



SWAP

Sustainable solid WASTE management and Policies

Final Report

Project Acronym	SWAP
Work Package	WP 7
Deliverable	7.6 Final content reports to the EACEA
Deliverable Lead	TUHH – P1
Type	Report
Dissemination Level	Confidential
Contractual delivery date	M 36 (01/01/2024 - 14/03/2024)
Actual submission date	14/06/2024
Author(s)	Kitzberger, Magdalena (TUHH); Fadwa Kassem (TUHH)





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



SWAP

Sustainable solid WASTE management and Policies

DISCLAIMER

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

This document may contain material, which is the copyright of the SWAP Consortium parties, and may not be reproduced or copied without permission. All SWAP Consortium parties have agreed to full publication of this document. The commercial use of any information contained in this document requires a license from the owner of that information.

Neither the SWAP Consortium as a whole, nor a certain party of the SWAP Consortium warrant that the information contained in this document is capable of use, nor that use of the information is free from risk, and does not accept any liability for loss or damage suffered by any person using this information.

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 2020 - EAC-A02-2019-CBHE and carries the project n° 618723-EPP-1-2020-1-DE-EPPKA2-CBHE-JP.



Table of Contents

DISCLAIMER	2
ACKNOWLEDGEMENT	2
1. Short description of the project’s results in English	4
Background.....	4
Objectives	5
Implementation.....	6
Results	7
2. Horizontal Issues	8
Previous recommendation/follow-up	8
Transversal issues.....	10
Involvement of people with fewer opportunities	11
Refugees	12
Not applicable	12
Least Developed countries and regions	12
Innovation	13
3. Award Criteria.....	14
Relevance of the results	14
Regional cooperation	17
Quality of the project implementation	18
Description of the implemented activities	18
Quality Assurance Measures	20
Equipment	21
Curriculum development.....	23
Teaching/Training Activities	27
Governance reform	29
Links with society	31
Involvement of partners and stakeholders	33
Management of the grant	37
IMPACT AND SUSTAINABILITY	39



1. Short description of the project's results in English

Background

Asia stands out as one of the world's largest producers of waste, with projections indicating a further increase in waste production. However, the readiness level of many Asian countries in terms of sustainable solid waste management (SWM) and valorization remains inadequate. This shortcoming extends not only to technology and business but also to awareness, education, and training in the field. In both formal and informal education sectors, there exists a significant gap concerning SWM. Many Higher Education Institutions (HEIs) either lack degree programs related to waste management or offer only superficial lectures on the subject without integrating them into comprehensive training projects. Consequently, graduates often lack the necessary skills to meet the demands of the labour market, which faces challenges such as inefficient waste separation processes, complex collection procedures, open dumping in landfills, and uncontrolled gas emissions and leachate. This disparity between the demand for and supply of knowledge and skills within the SWM sector poses a pressing issue for many Asian countries. To address this challenge, there is a need to develop a dedicated workforce and enhance knowledge through specialized training programs. The “Sustainable solid Waste management and Policies – SWAP” project aims to bridge these knowledge gaps by addressing specific needs identified in the countries of Vietnam, Cambodia and Thailand.

Vietnam: In Vietnam, while there are numerous universities, colleges, and vocational schools offering programs related to waste management, there is a shortage of qualified lecturers and modern curricula that incorporate up-to-date technical and operational experiences. Institutions like our partners from the Hue University of Agriculture and Forestry (HUAF) and Thai Nguyen University of Agriculture and Forestry (TUAF) require capacity-building initiatives to train professionals and improve teaching facilities and methods.

Cambodia: Cambodia faces challenges due to rapid population growth and urbanization, leading to a significant increase in solid waste generation. However, there is a lack of recycling industries, infrastructure, and markets for recyclable materials and products. Initiatives such as establishing vocational training centers and enhancing environmental education at institutions like the Royal University of Agriculture (RUA), University of Heng Samrin Thbongkhmum (UHST) and the NGO, COMPOSTED (formerly COMPED) are crucial in addressing these challenges.

Thailand: Thailand also deals with substantial waste management issues, necessitating the involvement of academia in capacity building and training. Limited numbers and types of courses related to solid waste management have been provided, while available courses are only offered mostly for students at the university level. Our Partner Institutions Maejo University (MJU) and Chiang Mai University (CMU) seek to modernize their educational offerings to meet industry demands and improve the quality of academic staff through exchanges and training programs.

Additionally, there is a need to raise awareness among local communities and improve local governance in waste management policies. Efforts to integrate SWM education into school curricula and provide training in vocational and education trainings in sustainable practices are essential steps



in achieving this goal. As well as addressing the informal waste management sector. Together with four Partners from Europe, the SWAP project addresses the multifaceted challenges of sustainable solid waste management in Asia by enhancing education, training, institutional capacity and raising awareness. Through targeted interventions and collaboration, the project fosters a dedicated workforce equipped with the knowledge and skills needed to tackle the region's waste management issues effectively.

Objectives

The Sustainable Waste Management and Policies (SWAP) Project is designed to address the critical challenge of low awareness, education, and training in sustainable waste management across Vietnam, Thailand, and Cambodia. In these countries, there exists a significant gap between the skills and knowledge of university graduates and the demands of the waste management sector, businesses, and governmental bodies. The project sets out to achieve several key objectives:

Firstly, it aims to enhance capacity within the waste management sector by developing and implementing comprehensive training programs at tertiary levels. These programs focus on modernizing curricula on Bachelor, Master and Technical and Vocational Education and Training (TVET) level, improving teaching methods, and upgrading facilities to align with the evolving needs of the industry.

Secondly, the project targets the support and empowerment of informal waste practitioners. Specialized training programs and physical workplaces have been created to provide these individuals with technical education alongside sessions on business start-up. Moreover, the project did implement trainings which aimed at promoting safer work practices within the informal waste sector.

Another core objective of the SWAP Project is to improve entrepreneurship and employability among graduates. This is achieved through the establishment of strong links with the private sector to address their demand for specialized personnel. By enhancing graduates' readiness for employment and fostering entrepreneurship, the project aims to contribute to economic development in the region. Furthermore, the project seeks to support policy development related to sustainable waste management. By providing assistance in the development of relevant policies, the project aims to create a conducive regulatory environment that promotes sustainable waste practices. Moreover, the project emphasizes the importance of cooperation and exchange of best practices. It seeks to facilitate continuous cooperation between Higher Education Institutions (HEIs) in Southeast Asia and the European Union. Additionally, the project aims to disseminate project results and sustainability concepts to the general public, including students, schools, farmers and other participants.

At the national level, the project aligns with specific objectives identified in national strategies and action plans:

In *Vietnam*, the focus is on developing research institutions and encouraging the adoption of appropriate waste treatment technologies by waste practitioners and companies. In *Cambodia*, efforts are directed towards building institutional and human resources capacity for implementing environmental policies and exchanging experiences on sustainable natural resource management. In



Thailand, the project aims to build local capacity for practitioners, including the private sector, to foster green industry and enