Resources:** University partners have available human and facility resources which can enable the development and delivery of comprehensive TVET courses, utilizing expertise and infrastructure for effective practical training.
- **Addressing Emerging Interest in Waste Treatment:** The growing interest in waste treatment topics like biogas and composting presents an opportunity for TVET. Training programs can cater to this demand, preparing individuals with practical skills in a niche yet vital sector.

Disadvantages:

- **Challenges with Remote Location:** Partners face difficulties due to the remote location of universities, hindering onsite participation. To overcome this, implementing hybrid courses (simultaneous onsite and online) can enhance accessibility and engagement.
- **Time Constraints and Diverse Trainee Requirements:** Partners reported challenges with varying trainee requirements and limited time. Addressing this could involve extending training periods or offering tailored modules to accommodate diverse needs.
- **Limited Awareness and Dissemination:** TVET programs focusing on waste topics are relatively new in the region. To address this, extensive promotion and dissemination efforts are necessary to reach a wider audience, increasing awareness about these courses and their significance.
- **Fundraising Challenges for Long-Term Sustainability:** Securing funding for TVET programs poses a challenge. Collaboration with stakeholders, including industries and local governments, is pivotal for sustainable funding. Partners should actively seek alternative funding sources and leverage existing connections with industry and governmental bodies.

In summary, while TVET related to waste topics presents numerous opportunities, addressing challenges such as accessibility, diverse trainee needs, limited training time, awareness, and funding requires strategic planning, collaborative efforts, and innovative approaches to ensure effective implementation and long-term success.

6. Enhancement of Training Products and Sustainability and Long-Term Future of TVET at partners of the projects



Enhancing Training Products and Ensuring Long-Term Sustainability of TVET at partner institutions involves leveraging advantages and addressing challenges in a strategic manner:

Curriculum development and enhancement:

- **Continuous Review and Update:** Regularly assess and update training materials and curriculum to align with industry standards, technological advancements, and emerging trends.
- **Industry Collaboration:** Foster partnerships with industries to understand their evolving needs and integrate practical, hands-on training that reflects real-world scenarios.
- **Skill Specialization:** Develop specialized modules or certifications within TVET programs to address specific industry needs, such as waste management or renewable energy technologies.

Technology Integration and Innovation:

- **Utilize Advanced Tools and Technology:** Incorporate modern teaching tools, simulation software, and e-learning platforms to enhance the learning experience and provide access to remote learners.
- **Embrace Digital Learning:** Develop online resources, webinars, and interactive modules to cater to diverse learning styles and facilitate self-paced learning.

Flexibility and Customization:

- **Modular Training Programs:** Offer modular courses or flexible schedules to accommodate diverse trainee requirements and allow learners to tailor their learning paths.
- **Personalized Learning:** Implement adaptive learning strategies that personalize training based on individual skill levels and learning preferences.

Outreach and Promotion:

- **Targeted Marketing and Promotion:** Expand promotional efforts through targeted advertising, workshops, industry conferences, and partnerships with community organizations to increase awareness.
- **Engage Stakeholders:** Collaborate with local communities, government agencies, and industry stakeholders to disseminate information about TVET programs and their benefits.

Sustainable Funding Models:

- **Diversified Funding Sources:** Explore various funding avenues such as public-private partnerships, grants, corporate sponsorships, and endowments to establish a stable financial base.
- **Long-Term Sustainability Planning:** Develop sustainable financial models and fundraising strategies that focus on both short-term needs and long-term goals.



Monitoring and Evaluation:

- **Assessment and Feedback:** Regularly evaluate the effectiveness of training programs through feedback from participants, industry partners, and trainers. Use this feedback to make necessary improvements.
- **Quality Assurance:** Implement quality assurance mechanisms to maintain the standard of training programs and ensure continuous improvement.

Collaboration and Networking:

- **Partnership Expansion:** Strengthen collaborations with other educational institutions, industry bodies, and governmental organizations to exchange best practices, share resources, and create a network of support.

By implementing these strategies, training institutions can improve the quality and relevance of their training programs, increase participation, and ensure their sustainability in the long run. Regular assessment, adaptability, and responsiveness to the evolving needs of industries and learners are critical for the success of TVET initiatives.

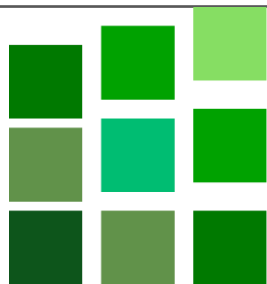


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IMPLEMENTATION OF CMU's TVET TRAINING

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Work Package	WP1
Deliverable	D 3.4
Deliverable Lead	P6 - TUAF
Type	Report
Dissemination Level	Public
Contractual delivery date	
Actual submission date	31 October 2023
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1 Introduction

Chiang Mai University (CMU) was founded in January 1964, under a Royal Charter granted by His Majesty King Bhumibol Adulyadej. CMU is the first provincial university in Thailand, based on the government's policy and the objectives of the northern people, as a center for academic and occupational knowledge in order to benefit the region and the country as a whole. This university is a place for knowledge collection, studies, research, and knowledge transfer according to academic freedom based on morality and academic excellence, application and transfer, and arts and culture development. Upon these missions, CMU has engaged in the setting up of courses and trainings for different groups of students. Though the Technical and Vocational Education and Training (TVET) degree is not awarded directly under the current CMU regulation, training for the trainees who need to have the practical skill for particular professions has been strongly supported by the university.

In order to fulfill CMU mission and fully reap the benefit of collaborating in SWAP, Department of Environmental Engineering, as a main contributor of the project, has organized the TVET course entitled "Biogas technology: principle, design and operation" on the 16th July 2023. This training is designed specifically for the people who already have fundamental knowledge in the biological waste treatment and want to be able to properly design and operate the anaerobic system, especially for biogas production.

2 Preparatory Process and Participant Statistics

In order to set the TVET topic that was both compatible with the trainee's needs and utilization of TVET materials developed in the SWAP project, the organizing team at CMU had held a meeting and came up with the selection criteria. The first criteria was that the topic needed to be relevant to the expertise of the Department of Environmental Engineering lecturers so that the training would be as effective as possible. The topic also needed to be in line with the problems related to waste/solid waste in Thailand. This second criteria was set to draw interest from the prospect trainees and also to ensure that the trainees would gain benefit from the training either for their current works or the opportunity to be hired by the relevant companies/organizations, which is the main objective of the TVET program.

As one of the main core strengths of the lecturers lies in the area of waste utilization and, in particular, waste to energy, and the fact that organic waste has been high in the agenda for the responsible organization in Thailand to tackle, the TVET topic "Biogas technology: principle, design and operation" was well suited all set criteria. To widely attract the interested trainees, dissemination of the course was done through CMU's Lifelong Education (<https://www.lifelong.cmu.ac.th>) and details of the TVET course, which are translated from the Thai version of the Training Course Opening Request Form, are presented as follows:



THE TRAINING COURSE

BIOGAS TECHNOLOGY: PRINCIPLE, DESIGN AND OPERATION

1. General Information

1.1 *Course name:* Biogas technology: principle, design and operation

1.2 *Organized by:* Department of Environmental Engineering, Chiang Mai University, Thailand

1.3 *Responsible person*

Name-Surname: Assistant Professor Dr. PATIROOP PHOLCHAN

Position: Head of Environmental Engineering Department, Faculty of Engineering

Tel: 66-53-944192 Ext. 108

Email: patiroop@eng.cmu.ac.th

1.4 *Numbers of trainees:* 42 trainees

1.5 *Target trainees:* Current undergraduate students with the background of fundamental biological waste treatment and people who are already working in the field of waste treatment and utilization.

2. Specific information of the course

2.1 Principles

Biogas technology is a technology for transforming organic matter, both in solid and liquid forms under anaerobic conditions, into biogas. With methane as the main component, biogas is flammable and can be used to generate heat through direct combustion or for electricity production. Biogas technology plays a significant role in the sustainable management of organic waste and various biomass sources from industrial facilities and the agricultural sector.

Although the use of biogas technology is relatively widespread in Thailand, especially in industries using raw materials derived from agriculture, the complexity of diverse microbial activities in the reactor poses challenges for system designers and operators. Fluctuation of the system performance results in the biogas not being produced to the full potential of the feedstock and the treatment efficiency is lower than the expected level. This training program is crucial for imparting practical knowledge to environmental engineers and system operators, enabling them to properly design and effectively utilize biogas technology in various applications.

2.2 Objectives

After the completion of this course, trainees will be able to appropriately design and operate the biogas production system according to the sound theory.

2.3 Structure of the course

The total course duration is 7 hours, divided into lectures, case studies and practices.

Schedule of the course is shown in the following table:



Sections	Topics	Activities	Duration (hours)	Instructors
1	Degradation mechanism of organic substances under anaerobic conditions.	Lecture	1	Asst. Prof. Dr. Patiroop Pholchan
2	Suitable operating conditions for microorganisms in the biogas producing reactor.	Lecture /Practice	2	Asst. Prof. Dr. Patiroop Pholchan
3	Types of anaerobic reactor.	Lecture	1	Asst. Prof. Dr. Patiroop Pholchan
4	Design, case studies and practice for the design of anaerobic reactors.	Lecture /Practice	3	Asst. Prof. Dr. Patiroop Pholchan and Mr. Nuttakorn Towiwek*

*Mr. Nuttakorn Towiwek is an expert environmental engineer, who has been involved in the design and operation of various biogas systems for industries and farms both in Thailand and abroad. He is also an alumni of the Department of Environmental Engineering, CMU and still frequently works with the Department in conducting the research and professional works.

2.4 Course Evaluation

1) Participants must complete a post-training assessment with a score of at least 70% to be considered as having successfully completed the training.

2) Participants must complete a course satisfaction assessment after the end of the course.

Those who have successfully completed the aforementioned evaluations will be awarded with the certificate issued by the Department of Environmental Engineering under the Sustainable Solid Waste Management and Policies (SWAP) supported by ERASMUS+.

3. Keywords and the course overview

3.1 Keywords

Biogas technology; Design; Operation; Wastewater; Biomass

3.2 Course overview

This course is for disseminating the knowledge in the area of biogas technology. Activities comprise both lecture and practice sessions covering anaerobic degradation mechanism, design and operation of anaerobic systems. Trainees are expected to be able to properly design the biogas system and maintain the stability of the system through the appropriate operating practice.



4. Application period and time

Open of application: 28th June 2023 (at 08:30)

Close of application: 10th July 2023 (at 16:30)

Application can be done via CMU lifelong education website
<https://www.lifelong.cmu.ac.th>.

5. Payment period

The training fee is waived for the current CMU students. Other participants need to pay the training fee to CMU (600 Baht each) by the 10th July 2023 (at 16:30).

6. Training period; format and location

Training period: 16th July 2023 at 09:00-17:00

Training format: Onsite

Location: A third-floor lecture room of the Department of Environmental Engineering,
Faculty of Engineering, Chiang Mai University

7. Announcement of training results: 21st July 2023

8. Source of the course budget

Organization of the course is done using the materials developed in the SWAP project under the support of ERASMUS+.

9. Contact person(s)

1) Assist. Prof. Dr. Pimluck Kijjanapanich

Tel: 053-944192

Email: pimluck@eng.cmu.ac.th

2) Assist. Prof. Dr. Patiroop Pholchan

Tel: 053-944192

Email: patiroop@eng.cmu.ac.th

10. Applicant qualifications

1) Current or graduated students of the Environmental Engineering Department.

2) Designers or operators of the biogas systems.

11. Application documents

Current students: Student ID. Graduates: Copy of transcript

Designer and users of the biogas systems: Supporting letter from the company



3. Pre and Post-training Evaluation of TVET courses

- At the end of the training course, the trainees must do the examination (post-test) for evaluating skill acquisition and competency after TVET programs at CMU. For the examination, the trainees have to design the biogas reactor according to the provided conditions and got a score of at least 70%. For the training course on 16th July 2023, 37 (88%) of the trainees past the examination from the total of 42 trainees
- This training course has only post-evaluation because this training is designed specifically for the people who only have fundamental knowledge in the biological waste treatment and do not know how to design the biogas unit. Thus, it was insignificant to do the pre-test about how to design the biogas unit.
- *CMU's efforts in tracking graduates' success and career progression*
Department of Environmental Engineering has set up the communication channel via Line application for all participants. This channel was intended to be used for; distributing all relevant materials/issues, e.g. training course handouts, information regarding the certificate, etc.; for all participants to ask questions related to their application of the knowledge learnt during the course and for tracking participant's progress after attending the training course.
- *Bridge between TVET programs and industry-specific career pathways*
This TVET course is intended for the participants who wish to be able to properly design and operate the biogas system. These skills are very important for the environmental or other related engineers as biogas technology has been strongly promoted by industrial and governmental sectors as a tool to manage and utilize wastes throughout the country. For the training course on 16th July 2023, 8 trainees were from the industry sector who are working on the topic related to biogas production.

4. Advantages and Disadvantages of TVET

The organized TVET course helps to merge academic theory with the practical skill in the area of biogas system design and operation for the trainees. The training course is an important stage for the Department of Environmental Engineering to extract the knowledge gained from the research and link it with professional engineering practices. Through the real design and operation examples of the biogas systems with different kinds of wastes together with the case studies, trainees can effectively learn and practice to have the required skills. This, along with the high demand for the skillful personal in the biogas technology, will enable the trainee to perform the important engineering tasks and should help to enhance the opportunity for them to either get promoted or employed in the future.

Overall, the trainees were satisfied with the training, instructors, and the contents provided on the course. They were confident that their knowledge and understanding about the biogas systems after training had been improved and able to apply knowledge of biogas technology on their work.



There were suggestions for subjects the participants would be interested in after this course. These topics include biogas upgrading, solid waste management, and other wastewater treatment systems. These suggestions would be included in consideration for the offering topic in the future.

The only disadvantage of TVET for CMU would be caused by the location of the university. As CMU is in the very northern part of Thailand, participants could be discouraged by the travel that they have to make. Considering that almost all the major industrial estates are located in the middle part of the country, CMU's TVET course could miss out on numbers of prospected trainees. To overcome this obstacle, the hybrid course (simultaneous onsite and online) can be considered. The content specific for the participants in the area, such as the technology for the specific food industries or farms, should also attract the participants who live or work in Chiang Mai's proximity. In addition, other TVET courses also have the potential to be offered. As the contents of the developed materials from SWAP project are quite various, choosing the appropriate course according to the need at the time should be another interesting strategy.

5. Enhancement of Training Products at CMU

In the first CMU's TVET course, the SWAP's training material entitled "Bio-waste treatment" was adopted. This particular material was very useful as it provided some necessary fundamental information for anaerobic digestion. The material was vigorously enhanced by combining with those offering in-depth contents of the design and operation aspects of the biogas system. Also, to aid the practice activity of the course, case studies were included. These case studies were obtained from the real cases that both instructors, i.e. Asst. Prof. Dr. Patiroop Pholchan and Mr. Nuttakorn Towiwek, had involved in the research, design and operation processes of biogas systems used in different industries and animal farms. Some specific, but frequently occurred operational problems were also explained. These actual problems, requested to be addressed by the participants who worked for a partner industry during the material preparation step, effectively helped to captivate the attention from all the participants during the training course.

6 Sustainability and Long-Term Future of TVET at CMU

Assisted by the CMU platform of the lifelong education, in which the training course (basic, reskill, upskill and advanced courses) can be officially offered and the unit and workforce specifically assigned for this task by the Faculty of Engineering, CMU, the sustainability of CMU's TVET can possibly be maintained. Some disadvantages and obstacle, though, still need to be addressed as described in Section 4. The hybrid course could be considered to increase the numbers of participants from other parts of the country. The content specific for the participants in the area should also attract the participants who live or work in Chiang Mai's proximity. New and in-demand TVET courses, according to the need or agenda of the governmental organizations and private sectors, should also help to get the activity going in the



long run. The governmental organization partners will be of particular useful as they can also help to subsidize the training fee for the interested participants.

Appendix

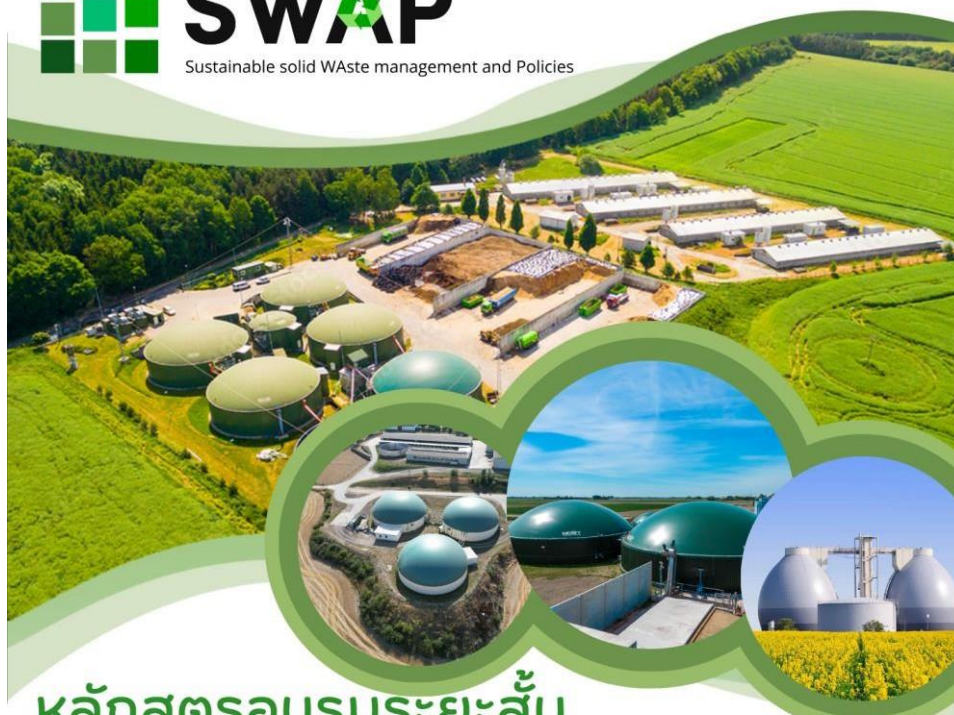


Figure 1. training activities



SWAP

Sustainable solid WASTE management and Policies



หลักสูตรอบรมระยะสั้น

"เทคโนโลยีก๊าซชีวภาพ หลักการ การใช้งาน และการออกแบบ"

เปิดรับสมัคร วันที่ 11 กรกฎาคม 2566 (08.30 น.)

ปิดรับสมัคร วันที่ 15 กรกฎาคม 2566 (16.00 น.)

หัวข้อในการอบรม

- ✓ กลไกการย่อยสลายสารอินทรีย์ภายใต้สภาวะไร้ออกซิเจน
- ✓ การเดินระบบเพื่อให้ได้สภาวะที่เหมาะสมสำหรับจุลินทรีย์ในถังปฏิกรณ์ผลิตก๊าซชีวภาพ
- ✓ ชนิดของถังปฏิกรณ์แบบไร้ออกซิเจน
- ✓ การออกแบบ กรณีศึกษา และการฝึกปฏิบัติการการออกแบบถังปฏิกรณ์แบบไร้ออกซิเจน

เงื่อนไขการเข้าร่วม

บุคคลทั่วไป
นักศึกษา วิศวกรรมสิ่งแวดล้อม มช.

วัน เวลา และสถานที่

16 กรกฎาคม 2566 | 09.00 - 16.30 น.
ห้องบรรยายชั้น 3
ภาควิชาวิศวกรรมสิ่งแวดล้อม
คณะวิศวกรรมศาสตร์ มช.



Figure 2. Infographic of training course

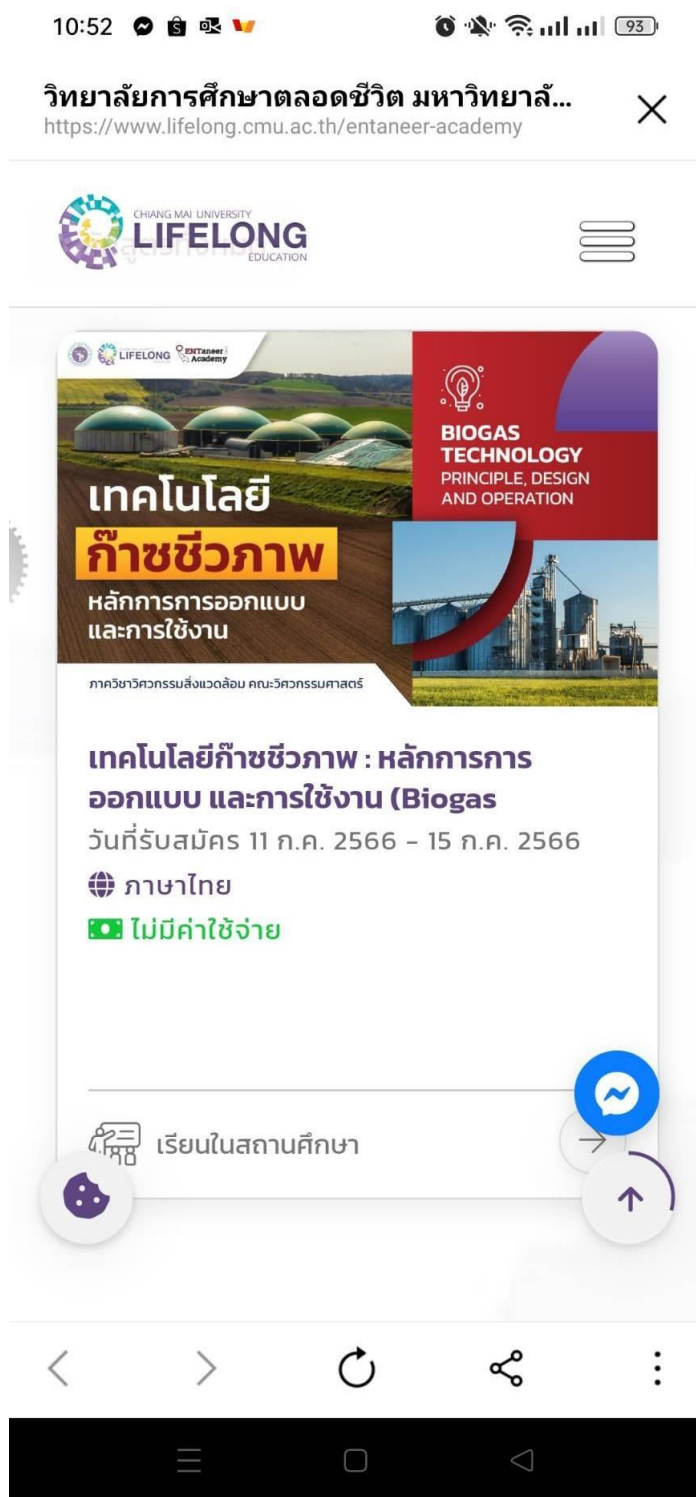


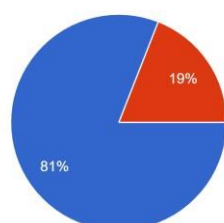
Figure 3. Dissemination of the training course via CMU's Lifelong Education
(<https://www.lifelong.cmu.ac.th>)



Feedbacks from participants

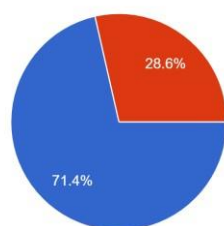
TRAINING

ประเภทผู้เข้าอบรม Type of trainee
42 responses



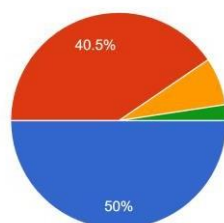
● นักศึกษา Student
● บุคคลทั่วไป Staff from industry sector

เนื้อหาการฝึกอบรมตรงตามความคาดหวัง Training content meets expectations
42 responses



● 5
● 4
● 3
● 2
● 1

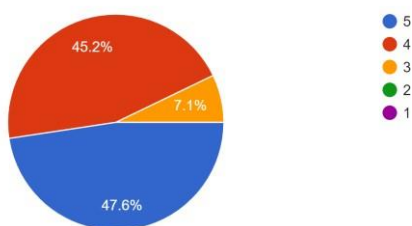
ระยะเวลาในการฝึกอบรมมีความเหมาะสม The duration of training is appropriate
42 responses



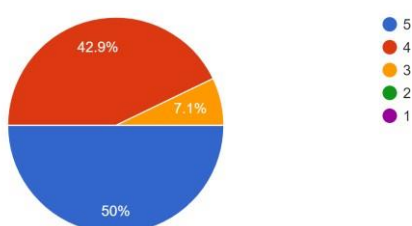
● 5
● 4
● 3
● 2
● 1



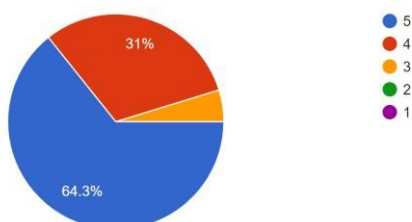
สถานที่และอุปกรณ์ฝึกอบรมมีความเหมาะสม Training locations and equipment are appropriate
42 responses



วิธีการและรูปแบบการฝึกอบรมเอื้ออำนวยต่อการเรียนรู้ Training methods facilitate learning.
42 responses



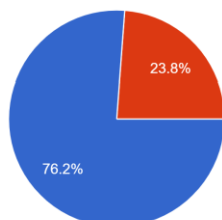
สื่อประกอบการสอนมีเนื้อหาที่เหมาะสม Teaching media has appropriate content
42 responses





LECTURER

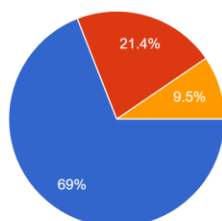
สามารถอธิบายเนื้อหาได้อย่างชัดเจนและตรงประเด็น
42 responses



Able to explain content clearly and to the point



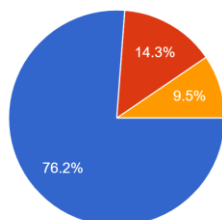
การใช้ภาษาที่เข้าใจง่ายและเหมาะสม
42 responses



Using language that is easy to understand and appropriate



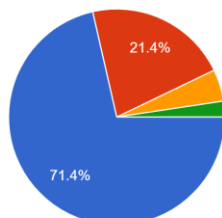
เปิดโอกาสให้แสดงความคิดเห็นและการซักถามข้อสงสัย
42 responses



Provide an opportunity to express opinions
and ask questions.



ตอบคำถามได้อย่างชัดเจนและตรงประเด็น
42 responses



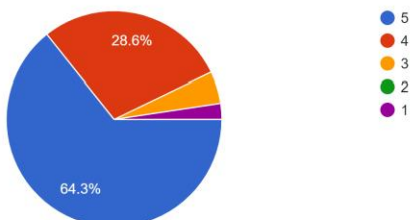
Answer questions clearly and to the point





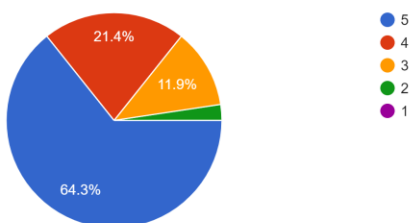
KNOWLEDGE AND UNDERSTANDING GAINED FROM TRAINING

ความรู้และความเข้าใจจากการฝึกอบรมเป็นประโยชน์ต่อท่านเพียงใด
42 responses



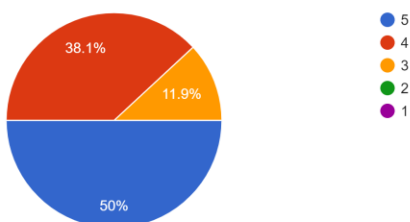
How beneficial is the knowledge and understanding from the training to you?

สามารถนำความรู้ที่ได้ไปเผยแพร่/ถ่ายทอดได้/ใช้ประโยชน์ได้
42 responses



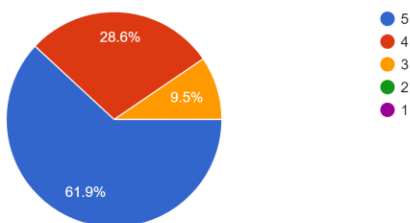
Able to disseminate/transfer/use knowledge gained

ความมั่นใจและสามารถนำความรู้ไปใช้ ด้านเทคโนโลยีไบโอแก๊ส
42 responses

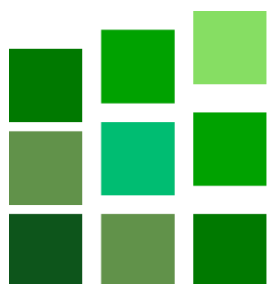


Confidence and being able to apply knowledge Biogas technology

ความรู้และความเข้าใจหลังการฝึกอบรม เมื่อเทียบกับก่อนเข้าอบรม
42 responses



Knowledge and understanding after training
Compared to before attending



Sustainable solid WAsTe management and Policies

DELIVERABLES 3.4

IMPLEMENTATION OF MJU's TVET TRAINING

Project Acronym	SWAP
Work Package	WP1
Deliverable	D 3.4
Deliverable Lead	P6 - TUAF
Type	Report
Dissemination Level	Public
Contractual delivery date	
Actual submission date	31 October 2023
Author(s)	Mujalin Pholchan (MJU)





1 Introduction

Introduction to Maejo University

Maejo University (MJU) is among the leading universities in Thailand with the curricula centered on agriculture is the oldest agricultural institution in the country. It was founded in 1934 as the Northern Agricultural Teachers Training School and restructured and renamed several times until it gained the status of a public university in 1996, known as Maejo University. There are a total of 15 faculties, 3 colleges and 5 university enterprises. The number of full-time staff and students are 1,399 and 15,106 people. Currently, MJU hosts 12,851 undergraduate students, 601 master's students and 153 Ph.D. students. MJU has the mission to educate students to have academic and professional knowledge, to expand opportunities for the disadvantaged to pursue higher education and promote lifelong learning for people of all levels, to create and develop innovations and knowledge in various disciplines, especially in agriculture, and applied sciences for learning and technology transfer to society and to expand academic services and cooperation nationally and internationally.

Being a prominent institution specializing in agricultural training and education, MJU is committed to promoting sustainability. In 2022, the university achieved a national ranking of 11th and an international ranking of 157th out of 1,050 global institutions, showing its outstanding performance and growth. MJU has allocated significant financial resources to remodel its infrastructure, facilitating the implementation of the GO Eco (Green, Organic, and Ecological) Campaign on campus. This campaign encompasses various initiatives aimed at enhancing waste management, water management, and transportation within the campus and neighbouring communities in the near future. Given MJU's status as a prominent agricultural research hub, a significant number of MJU researchers actively engage in activities that generate agricultural waste and by-products. It is imperative for these researchers to recognize the adverse environmental impacts of their research endeavors and work on enhancing their waste management practices. Furthermore, there is an opportunity for researchers to elevate their awareness and potentially reshape their research methodologies to align with sustainability principles. Collaborating with partners to implement circular economy concepts, for example, is a promising avenue. Also, the graduates require access to a comprehensive training program to bolster their



prospects of employment in the environmental sector. Equipping students with a sound understanding of solid waste management is essential not only for MJU's benefit but also for the neighbouring communities to achieve environmental sustainability.

Objectives and importance of Technical and Vocational Education and Training (TVET)

The highly trained and skilled informal workers and graduates are urgently needed for organization, policymakers, implement, and enforcing the policies that allow to improve upon environmental sustainability through better and effective solid waste management. MJU T-VET courses aim to bridge the gap between education and the job market, ensuring that students are well-prepared for productive and successful careers in waste management. The objectives are;

1. To equip students with practical, hands-on skills and competencies that are directly relevant to solid waste management.
2. To prepare individuals for the job market by providing them with the skills and knowledge needed to excel in solid waste management
3. To instil a lifelong learning mindset encouraging individuals to continue updating their skills and knowledge throughout their careers and make education more accessible to a wider range of individuals.

Participants who undergo this TVET program will receive the following benefits upon completion:

Knowledge: Learners will acquire knowledge in agricultural waste management with value addition.

Think and Do: Learners will possess practical skills that can be effectively applied in their own agricultural settings, creating real benefits.

Lifelong Learning: Participants will have the capacity for self-improvement and development, building upon the knowledge they have gained.

Name of TVET training courses at MJU and targeted audience of TVET trainings developed from the SWAP project

Regarding to the developed TVET materials, two topics that MJU organizes are;

1) Solid Waste Characterization and Sorting

This subject is a crucial step for solid waste management and the data obtained can be



further applied for the evaluation of the effectiveness of the collection waste system, the design for waste recycling and waste treatment process and also the economic and investment for waste management business.

2) Bio-waste Treatment

The topic of biotreatment is also of significant relevance in Thailand, given the country's abundant sources of organic waste and food waste. The production of by-products such as compost and biogas through bio-waste treatment processes has attracted substantial attention and generated economic advantages.

This T-VET course is designed specifically for the graduates, alumni, local authorities and people who have a keen interest in upskilling and reskilling to enhance their expertise in waste management.

2 Preparatory Process and Participant Statistics

Overview of the preparatory process at Maejo university for TVET programs

In order to align the TVET topic with the trainees' needs and leverage the TVET materials developed in the SWAP project, the organizing team at MJU conducted a meeting and established selection criterion. The first criterion was that the topic should closely match the expertise of the staff from program in environmental technology and biotechnology to maximize the training's effectiveness. Additionally, the topic had to address recent issues related to waste/solid waste in Thailand and agricultural waste management which aligns with MJU's area of expertise. This was aimed at generating interest among potential trainees and ensuring that the training would be beneficial for their current roles or enhance their prospects of employment with relevant companies/organizations, which is the primary objective of the TVET program.

Customization of training programs based on Maejo university standards and participant needs

Here is the customization of MJU T-VET programs.

1. Needs Assessment:

MJU Conducted surveys and interviews with students, graduates, alumni and communities to understand their specific knowledge gaps and expectations. MJU SWAP staff



analysed the university's existing curriculum and standards in environmental studies to identify areas where additional training is required.

2. Curriculum Development and accreditation:

MJU customized the non-degree T-VET course content to align with university standards and curriculum. The T-VET course needed to get approval from university board before getting the permission to open and get accreditation.

3. Resources preparation:

The instructors prepared and provided course outline and teaching materials.

4. Assessment and Feedback:

The organizers prepared and implemented regular assessments to gauge participants' progress and understanding. All feedback were collected from participants to make continuous improvements to the program.

5. Certification:

Apart from accreditation, the certificates of achievement upon successful completion of the course, in accordance with university standards.

Information about the implementation of the TVET (time, venue and participants)

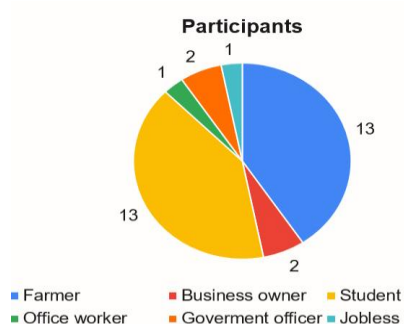
MJU organised two T-VET courses on agricultural waste utilization and organic waste Treatment. The first waste utilization non degree module was organized on site at Faculty of science , Maejo university with the total of 32 trainees in 10-12th March 2023. Targeted trainees are on Farmers, alumni, students, office worker, business owner, jobless. The second one was co-organized with farmers and organic farm networks with the title of organic waste treatment technology on the 5 th April 2023. Number of trainees are 28 and they are organic farmers network, community enterprise and business owner.



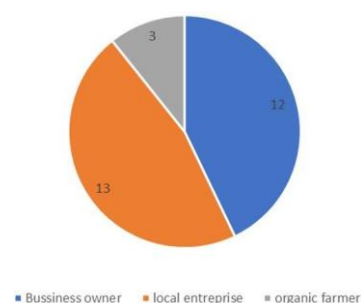
	Waste utilization non degree module	Organic waste treatment technology
Venue	Faculty of Science, Maejo university	On-site, Hotel in Chiangmai
Content	Composting Biochar application Bakery from waste Online platform for business	Composting technology
Materials	Hand-outs on composting process, biochar application and bakery	Hand-outs on composting process
Duration	3 days	1 day
Target group	Farmers, alumni, students, office worker, business owner, jobless	Organic farmers network, community enterprise, business owner
Participant statistics	32	28

3 Post-training Evaluation and Career Pathways

Following the training course, participants are required to employ a post-test aimed at assessing their skill acquisition and competency in TVET programs at MJU to achieve a minimum score of 80%. Results of the course will be assessed using the pre- and post-tests. At least 80% improvement in the score of the post-test compared to that of the pre-test is required for a trainee to be considered as “satisfaction” and will receive a certificate. Satisfaction of trainees on the course will be evaluated. In the training course held on 10-12th March, 2023, all trainees successfully passed the examination and gave high satisfaction.



Participants attended waste utilization non degree TVET module



Participants attended organic waste treatment technology TVET short course



MJU's efforts in tracking graduates' success and career progression by setting up the communication channel via Line application and email lists for all participants. These channels was intended to be used for; distributing all relevant materials/issues, e.g. training course handouts, information regarding the certificate, etc.; for all participants to ask questions related to their application of the knowledge learnt during the course and for tracking participant's progress after attending the training course.

Bridge between TVET programs and industry-specific career pathways

This TVET course is intended for the learners who wish to be able to have knowledge and understanding of various technologies for repurposing agricultural waste materials to create benefits and to possess skills in utilizing agricultural waste materials in different forms to generate advantages and value-added products. MJU establishes partnerships with relevant industries and employers. These partnerships can involve regular communication, collaboration on curriculum development, and opportunities for industry professionals to engage with students. It can be the work-based learning that allow students to gain practical, real-world skills and make connections within their chosen agro-industry and local government. We will ensure that TVET programs offer certifications and credentials that are widely recognized and valued by employers in the target industry. More than 58 % of trainees attending the first MJU TVET were already employed and working in the area related to the waste utilization, while 100% of trainees attending organic waste treatment short course were already in the position of employment.

4 Advantages and Disadvantages of TVET

Advantages of TVET implementation at Maejo university

1. Practical skills: TVET programs emphasize practical skills and hands-on training on agricultural waste management which in one of MJU strength.
2. Employability: TVET trainees have a higher rate of employability as they possess skills that are in demand in the job market.



3. Faster entry into the workforce: TVET programs are usually shorter in duration than traditional academic programs, allowing trainees to enter the workforce more quickly.

4. Hands-on learning: TVET encourages hands-on learning, which can be more engaging and effective for certain types of learners.

5. Affordability: TVET programs can be more cost-effective than traditional higher education, making education more accessible to a broader range of individuals.

Disadvantages specific to MJU's context and how those disadvantages were/will be addressed.

1. Lack of Academic Depth: TVET programs may not provide the same depth of theoretical knowledge as traditional academic programs, which could be a disadvantage in some professions. More knowledge can be uploaded to MOOC or online learning platform for further information.

2. Teacher Qualifications: The quality of TVET programs can vary, and the qualifications of instructors may not always meet the desired standards. This can be solved by collaborating with MJU staff from other departments or sending the instructors to be upskilled.

3. The limitation of location: The location of the Maejo university is located in the very northern part of Thailand. As a result, some participants could not join the onsite course. To overcome this obstacle, the hybrid course (simultaneous onsite and online) can be considered.

5 Enhancement of Training Products at MJU

MJU approach to updating and enhancing training materials by update and integrate new methodology, new technologies and tools relation to agricultural waste utilization and management. MJU also planned for continuous professional development opportunities for trainers to be reskilled so that update advance knowledge and broader skill are enhanced. Co-finding and collaboratives with organization, local communities or third party are also in the plan for training enhancement to allow practical skills and hands-on training.

6 Sustainability and Long-Term Future of TVET at Maejo university



To address the sustainability aspects of the TVET courses, including strategies for ensuring their continuity and long-term impact, MJU will collaborate with industry partners or local communities to provide employment opportunities for graduates. The integration of entrepreneurship and business development skills to promote self-employment will be added into T-VET course to ensure jobs creation and stimulates economic growth and to align with circular economy concept. As MJU has great connection with local municipality and local communities through university activity and academic service, we will promote and support the capacity building for local training institutions to sustain and deliver the courses and also implement the course with relevant government policies and initiatives to secure ongoing support. Simultaneously, it is essential to sustain relationships of participants while conducting data collection and analysing and organizing the database. Moreover, public-private investment is another important driving force for T-VET sustainability. It demonstrates that the effectiveness of public-private partnerships is one of the key successes for PR and gain more interests to broader community.

7 Appendix

The banner is a promotional poster for a TVET course. It features the logos of the European Union, Erasmus+ Programme, and SWAP. The text is in Thai and English. The main title is 'ขอเชิญน้องๆ นักเรียน นักศึกษา ผู้ประกอบการและผู้ที่เกี่ยวข้องไปเข้าร่วม' (We invite students, teachers, business owners, and related parties to join). Below this, it says 'อบรม Module การใช้ประโยชน์จากวัสดุเหลือใช้ทางการเกษตร' (Training Module: Utilization of Agricultural Waste). The dates are 'วันที่ 10 มีนาคม 2566' (March 10, 2023) and 'วันที่ 11 มีนาคม 2566' (March 11, 2023). The time is 'ในระหว่างวันที่ 10-12 มีนาคม 2566 เวลา 8.30 - 12.00 น.' (Between March 10-12, 2023, 8.30 - 12.00 PM). The location is 'ณ คณะวิทยาศาสตร์ มหาวิทยาลัยแม่โจ้' (At the Faculty of Science, Maejo University). There is a QR code on the right side with the text 'ผู้ที่สนใจลงทะเบียนผ่านทางสแกน QR Code นี้ได้เลย' (Those interested can register by scanning this QR code). Below the QR code, it says 'หรือ https://forms.gle/TYM6Pmafckw4wrUF9' (or https://forms.gle/TYM6Pmafckw4wrUF9). The banner also includes a list of topics to be discussed and a contact number 'โทร 0-5387-3128'.

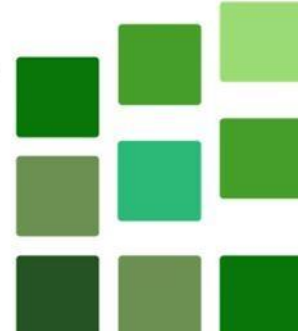
PR banner for TVET (non degree on waste utilization)



Short Course for Reskill Upskill/ Module Credit bank/ สัมฤทธิ์มิตร
ภายใต้โครงการการพัฒนาบุคลากรด้านเทคโนโลยีและนวัตกรรมเกษตรอัจฉริยะด้านกระบวนการเรียนรู้ตลอดชีวิต

Module การใช้ประโยชน์จากวัสดุเหลือใช้ทางการเกษตร

ระหว่างวันที่ 10-12 มีนาคม 2566 ณ คณะวิทยาศาสตร์ มหาวิทยาลัยแม่โจ้









หลักสูตรเทคโนโลยีสิ่งแวดล้อม คณะวิทยาศาสตร์ มหาวิทยาลัยแม่โจ้ ได้จัดกิจกรรม Module สำหรับ
การพัฒนาด้านเทคโนโลยีและนวัตกรรมเกษตรอัจฉริยะด้านการเรียนรู้ตลอดชีวิต (Short
Course for Reskill Upskill/Module Credit bank/สิ้นฤทธิ์นับิต)

ในวันที่ 10 -12 มีนาคม 2566 หลักสูตรเทคโนโลยีสิ่งแวดล้อม คณะวิทยาศาสตร์ มหาวิทยาลัยแม่โจ้ ได้จัดกิจกรรม Module สำหรับการพัฒนาด้านเทคโนโลยีและนวัตกรรมเกษตรอัจฉริยะด้านการเรียนรู้ตลอดชีวิต (Short Course for Reskill Upskill/Module Credit bank/สิ้นฤทธิ์นับิต) ในหัวข้อ Module การใช้ประโยชน์จากวัสดุเหลือใช้ทางการเกษตร ซึ่งประกอบด้วย การผลิตปุ๋ยชีวภาพเพื่อ
ปรับปรุงคุณภาพของดิน การผลิตอินทรีย์วัตถุจากวัสดุเหลือใช้ทางการเกษตร และการผลิตฟิล์มชีวภาพและความงามจากวัสดุเหลือใช้ทาง วัตถุประสงค์เพื่อต้องการอบรมและพัฒนาและยกระดับด้านเทคโนโลยี
และนวัตกรรมเกษตรอัจฉริยะด้านเกษตร ปศุสัตว์ และปศุสัตว์ประมง และการจัดการของเสียด้านการเรียนรู้ตลอดชีวิตด้านการเรียนรู้ตลอดชีวิตและการพัฒนาแบบนวัตกรรมด้าน
เทคโนโลยีและนวัตกรรมเพื่อใช้ในการพัฒนาผู้ประกอบการในสถานประกอบการภายใต้ Platform กลางของมหาวิทยาลัย ณ คณะวิทยาศาสตร์ มหาวิทยาลัยแม่โจ้



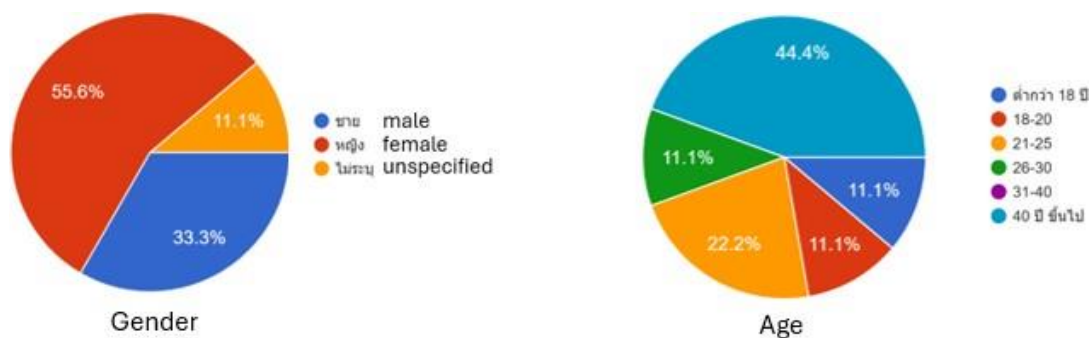
Link for T-VET activity

: https://secretary-science.mju.ac.th/wtms_newsDetail.aspx?nID=27115&lang=th-TH

Trainer's learning: level of knowledge /learning and level of experience on the topic

Each question is rated on a scale from 1 to 5, with 1 representing the lowest and 5 representing the highest score. The summary of the evaluations is presented as illustrated in

Figure 6 to 8



Trainees background

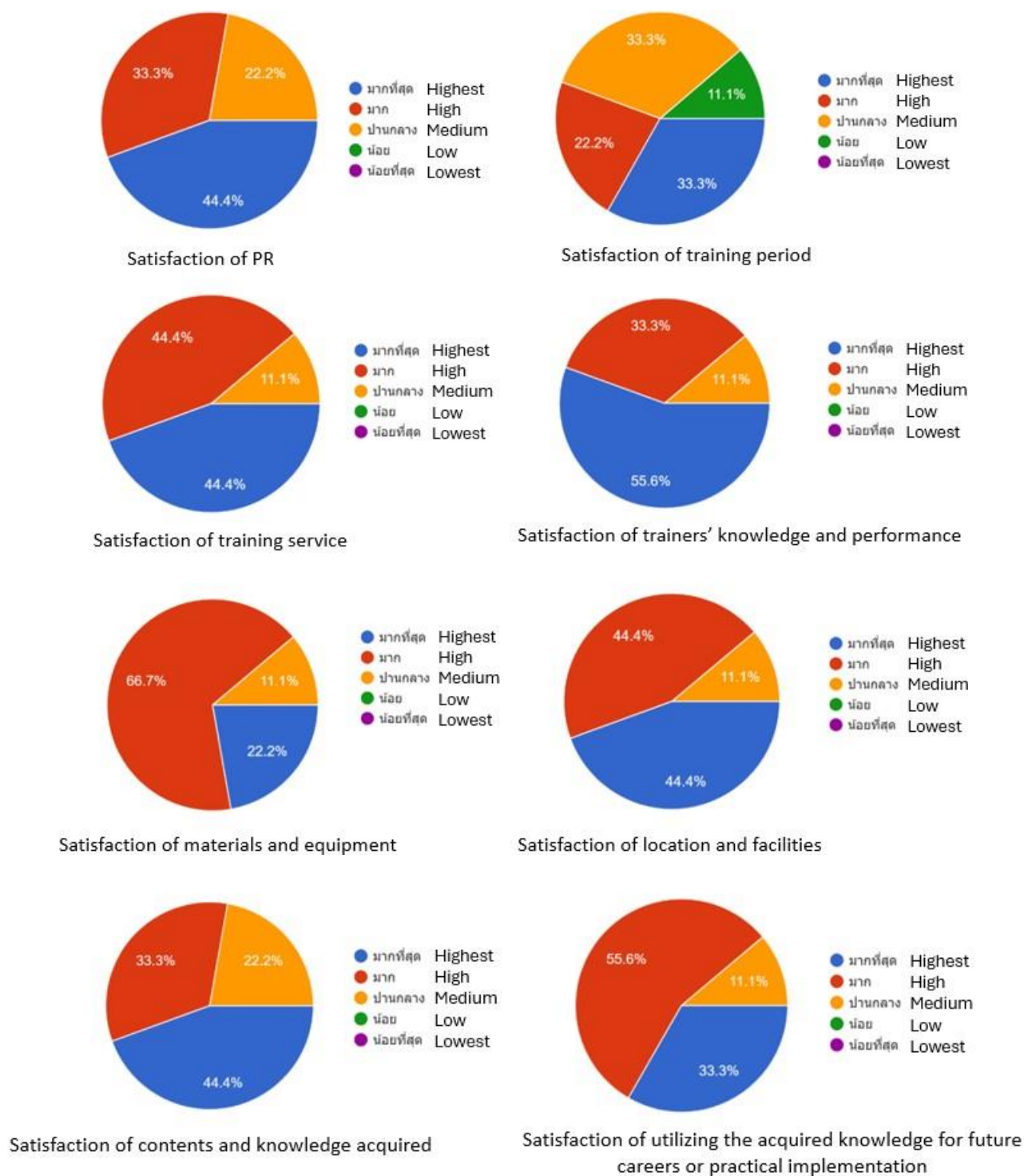
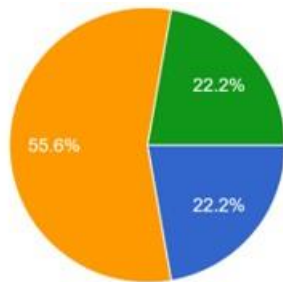
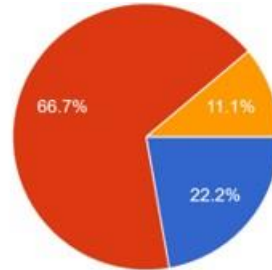


Figure 7. Levels of satisfaction with the training course.



Level of knowledge before training



Level of knowledge after training

Levels of knowledge before and after the training.



Sustainable solid Waste management and Policies

DELIVERABLES 3.4

IMPLEMENTATION OF HUAF's TVET TRAINING

Project Acronym	SWAP
Work Package	WP1
Deliverable	D 3.4
Deliverable Lead	P6 - TUAF
Type	Report
Dissemination Level	Public
Contractual delivery date	
Actual submission date	
Author(s)	Le Thi Thuy Hang (HUAF)





1 Introduction

In accordance with the Decision No. 124/CP of Vietnamese Government Council, Hue University of Agriculture and Forestry (HUAF) was founded in August 1967. HUAF's missions are to conduct undergraduate and graduate training programs, to carry out research and to transfer technology in Central Vietnam and throughout the country.

HUAF tries its best to become as the prestigious university. Additionally, HUAF makes great efforts in training to provide localities and enterprises with qualified human resources. It is highly appreciated as a good center in science and technology to contribute the development of socio-economic to the whole country in integration tendency.

With above-mentioned missions, HUAF has been conducting the short-term training courses for the different targeted groups based on the demands of labour market. The

Technical and Vocational Education and Training (TVET) is considered as a non-academic training course at our university which provides the practical skills for the particular professions to meet the social requirements in capacity improvement for employees.

In the framework of SWAP project, the TVET course titled "Agricultural waste utilization into organic fertilizer for crop production" has been organized on 17-18th May, 2023. This course serves the farmers, households, employees who are working in NGOs, government organizations, private enterprises as well as the graduates who are interested in this topic.

1 Preparatory Process and Participant Statistics

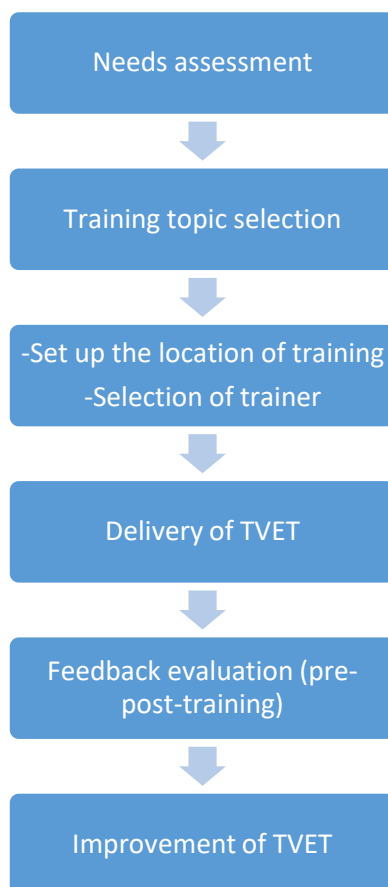
Preparatory Process:

Based on the society needs of training, the TVET training topics were identified and discussed in the meeting between SWAP team and HUAF's leaders. In order to prepare the delivery of TVET course well, SWAP team held a meeting with the leaders of HUAF to discuss arrangement of facilities and human resources before the delivery of TVET.

After identifying the TVET training topic, the SWAP team and HUAF's leaders discussed to select where the TVET training will be implemented and who will deliver the TVET. The



following diagram shows preparatory of TVET delivery.



Name of TVET course: Agricultural waste utilization into organic fertilizer for crop production

Objectives: To provide general and in-depth knowledge about the process to make organic fertilizer from agricultural wastes and use it for crops in a safe and sustainable manner.

Prerequisites: Not applied.

Methodology: Handout, lecturing, practice, group discussion

Assessment:

- Presentation results from group discussion
- Report
- Direct evaluation in practice

Trainer: the staff of Department of Crop Science and SWAP team

Venue: Department of Crop Science and Centre for Agricultural Research and Services, Hue University of Agriculture and Forestry.

Number of participants: 36 participants (9 participants from government agency and private enterprises, 4 lecturers and 23 from graduates)



Time: 17-18th May 2023

Training contents:

Chapter	Content	Hours
A	Theory part	8.0
Chapter 1	The overview and situation of using agricultural wastes for organic fertilizer in Vietnam	1.0
1.1.	The situation of agricultural wastes in Vietnam	0.1
1.2	Using of agricultural wastes for organic agriculture in Vietnam	0.2
1.3	Situation of organic fertilizer production in Vietnam	0.3
1.4	The role of organic fertilizer	0.2
1.5	Group discussion and assignment	0.2
Chapter 2	Principles and methods how to make agricultural wastes into organic fertilizer	5.0
2.1	Classification of organic fertilizer	0.5
2.2	The physicochemical basis of the composting process	0.5
2.3	Controlling the composting process	0.5
2.4	Traditional organic fertilizer production process	1.5
2.5	Industrial organic organic fertilizer production process	1.0
2.6	Evaluation on quality of organic fertilizer	0.5
2.7	Group discussion and presentation	0.5
Chapter 3	How to use organic fertilizer for crops	2.0
3.1	Use of organic fertilizers to improve soil properties	0.5
3.2	Use of organic fertilizers in nurseries	0.3
3.3	Use organic fertilizers for crops: food crops, vegetables,...	0.7
3.4	Group discussion and presentation	0.5
B	Practise part	8.0
1	Preparation, classification of wastes for organic fertilizer	2.0
2	How to make wastes into organic fertilizer	4.0
3	How to apply organic fertilizer from wastes for crops	2.0



2 Pre and Post-training Evaluation of TVET courses

The pre and post-training evaluation questionnaire was distributed to the participants who joined in TVET after ending the TVET. The questionnaire includes two parts in which the first part is to evaluate the degree of understanding of the different topics before the start of training and the second part is to evaluate the degree of understanding of the different topics after the training. The evaluation results indicated that the rate of participants answered “clearly understand” and “understand more clearly” after the training is quite high for all training topics meanwhile the rate of participants answered “not clearly understand” and “quite understand” before the training is high for all training topics. The rate answered “willing to apply what they learned”, “satisfied the training course” and “the training course provided enough knowledge for practice” is 92% (see the annex).

3 Advantages and Disadvantages of TVET

Once the TVET participation, the learners are able to combine the practical skills and academic knowledge as well as update the advance techniques in their jobs. Especially, the graduates have more opportunities to enhance employability in future. Moreover, HUAF contributes the workforce development in Central Vietnam in particular and in the whole country in general. However, HUAF is located in the central Vietnam which is far from the North and South Vietnam therefore it's more expensive travel. Moreover, in the initial period of TVET delivery, it's difficult to involve in learners as many as possible. We need more time to strengthen the cooperation between HUAF and enterprises.

4 Enhancement of Training Products at HUAF

HUAF will always update new knowledge, new technologies through the close collaboration between HUAF and industry enterprises or joint research development with foreign institutions aimed at updating and enhancing the training materials. In Vietnam, we have incorporated School of Environmental Sciences and Technology's research and technological advancements in training programs. Additionally, we give more opportunities for the trainers to join the training programs so that they can improve their capacities in the field of agricultural waste utilization and management.

5 Sustainability and Long-Term Future of TVET at HUAF

Strategies deployed by HUAF for sustainable TVET programs:



- Cooperating with Government and private industry partners is the way to sustain the TVET. From that, we build the joint research in the development of the new technologies so that the trainers can update the knowledge and enhance the training materials. The employees from private enterprises is the potential learners for TVET to improve their capacity in jobs.
- Integration of TVET in HUAF's long-term educational vision is one of the sustainability strategies. TVET is considered the compulsory course being equivalent to the internship course in the academic training programme.
- The diversification of TVET training topics is the way to meet the labour market needs aimed at TVET sustainability.

6 Appendix

Photos





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SWAP

Sustainable solid WASTE management and Policies



List of participants

Co-funded by the
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of the European Union

SWAP
Sustainable solid Waste management and Policies

DANH SÁCH THAM GIA/ATTENDANCE LIST

“SWAP_TVET_ Agricultural waste utilization into organic fertilizer for crop production” “Date& Place: 17-18th May 2023_HUAF”

Đơn vị/Cơ quan (Institution)	Họ và tên (Full name of Participant)	Ký tên (Signature) 17/5/2023	Ký tên (Signature) 18/5/2023
Bachelor Student of HUAF	Hoàng Thanh Phương		
Bachelor Student of HUAF	Nguyễn Hữu Chương		
Bachelor Student of HUAF	Huỳnh Thị Nga		
Bachelor Student of HUAF	Trần Thị Bảo Vy		
Bachelor Student of HUAF	Nguyễn Văn Bảo		
Bachelor Student of HUAF	Bùi Viết Lộc		
Bachelor Student of HUAF	Nguyễn Khánh Hoa	Hoa	Hoa
Bachelor Student of HUAF	Nguyễn Hồng Minh	Minh	Minh
Bachelor Student of HUAF	Huỳnh Thị Thủy	Thủy	Thủy

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

SWAP
Sustainable solid Waste management and Policies

DANH SÁCH THAM GIA/ATTENDANCE LIST

“SWAP_TVET_ Agricultural waste utilization into organic fertilizer for crop production” “Date& Place: 17-18th May 2023_HUAF”

Đơn vị/Cơ quan (Institution)	Họ và tên (Full name of Participant)	Ký tên (Signature) 17/5/2023	Ký tên (Signature) 18/5/2023
Bachelor Student of HUAF	Trần Đức Lộc		
Bachelor Student of HUAF	Hồ Anh Bình		
Bachelor Student of HUAF	Nguyễn Thanh Vương		
Bachelor Student of HUAF	Lê Hoàng Diệu Trinh	Trinh	Trinh
Bachelor Student of HUAF	Đoàn Thị Bích Diễm	Diem	Diem
Bachelor Student of HUAF	Hứa Văn Niệm	Niem	Niem
Bachelor Student of HUAF	Nguyễn Sang	Sang	Sang
Bachelor Student of HUAF	Lê Huy	Huy	Huy
Bachelor Student of HUAF	Hoàng Đức Minh Tân	Tan	Tan



DANH SÁCH THAM GIA/ATTENDANCE LIST

"SWAP_TVET_ Agricultural waste utilization into organic fertilizer for crop production" "Date& Place: 17-18th May 2023_HUAF"

Đơn vị/Cơ quan (Institution)	Họ và tên (Full name of Participant)	Ký tên (Signature) 17/5/2023	Ký tên (Signature) 18/5/2023
Hội Nông dân tỉnh Thừa Thiên Huế	Nguyễn Văn Quý		
Hội Nông dân tỉnh Thừa Thiên Huế	Hoàng Đức Đạt		
Chi cục Trồng trọt và Bảo vệ thực vật tỉnh Thừa Thiên Huế	Huỳnh Thị Tâm Thúy		
Chi cục Trồng trọt và Bảo vệ thực vật tỉnh Thừa Thiên Huế	Phan Thị Mộng Mơ		
Công ty Vipesco	Hồ Thị Hà Duyên		
Lecturer of HUAF	Hồ Lê Quỳnh Châu		
Lecturer of HUAF	Trần Thị Ánh Tuyết		
Lecturer of HUAF	Trương Thị Diệu Hạnh		
Lecturer of HUAF	Vì Thị Linh		



DANH SÁCH THAM GIA/ATTENDANCE LIST

"SWAP_TVET_ Agricultural waste utilization into organic fertilizer for crop production" "Date& Place: 17-18th May 2023_HUAF"

Đơn vị/Cơ quan (Institution)	Họ và tên (Full name of Participant)	Ký tên (Signature) 17/5/2023	Ký tên (Signature) 18/5/2023
Bachelor Student of HUAF	Phạm Phước Quý		
Bachelor Student of HUAF	Cáp Kim Đạt		
Bachelor Student of HUAF	Lê Thị Hoài Chúc		
Bachelor Student of HUAF	Lê Hoàng Như Ngọc		
Bachelor Student of HUAF	Nguyễn Văn Hưng		



DANH SÁCH THAM GIA/ATTENDANCE LIST

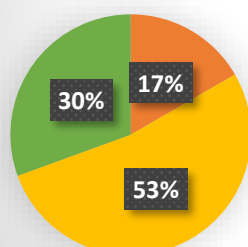
"SWAP_TVET_ Agricultural waste utilization into organic fertilizer for crop production" "Date& Place: 17-18th May 2023_HUAF"

Đơn vị/Cơ quan (Institution)	Họ và tên (Full name of Participant)	Ký tên (Signature) 17/5/2023	Ký tên (Signature) 18/5/2023
Công ty Cổ phần Dịch vụ Cấp treo Bà Nà	Nguyễn Duy Phong		
Tập đoàn Lộc Trời	Châu Võ Trung Thông		
Công ty Bình Điền Mekong	Hoàng Hải Vân		
Chi cục Trồng Trọt và Bảo vệ thực vật	Nguyễn Thị Như Minh		

Survey results

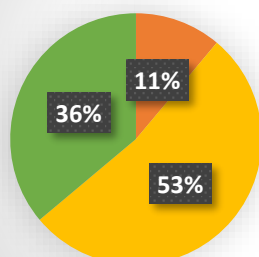
The pre-training evaluation results

Overview of the use of agricultural by-products and organic fertilizers in Vietnam



- Knownothing
- Not clearly understood
- Quite understand
- Understand
- Clearly understand
- Understand more clearly

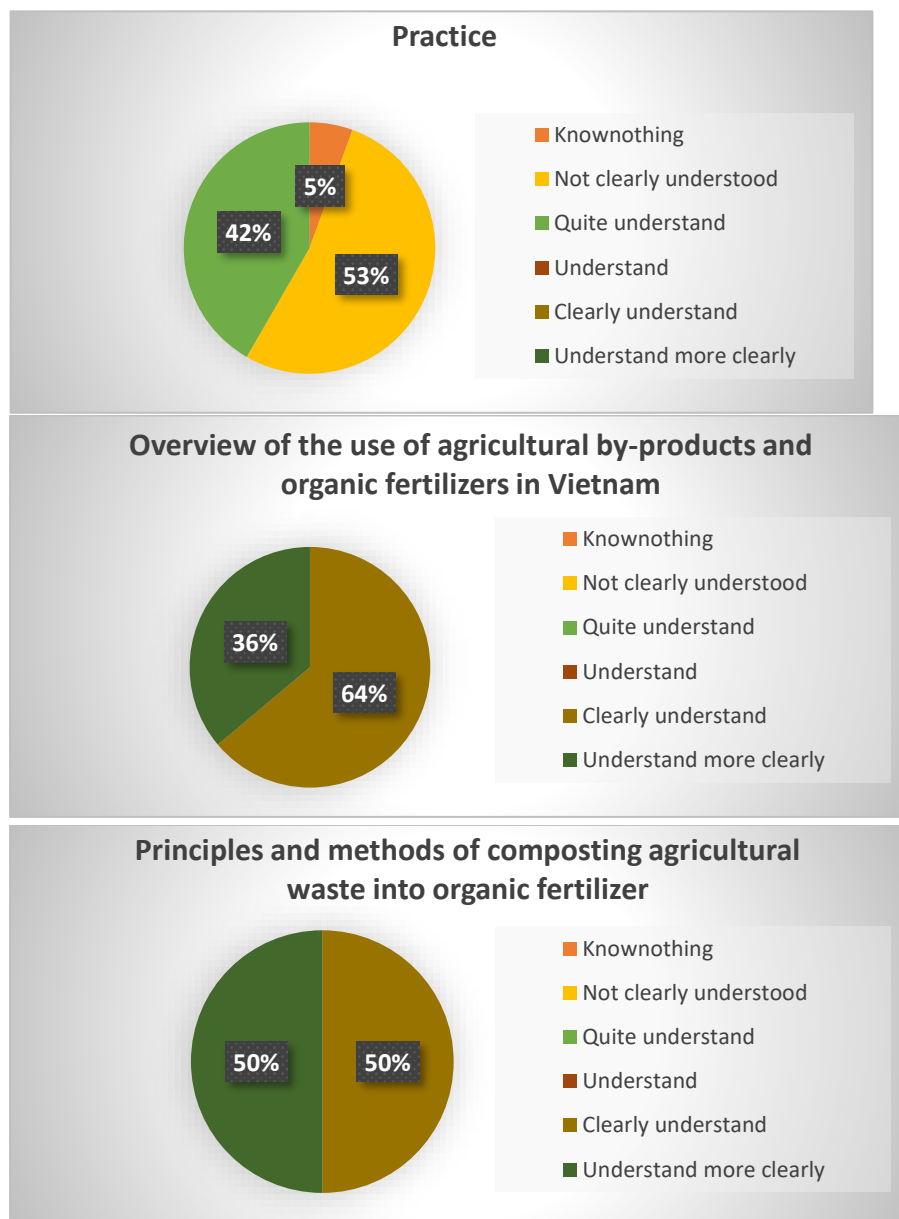
Principles and methods of composting agricultural waste into organic fertilizer



- Knownothing
- Not clearly understood
- Quite understand
- Understand
- Clearly understand
- Understand more clearly

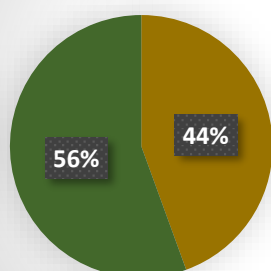


The post-training evaluation results



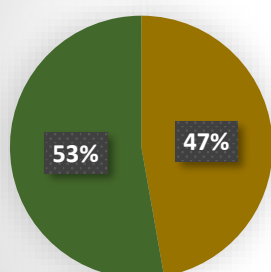


Apply organic fertilizezs to plants



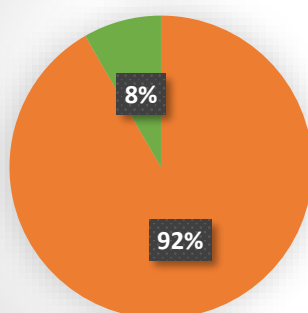
- Knownothing
- Not clearly understood
- Quite understand
- Understand
- Clearly understand
- Understand more clearly

Practice



- Knownothing
- Not clearly understood
- Quite understand
- Understand
- Clearly understand
- Understand more clearly

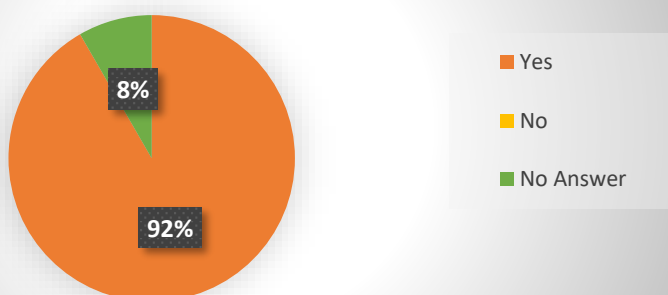
Willing to apply what they learned



- Yes
- No
- No Answer



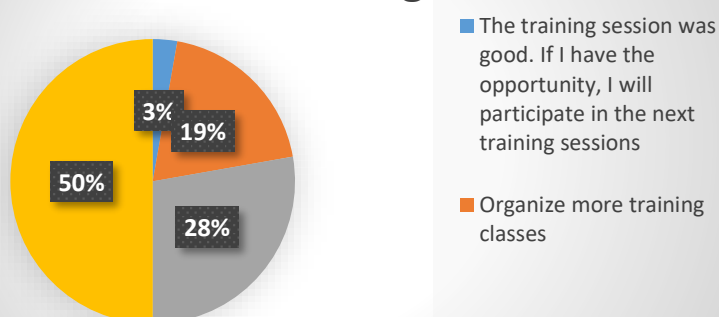
Satisfied with the training course



The training course provided enough knowledge for practice



Reactions on the training course





Sustainable solid Waste management and Policies

DELIVERABLES 3.4

IMPLEMENTATION OF TUAF's TVET TRAINING

Project Acronym	SWAP
Work Package	WP1
Deliverable	D 3.4
Deliverable Lead	P6 - TUAF
Type	Report
Dissemination Level	Public
Contractual delivery date	
Actual submission date	
Author(s)	Truong Thi Anh Tuyet, Dang Van Minh, Nguyen Duy Hai (TUAF)





1 Introduction

Thai Nguyen University of Agriculture and Forestry (TUAF), founded in 1969, stands as a leading institution in the realm of fisheries, aquaculture, agriculture, forestry, rural development, environmental and natural resource management in Vietnam. It also holds a prestigious reputation in Southeast Asia. Our main campus, nestled in Thai Nguyen City, Vietnam, spans over 100 hectares. The university comprises 8 Faculties, 2 Institutes, 8 Centers, and 8 Offices.

In the context of Vietnam's evolving environmental landscape, the need for comprehensive training in solid waste management has emerged as a pressing concern. Rapid urbanization and industrialization have led to increased waste generation, necessitating proficient skills and knowledge to tackle this issue effectively.

Recognizing this urgent need and under the Sustainable Solid Waste Management and Policy Project (SWAP) funded by the European Union, TUAF has initiated Technical and Vocational Education and Training (TVET) programs tailored explicitly for diverse groups. These programs aim to bridge the gap between theoretical understanding and practical application concerning waste management practices.

These specialized TVET initiatives cater to a broad spectrum of stakeholders, including students pursuing academic careers, non-academic sector (farmers seeking sustainable agricultural practices, and governmental offices engaged in waste regulation and management). The fundamental objective of these programs is to enhance participants' expertise in waste classification and organic waste treatment methods.

By targeting a diverse audience, TUAF's TVET programs play a pivotal role in fostering a well-equipped workforce capable of addressing the multifaceted challenges of solid waste management in Vietnam. These initiatives not only empower individuals with essential skills but also contribute significantly to environmental sustainability and the nation's efforts to combat escalating waste-related issues.

2 Preparatory Process and Participant Statistics

2.1. Preparatory Process

The preparatory process for Technical and Vocational Education and Training (TVET) programs at TUAF involves several key steps to ensure effective planning and execution. Here is an outline of the preparatory process:



Needs Assessment and Analysis: TUAF conducts a thorough needs assessment to identify the specific demands and requirements for TVET training in solid waste management. This involves analyzing industry trends, assessing skill gaps, and understanding the needs of various stakeholders such as students, farmers, and governmental offices regarding waste management.

Curriculum Development: Based on the needs assessment, TUAF design a curriculum for the TVET program. The curriculum includes theoretical foundations, practical training modules, and hands-on exercises focused on waste classification and organic waste treatment.

Resource Allocation and Planning: TUAF identifies and allocates necessary resources for the successful execution of the TVET program. This includes securing facilities, equipment, teaching materials, and qualified instructors specialized in waste management practices.

Stakeholder Engagement and Collaboration: TUAF establishes partnerships and collaborations with relevant stakeholders, including governmental bodies, local communities, industries, and non-governmental organizations to conduct the training. These partnerships foster support, resource sharing, and alignment with industry standards, ensuring the program's relevance and effectiveness.

Development of Training Materials and Resources: TUAF develops comprehensive training materials, handbooks, manuals, and resources tailored to the TVET program's objectives. These materials aim to facilitate learning and serve as reference guides for both instructors and participants.

2.2. Delivery of TVET training TUAF conducted TVET training on waste classification and organic waste treatment for non-academic participants including 64 farmers, 2 local government, 2 free workers and 4 graduate students in Pac Nam, Bac Kan province from 18-21/9/2023

Tuition fee of the training were covered by the fund of Bac Kan Province People Committee.

Trainers: Dr. Nguyen Duy Hai, Ms. Duong Minh Ngoc

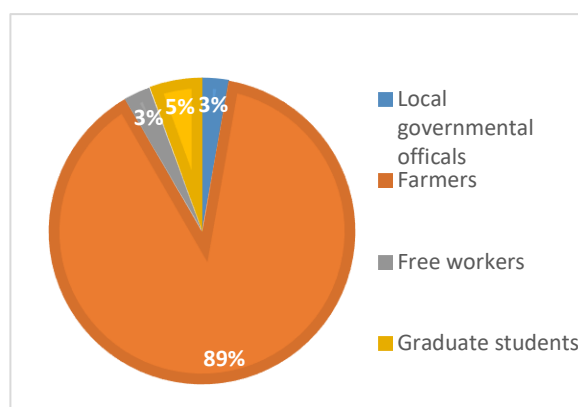


Figure 1. Participants' position



TVET course for non-academic trainees CLASSIFICATION AND TREATMENT OF RURAL SOLID WASTE

Objectives:

- Be able to identify and classify types of wastes appropriately
- Understand what compost is and what the benefits are
- Select appropriate materials for composting
- Build a compost heap
- Agricultural wastes-derived compost application

Prerequisites: Not applied.

Methodology: Handout, lecturing, practice, group discussion

Assessment:

- The evaluation will include practical assessments, participation in discussions, and a final knowledge assessment.
- Active engagement in hands-on sessions and discussions will be considered.

Trainer: Staff of Faculty of Environment and SWAP team at TUAF

Venue: Pac Nam, Bac Kan province

Number of participants: 72 participants (2 participants from local government agency, 64 farmers, 2 free workers and 4 graduates). Participants were divided into two classes

Time: 18-19/9 and 20-21/9/2023

Training duration: 2 days for each class

Training contents	Hours
Theory part	8.0
Part 1: The overview of using agricultural wastes-derived compost in Vietnam	1.0
The status of solid wastes and waste management policy in Vietnam	
Definition of composting	
Type and situation of compost products in Vietnam	
Using of compost for crop in Vietnam (<i>How compost is used?</i>).	
Group discussion and assignment	
Part 2: Principles and methods how to build up compost	5.0
Classification of agricultural waste and others	
The physicochemical basis of the composting process	
Controlling the composting process	
Building a compost heap	
Evaluation on quality of agricultural wastes-derived compost (<i>pH, OM, NPK</i>)	
Group discussion and presentation	
Part 3: How to use agricultural wastes-derived compost for crops	2.0
Use of agricultural wastes-derived compost to improve soil quality (<i>nutrients and organic matter</i>).	



Using compost to help combat some plant diseases and suppress weeds
Practical tips for on-farm production and farmers
Group discussion and presentation

Practical part

8.0

Preparation, classification of agricultural wastes for compost-making
How to build a compost heap
How to apply agricultural wastes-derived compost for crops

3 Pre and Post-training Evaluation of TVET courses

Pre- and post-evaluations were administered to TVET participants to gauge the effectiveness and quality of the program. The collected data was used to assess the impact of the training. Continuous monitoring and assessment through participant feedback were crucial in identifying areas for improvement and ensuring the program aligned with its objectives.

The pre-survey findings revealed that 65% of participants had not previously engaged in solid-waste-related training (see Figure 2). Their initial knowledge about waste classification, policies, regulations, and organic waste composting was at a level 2 (indicating a low level of knowledge). Following the training, there was a significant improvement in participants' understanding, with their knowledge level rising to a high level (rated at 4 and 5, indicating a proficient mastery of the topic). For a detailed analysis of the pre- and post-training feedback, please refer to the annex.

Anh chị đã từng tham gia các khóa tập huấn/đào tạo liên quan đến chất thải rắn chưa?/ Have you participated in solid waste-related trainings?

65 responses

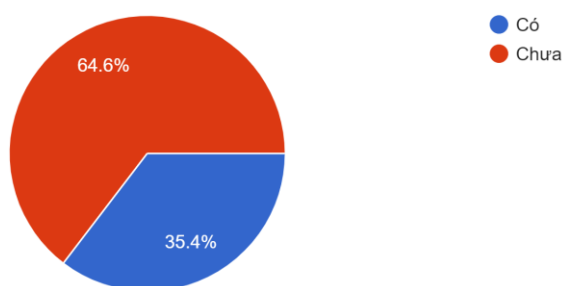


Figure 2. Percentage of trainees participating in solid waste-related training

The post-survey findings indicated that all participants provided positive feedback regarding the TVET training organized by TUAFF, with all respondents rating the program above 3 on the Likert scale (0: totally disagree and 5: totally agree).

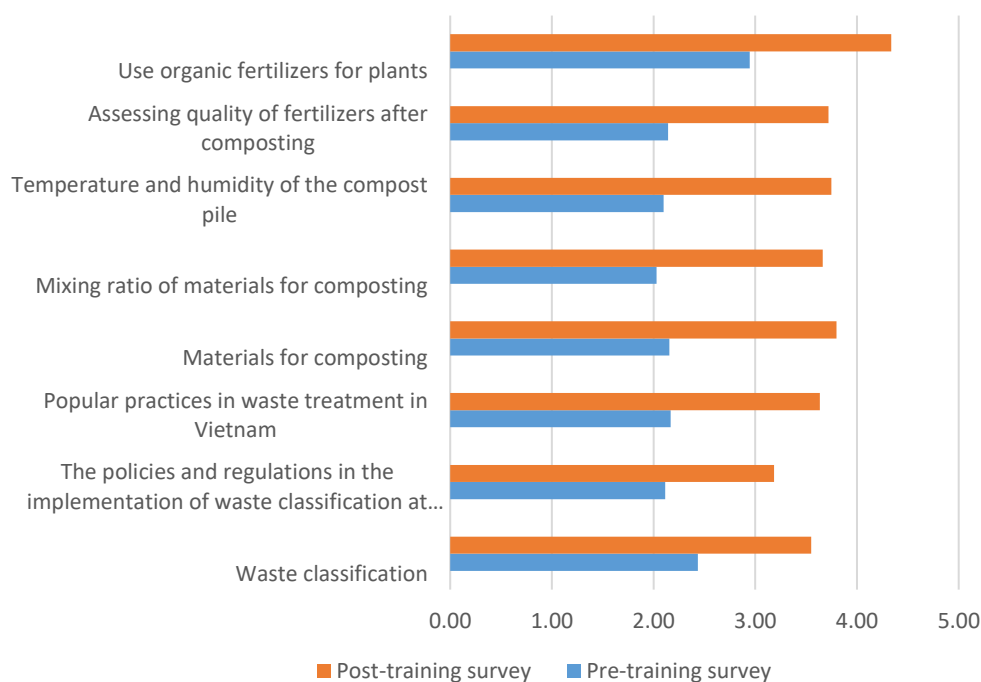


Figure 3. Pre- and post-training survey on knowledge of trainees

Notably, 98% of participants rated it as highly agree (4) or totally agree (5), showcasing strong endorsement. The average Likert assessment for trainee satisfaction exceeded 4.5 (see Figure 3).



Figure 4. Satisfactory assessment of trainees about the training course.



4 Advantages and Disadvantages of TVET

Advantages

- **Equipment/Facility Provided from the Project:** TVET programs were benefited from the support of SWAP project and TUAU on providing equipment and facilities. This enables hands-on training and practical skill development in a real-world setting.
- **Materials Assessed:** Quality teaching materials and resources are accessible within TVET programs, aiding in comprehensive learning. These materials contribute to a well-structured curriculum and enhance the educational experience.
- **Qualified Lecturers:** TVET programs usually employ experienced and knowledgeable instructors who bring expertise and practical insights into the classroom. Qualified lecturers facilitate effective learning and skill transfer to trainees.

Disadvantages:

- **Limited Practice Time:** Despite the availability of facilities, time constraints within TVET programs may limit practical training opportunities. Trainees might not have enough hands-on practice to fully develop their skills.
- **Diverse Trainee Requirements:** Trainees in TVET programs often come from varied backgrounds with different skill levels, learning paces, and prior experiences. Meeting the diverse needs of all trainees can be challenging, potentially leading to gaps in individual learning experiences.

5 Enhancement of Training Products at Hue University of Agriculture and Forestry

TUAU's approach to updating and enhancing training materials involves a multi-faceted strategy. Firstly, we prioritize collaboration with industries to co-create cutting-edge curricula that align with the dynamic needs and emerging trends within various sectors (two MoU was signed during the SWAP to support students in practical internship, collaboration in training and recruitment). This collaborative effort ensures that our training materials are not only up to date but also directly applicable and in sync with industry demands.

Furthermore, we will continue to infuse our training materials with the latest knowledge, methodologies, and technological innovations, ensuring that our trainees are exposed to state-of-the-art practices and developments.



In addition to these initiatives, TUAF continually seeks other avenues to enhance our TVET training products. We invest in faculty development programs, ensuring our educators remain informed and equipped to deliver high-quality and relevant instruction. Moreover, we engage in regular evaluations, soliciting feedback from stakeholders to refine and improve our training materials, making them more effective and responsive to evolving needs.

Through these concerted efforts, TUAF remains dedicated to providing top-tier TVET training materials that empower our learners with the knowledge, skills, and practical expertise necessary to excel in their respective fields.

6 Sustainability and Long-Term Future of TVET at Thai Nguyen University of Agriculture and Forestry

Some strategies and suggestions to ensure the sustainability and long-term success of TVET programs at Thai Nguyen University of Agriculture and Forestry (TUAF) include:

- **Continuous Industry Engagement:** Establishing ongoing dialogues and partnerships with industry representatives ensures that TVET programs remain aligned with industry needs. Regular consultations, advisory boards, and industry-focused workshops provide insights into the latest trends, skill requirements, and technological advancements.
- **Quality Assurance Mechanisms:** Implement robust quality assurance measures to monitor and evaluate the effectiveness of TVET programs. Regular assessments, feedback mechanisms from students and industry partners, and benchmarking against industry standards help maintain and enhance the quality of education imparted.
- **Adaptability and Flexibility in Curriculum:** Maintain a flexible curriculum that can swiftly adapt to changes in industry practices and technological advancements. Agile curriculum frameworks enable the integration of new skills, emerging technologies, and innovative teaching methodologies.
- **Professional Development for Instructors:** Provide continuous professional development opportunities for TVET instructors. Workshops, training sessions, and exposure to industry practices ensure that instructors remain updated with current industry trends, thereby enhancing their ability to deliver relevant and contemporary education.
- **Technology Integration in Training:** Embrace the use of technology within TVET programs. Incorporate digital learning platforms, simulation tools, and virtual laboratories to enhance practical learning experiences, preparing students for the technological demands of modern industries.



- **Community Engagement and Outreach:** Engage with the local community and relevant stakeholders to foster support and participation in TVET programs. Community involvement in project-based learning, internships, or apprenticeships not only enhances practical learning but also strengthens ties between education and industry.
- **Research and Innovation Initiatives:** Encourage and support research and innovation within TVET programs. Promote student-led research projects, innovation hubs, and collaborative initiatives that address industry challenges, fostering an environment of creativity and problem-solving.

By implementing these strategies, Thai Nguyen University of Agriculture and Forestry (TUAF) can further strengthen its TVET programs, ensuring their sustainability, relevance, and alignment with the evolving needs of industries and the broader community.

7 Appendix

Photos of TVET training for farmers and local government staff

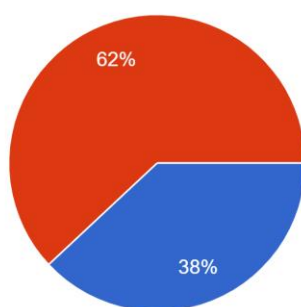




Survey results

Giới tính (Gender)

71 câu trả lời



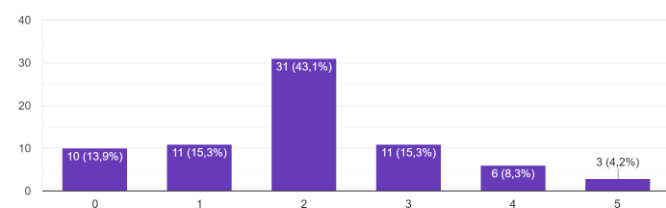
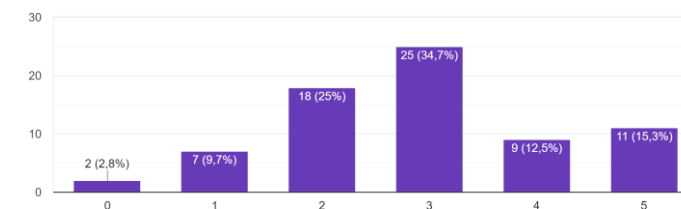
● Nam
● Nữ



Knowledge before training

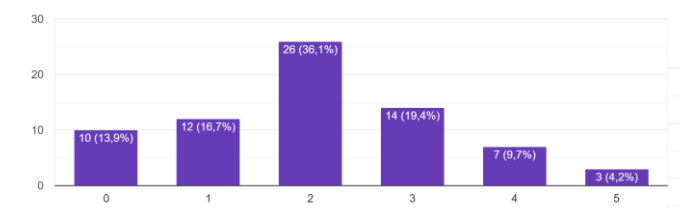
Sử dụng phân bón hữu cơ cho cây trồng/Use organic fertilizers for plants

72 câu trả lời



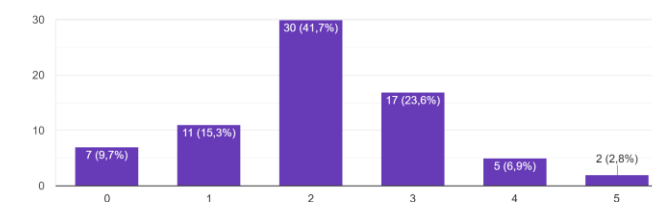
Nhiệt độ và độ ẩm của đống ủ/ Temperature and humidity of the compost pile

72 câu trả lời



Đánh giá chất lượng phân sau ủ /Assessing quality of fertilizers after composting

72 câu trả lời

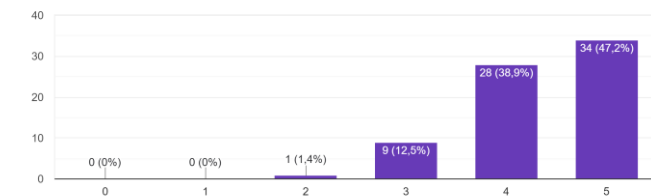


Knowledge after training

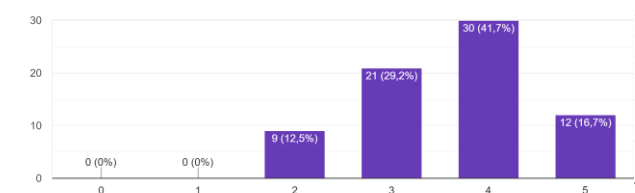
Nguyên liệu để ủ phân hữu cơ/ Materials for composting

Sử dụng phân bón hữu cơ cho cây trồng/Use organic fertilizers for plants

72 câu trả lời

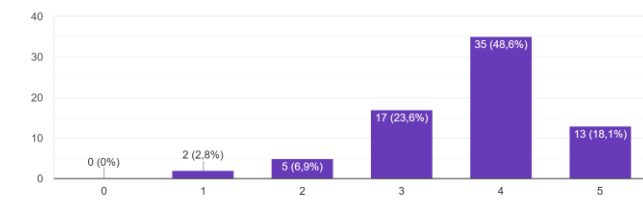


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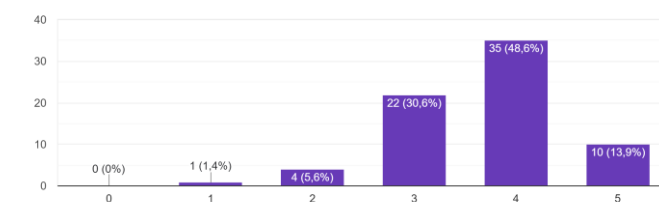
Nhiệt độ và độ ẩm của đống ủ/ Temperature and humidity of the compost pile

72 câu trả lời



Đánh giá chất lượng phân sau ủ /Assessing quality of fertilizers after composting

72 câu trả lời





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SWAP

Sustainable solid Waste management and Policies



SWAP

Sustainable solid Waste management and Policies

DELIVERABLES 3.4

IMPLEMENTATION OF UHST's TVET TRAINING

Project Acronym	SWAP
Work Package	WP3
Deliverable	D3.4
Deliverable Lead	P6-TUAF
Type	Report
Dissemination Level	Confidential
Contractual delivery date	M8 (15/08/2021)
Actual submission date	28/11/2023
Author(s)	Sok Pheak, UHST



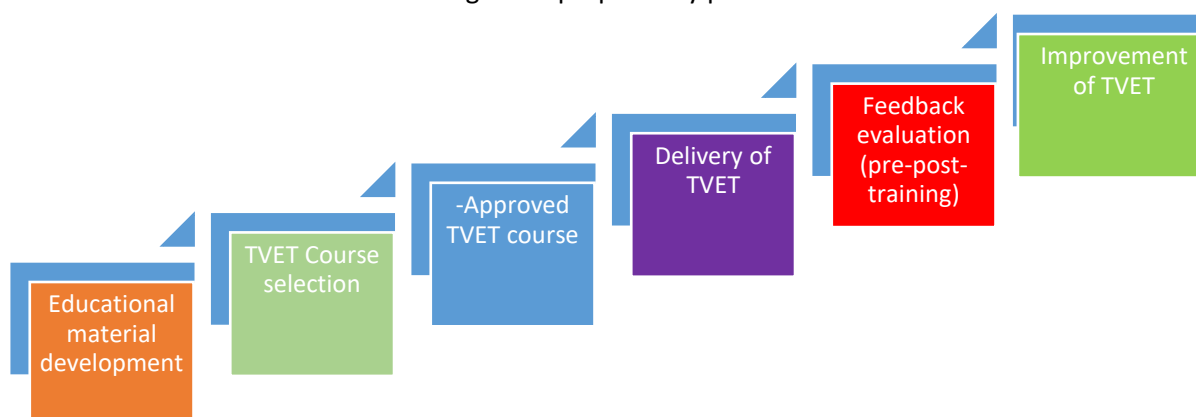


1 Introduction

University of Heng Samrin Thbongkhmum (UHST), a public university established in 2016, is to contribute to building human resource in response to job markets and social needs, as the core part of the Rectangular Strategy Phase 4 for improving public services to best serve the interests of the people and nation building. UHST provides the public with education, research, and community development and social services with the focus on Science, Technology, Engineering and Mathematics (STEM). UHST offers Vocational and Professional Training (TVET), Associate's and Bachelor's Degree Programs, which comprise of four faculties and three institutes with 26 programs. As of academic year, 2022-2023, UHST hosts total of 56 full-time staff, 29 contractual staff and 1,178 students (727 females). The university jointly implemented the SWAP project. It was a crucial aspect that the project developed TVET materials, which were the results of the project intervention. The material products were used for the students studying in the TVET program. The course was also applied using the SWAP equipment. Based on the SWAP project, one topic of the development of TVET material has been integrated into the curriculum of the TVET program, namely Introduction to Solid Waste Management. This course was integrated into the 2-year student of the agronomy skill, 2nd semester of the TVET program. This course is a new development, and it was accredited in March 2023 by the university management. It was implemented for 2 weeks, starting on 29 September 2023 with 19 TVET students. To support the university's curriculum, UHST has been implementing this course for TVET students at the Institute of Vocational and Professional Training of the university as targeted groups based on the demands of labour market. TVET is considered as a non-academic training course at our university which provides the practical skills for the particular professions to meet the social requirements in capacity improvement for future employees.

2 Preparatory Process

The course of Introduction to Solid Waste Management aims to provide both basic knowledges of solid waste management and practical tasks on type of wastes. Examples of solid waste collection and sorting in Cambodia context are then explained along with the practical exercise. Activities and possible on-site practices are also included. The following is the preparatory process:





2.1.1 Prerequisites

There is no prerequisite required. The course is considered as the basic knowledge for solid waste management.

2.1.2 Learning outcomes

After completion of the course trainees will be able to:

- Understand the basic concept of solid waste management
- Properly sort the mixed solid waste into different type of wastes
- Assess the impact of solid waste management in the environment

2.1.3 Learning contents

- Introduction to solid waste management
- Type of waste
- Issues of waste management
- Urban waste management
- 3R principles
- Regulations and legal framework for solid waste management

2.1.4 Delivery method and duration of the training

The training requires 8 hours per week (2 weeks, totally 16 hours). Schedule of the training is shown in Table 1.

Table 1. Training Schedule

Weeks	Time	Delivery methods
1 st	8.00-08.30	Pre-test
	08:30-16:30	Lecture: <ul style="list-style-type: none"> • Introduction to solid waste management • Type of waste • Urban waste management • Issues of waste management • 3R principles
2 nd	08:00-12:00	Practical exercise: <ul style="list-style-type: none"> • Regulations and legal framework for solid waste management
	13:30-16:45	Group presentation
	16.45-17.00	Post-test



3 Pre and Post-training Evaluation of TVET courses

A pre-test survey to find out the level of waste management of 19 TVET students at the University of Heng Samrin Thbongkhmum (UHST), Thbongkhmum province was conducted. The written questionnaires were focused on evaluation of introduction to waste management course in UHST. The recycling facility was generally well supported, with predominantly positive recycling attitudes and self-reported recycling behaviour indicated for students. As conclusion, the survey conducted shows that the students are ready for recycling activities if the recycling facilities are provided and accessible to them. The results of the pre-test also showed that most of the students (70%) did not know how to manage waste properly. When asking a question about a new course on introduction to waste management, 86.4% of the TVET students wants to have this course in their curriculum. The module expanded understanding of the subject area of the most student, 55.6% of them is strongly agreed (Figure 1).

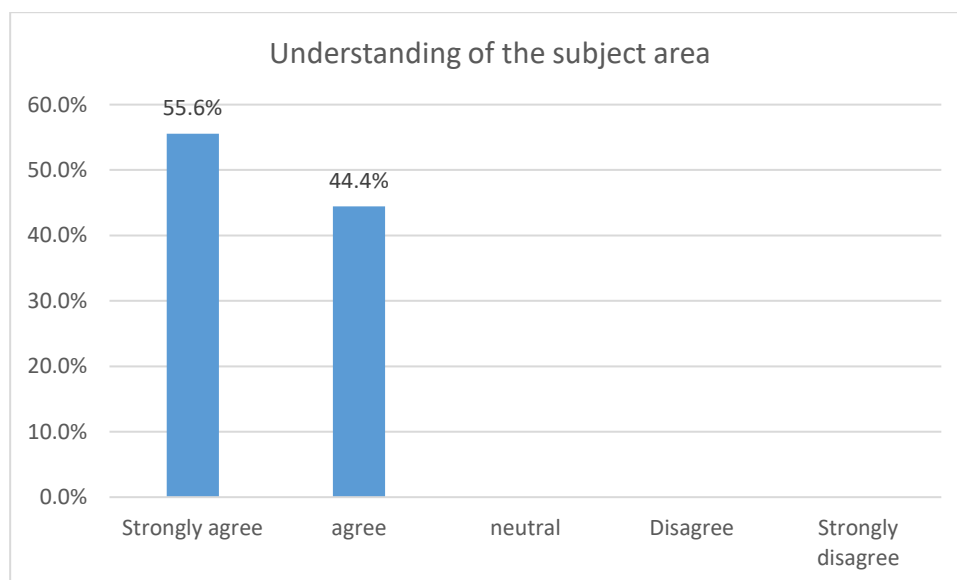


Figure 1: Understanding of the subject area

At least 83% of the learning activities for this module improvement is required for a trainee to be considered as “Very good” (Figure 2). The most interesting part of this modules: waste separating, 3R programme and how to separate waste into different categories, 3R programme, waste identification from 1-6 for hardly or easily way in waste recycling, definition of waste management, and waste management and landfill. When asking students on the course material is well-presented, 56% of the students said it was very good, while 33% is acceptable (Figure 3). It means that the lecturer is trying to presented with the general concept of waste management in the context of Cambodia, together with the existing experiences.

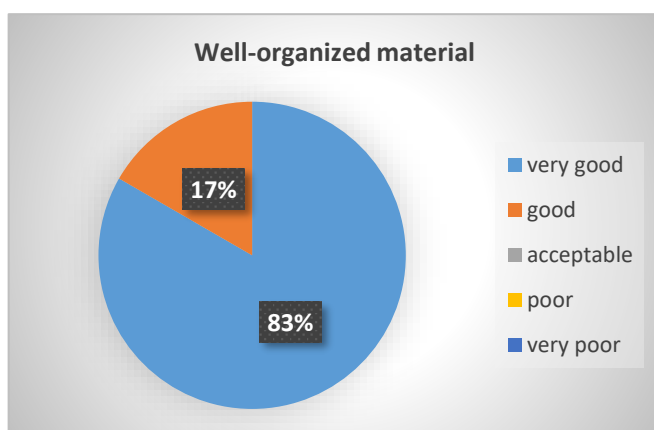


Figure 2: the course material is well-organized

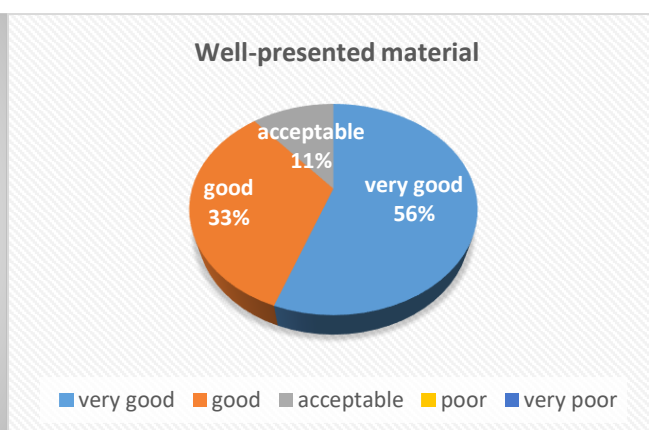


Figure 3: Course material is well-presented

When asking students on the course material is well-explained, 44% of the students said it was very good, while 39% is Good (Figure 4). The explanation of each course content is very crucial for students understand the basic information and knowledge on waste management including types of waste, urban waste management, particularly the issue of waste collection.

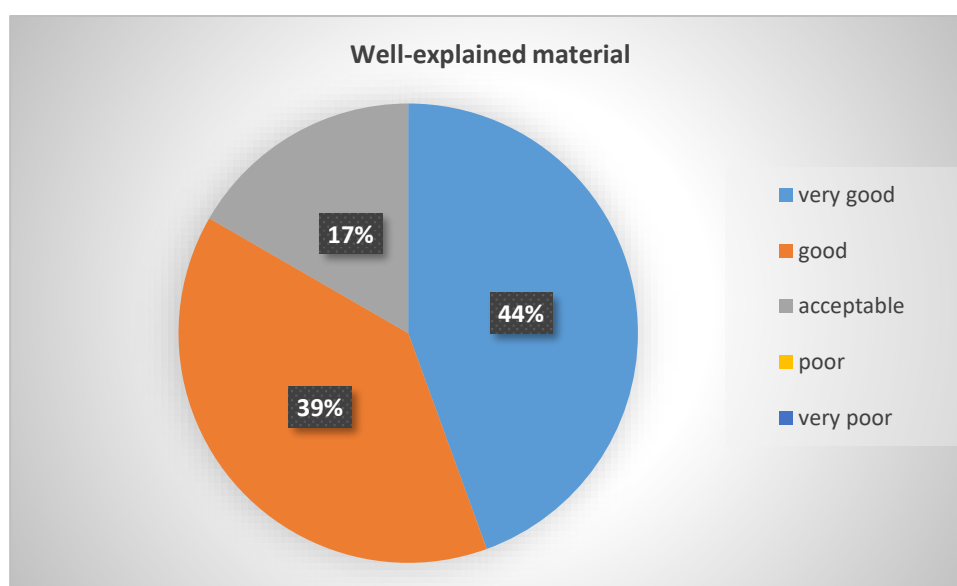


Figure 4: Course material is well-explained

100% of the students understand the content in-depth offering in the course, and 100% of them said that the course is valuable for working sector in the field of solid waste management. After the training, the students gain skills and knowledge improved and satisfied 'probably yes' (83.3%) and 'definitely yes' 16.7% (Figure 5).

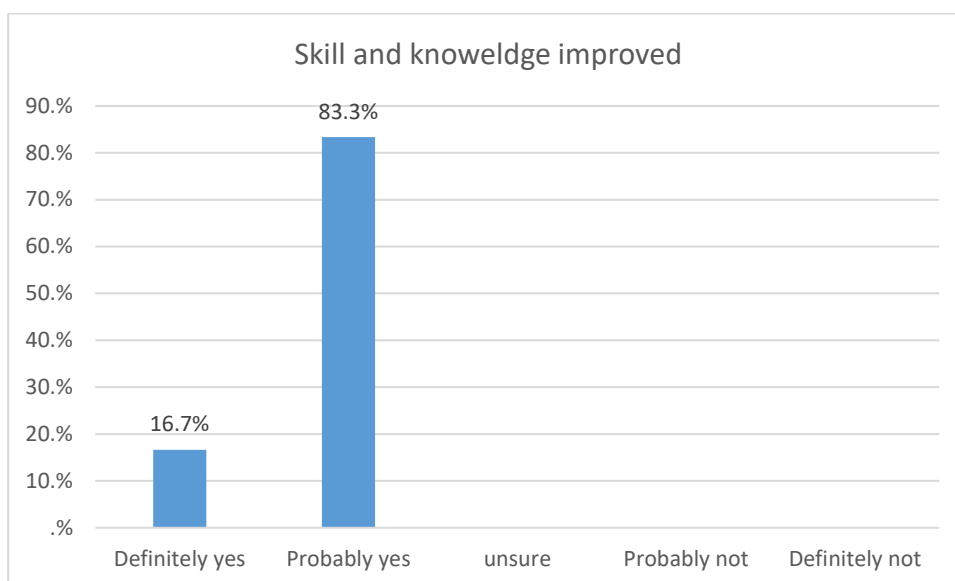


Figure 5: Skill and knowledge improved

4 Advantages and Disadvantages of TVET

Evaluating the advantages and disadvantages of vocational training and education based on a type of training technique is appropriate for certain situations, particularly in the context of country development. If you want to get trained and secure a job quickly, vocational training may be the right fit for TVET students. It is generally cheaper to go to a vocational institution than to a university or college. Vocational institutions are different from academic institutions considering they are based on career development rather than on academics. The programs there are also shorter than the 4-year standard undergraduate programs offered at universities. The learners are able to combine the practical skills and the advance techniques in their jobs, and the graduates have more opportunities to enhance employability in future. In addition, this is because vocational institute only have little academic work but mainly focus on practical. In case of UHST, the university offered TVET program, after they have completed secondary school, they were able to continue their studies in this program. However, there are some disadvantages of going the vocational education way. For instance, vocational training is associated with few job opportunities and non-transferable credits. Most of the career opportunities in a vocational institute are in the lower-paying jobs. This implies that one gets limited wages as well as companies to work for since their courses are not considered academically equal to university levels.

5 Enhancement of Training Products at University of Heng Samrin Thbongkhmum



To function properly, university lectures need to be skilled in technology and communication methods in this 21st century. They must have Information communication technology (ICT) knowledge, capacities, and skills as tools to be wielded in organizing education, instruction and study, and curriculum development. Also, ICT is a resource used to retrieve data for knowledge management and professional development. Integrating the Internet and applications are prerequisite for the ability to prepare contents for a variety of instructional Media. UHST will update new knowledge, new technologies through the close collaboration between the universities and other governmental institutions or joint research development with development partner for improving the quality of the training material products. Additionally, we give more opportunities for the trainers to join the training programs so that they can improve their capacities in the field of solid waste management.

6 Sustainability and Long-Term Future of TVET at University of Heng Samrin Thbongkhmum

There are many different models for institutional relationships between TVET programme and HEIs. Some key sustainable aspects could be:

- SWAP Training Hub placed at high management level within the HEI: in this case the Hub would report directly to Higher Management, could be highly visible and could support researchers and academics in numerous departments at the university.
- The Hub placed within a specific department in the HEI: in this case the Hub would report to the director of the department and would be more specifically aimed at supporting the staff in that department, while remaining available (but less visible) to other departments in the university.
- Training Hub as a specific project for support in Waste Management, within an already existing Support Office: in this case certain staff of the existing Office would be designated to provide similar support to their current position, but more specifically aimed at academics and researchers who could be involved in waste management activities.

Of course, each model has its advantages and disadvantages, and it will be up to each partner to determine what model will best suit their university as well as to address any challenges that need to be overcome in order to set up their Training Hub. Challenges might include:

- Partners must take the time to make Higher Management understand the need and value of the Training Hub within their institutions, so they can have their full support for the set-up and running of the Hub



- Partners should work with Higher Management to identify the best model for their Hub, and identify the appropriate physical space that can be made available for the Hub.
- The SWAP project provides funds to purchase technical equipment that will be used for future activities.
- Staff working in the Training Hub should be active in contacting research and academic staff who are (or are interested in) working in waste management topics, and should regularly organizing activities to support them.
- The Training Hub should make itself highly visible, so it becomes the main entry point for anyone wishing to collaborate with the Institution on Waste Management.

Appendix: Photo of activities





Sustainable solid Waste management and Policies

DELIVERABLES 3.4

IMPLEMENTATION OF RUA's TVET TRAINING

Project Acronym	SWAP
Work Package	WP1
Deliverable	D 3.4
Deliverable Lead	P6 - TUAF
Type	Report
Dissemination Level	Public
Contractual delivery date	
Actual submission date	30 November 2023
Author(s)	Yutha Nida, Kim Soben





1 Introduction

RUA is established a Training Hub in 2023 to provide services on waste management research, innovation, and business in Cambodia for specific objectives are 1). Offer training services to government institutions, non-governmental organisations, communities, the private sector, local people, and informal workers in the field of waste management; 2). Establish research partnerships among development partners, the public, private, and informal sectors and 3). Supporting business plans for SMEs (small and medium enterprises). RUA Training Hub is to raise awareness about municipal waste and create related business opportunities. To this end, various participants are selected, including students, farmers, agricultural cooperatives, agricultural communities, NGOs, entrepreneurs, public & private sectors, and relevant stakeholders. The facility used for this training is located at RUA, Phnom Penh and has the necessary equipment for practice. The training course offered by this Hub is compost production, which includes theory, practice, and field visits for sustainable agricultural use.

2 Preparatory Process and Participant Statistics

The training is designed by doing some survey regarding to the needs of the target participants and delivered by experienced lecturers and experts from RUA and relevant partners. They have years of experience in teaching, experimentation and compost production. There will be at least two lecturers in a course to ensure a diverse knowledge and the right answers for the participants.

The Training Center is located in the Center for Agricultural and Environmental Studies, which has sufficient space and equipment for the learning process and practices. At the beginning of this Training Center, only a short course on compost production is held within two days, which includes one day for theory and field visits on campus and one day for practice. In the long term, other courses will be offered for better management of municipal waste.

To attract participants to the planned course, a variety of promotional methods have been used. One of the most effective methods is advertising through social media, where the upcoming training courses are announced with detailed information. In addition, posters will also be used, with organizations, farming communities, and relevant institutions being provided with printed posters to provide information about the training program.

Under RUA Training Hub, a course was conducting, Compost Production for Sustainable Agriculture on 10 Mar 2023. At least 44 of participants have been attend to the training that from RUA staff, Faculty of Forestry's student, Center for Agricultural and Environmental Studies



staff and volunteers and NGO-composted.

3 Post-training Evaluation and Career Pathways

At the end of the training, a post-evaluation has been carried out to understand how the participants' awareness of the theoretical and practical phases of the training has changed and to improve and modernise the curriculum to meet the needs of the target groups.

Results of post-training evaluation

- **Participants' Understanding Level**

Participants have been attended training courses at different topic and level. So the level of understanding also different. According to the survey, 48 percent of participants moderate understanding, 41 percent less understanding and 11 percent high understanding about the sustainable use of agricultural product (figure 1). On the other hand, 48 percent much understanding, 41 percent less understand and 11 percent pretty much understand on waste terminology, including, 3R concepts, sustainable use of waste, zero waste lifestyle, waste characterization and safety, ect. and 57 percent much understanding, 31 percent less understanding and 12 percent pretty much understanding on practical phase during the training.

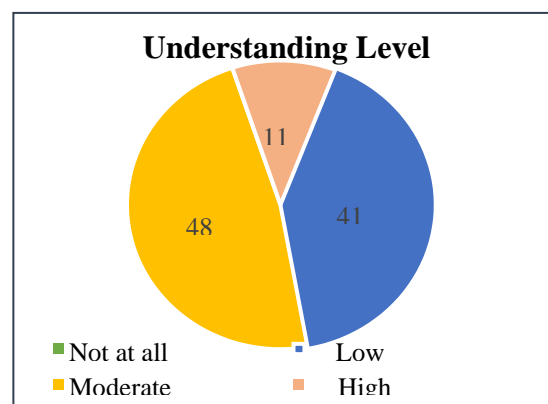


Figure 1. Level of understanding about the sustainable use of agricultural product

Importance of Training Course

According to survey, 52 percent much important course, 35 percent pretty much important and 13 percent is less important for the compost production and 57 percent much important, 27 percent pretty much important and 15 percent less important for waste terminology. Furthermore, 59 percent much important, 24 percent pretty much important and 17 less



important to the practical phase. This training course plays an important role for their professional career. According to survey, 54 percent much important, 31 percent pretty much important, 14 percent less important (figure 2). The university assessed students using the Treasure Survey for 3rd and 5th year graduate students to determine if they could find a skilled job/career with a decent salary after graduation. For the vocational students, it is not yet clearly defined how to pursue employment after graduation. However, we need to provide them with vocational knowledge and skills to establish a link between employment and the market (industry, private sector, etc.). On the other hand, the training program must include guest lectures from a specific stakeholder to give the trainees a chance to get a job.

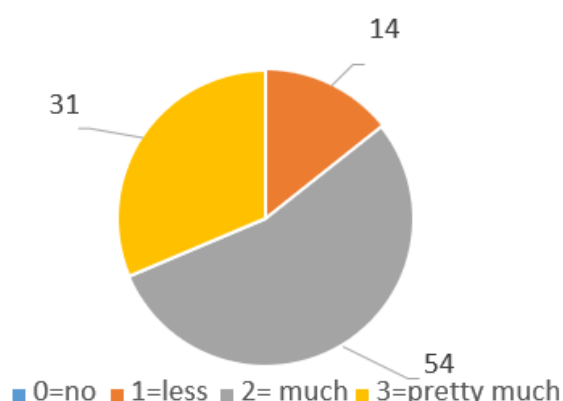


Figure 2: Importance of training course

4 Advantages and Disadvantages of TVET

The advantages and disadvantages of implementation TVET programme at RUA (See table 1).

Table 1: Illustration of advantages and disadvantages of implementation TVET programme

Advantages of TVET	Disadvantages of TVET
Upskilling for lecturer to be a professional in the next future; combined theory and practical.	TVET related to waste topics is low interested in Cambodia context or less concentration, so we need to do more activity for mobilization
Provide knowledge on related topics to young generation/audience.	
Improve research on waste composition in the context of 3R and up-cycling.	
Improve technical skill regarding waste management	
Initiate business ideas for improvement of local livelihood especially for non-skilled workers	



5 Enhancement of Training Products at RUA

Teachers must evaluate the course, the material and the teaching method after each course in order to update them and meet the needs of the students and the market. Updating your training material is important to ensure that your employees have the latest and most relevant information, skills and best practises.

The Hub acts as a bridge between employees and employers to fulfil the requirements. Therefore, Hub needs to conduct a needs analysis with all relevant industry stakeholders or employers to simplify which courses need to be developed and modernised before the course is delivered. In addition, the inclusion of RUA's research and technological advances in the training programme is intended to improve technology transfer in the field of waste management in Cambodia.

6 Sustainability and Long-Term Future of TVET at RUA

To ensure smooth project implementation, a total number of 15-20 participants from different institutions/sectors will be allowed to participate in the course. In the first years, participants will receive courses at 50% reduced fees (25 USD per training) due to the need to build capacity and improve facilities during project implementation. Thereafter, each participant will be charged \$50/person per course for service delivery and coordination even after the course is completed. This approach can contribute to the sustainability of the project and is suitable for knowledge transfer to start or improve businesses.

The training course will be self-financing after the completion of the project through the revenue generated from the course offering. The RUA -training centre intends to offer at least 6 training courses per year. With a minimum of 15 participants per course, approximately \$4,500 USD per year will be generated as revenue. Of this amount, 25% will be used to cover training fees for the experts, another 25% will be used for depreciation costs of all materials and equipment used for the training courses, and another 25% will be used for internal administration and operation of the training centre RUA. The rest will be saved for later use. The number of courses will not be limited to 6, but this is just the beginning. When the training centre RUA is better equipped and more experienced, the courses will be expanded to include more participants to generate more revenue and provide more expertise on MWS. In the long term, other services such as consulting and feasibility studies will be offered to people who want to start a waste management business.

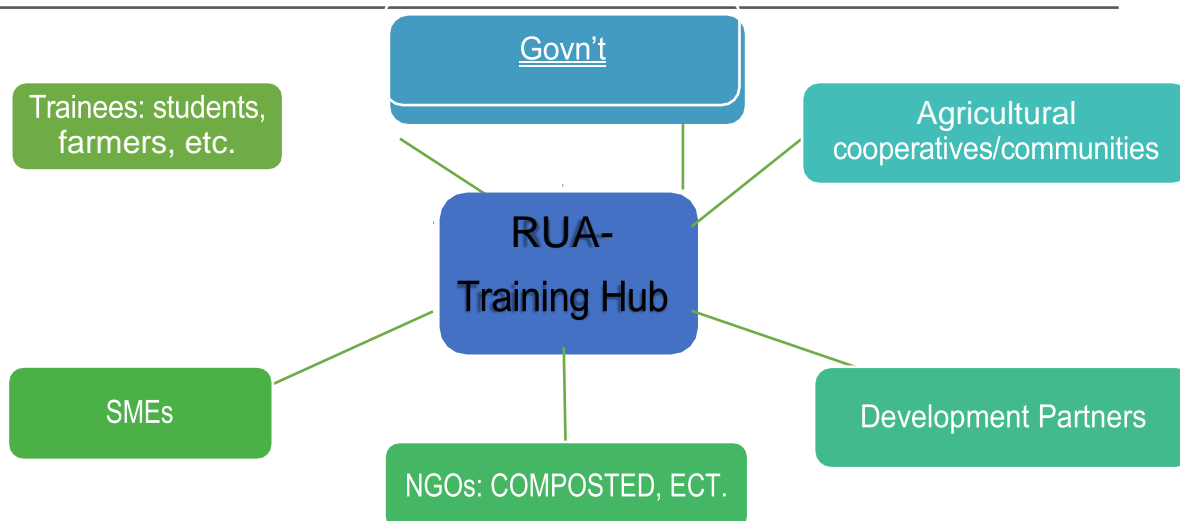


Figure 3: RUA-Training Hub's relevant partners

The RUA -Training Hub is established under the direct management of the Center for Agricultural and Environmental Studies under the mandate of the Faculty of Forestry, RUA, in Phnom Penh. The structure of the RUA -Training Hub is as follows:

The top-down management structure for the RUA - training hub is shown in Figure 3. This hub is divided into three unit: Administration and Finance unit, Knowledge Management unit, and Technical unit. The Administration and Finance unit is responsible for all kinds of paperwork needed in the hub, communicating with relevant stakeholders such as resources, trainees from different institutions, organizing all kinds of trainings, and managing the financial flow of the hub. The Knowledge Management Unit is responsible for storing all resources related to the development of the courses and for publishing all activities carried out within the hub. The last unit includes the formation of a resource group and the collection of all necessary training materials to ensure that the course is appropriately delivered to the target audience.

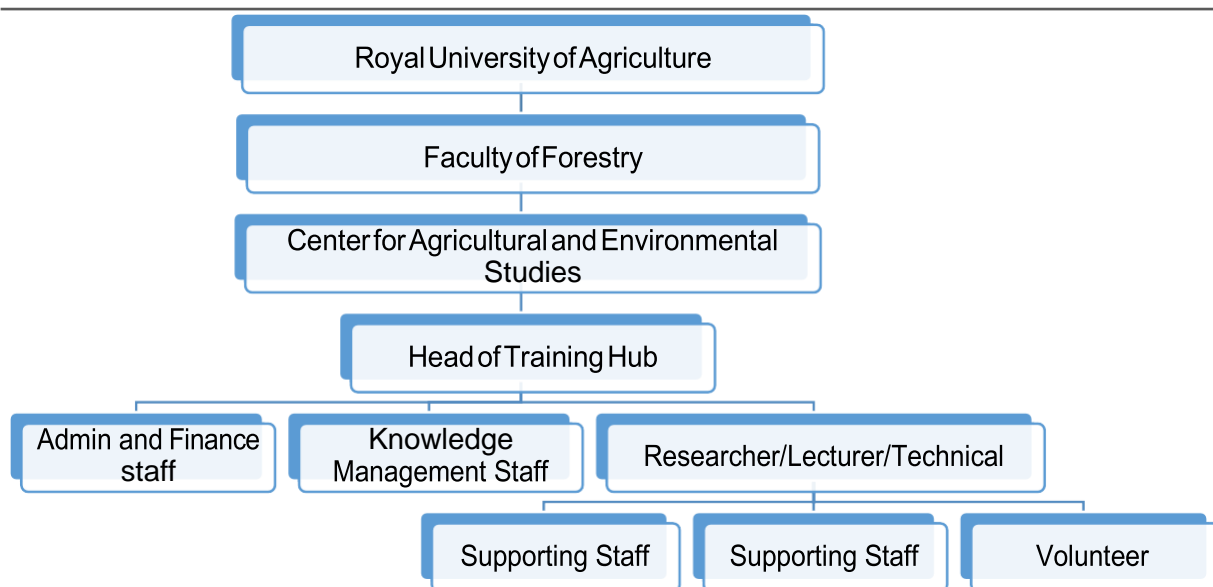


Figure 4: RUA Training Hub's structure

7 Appendix



Appendix 1: RUA provided training on Compost Production for Sustainable Agriculture on 10 Mar 2023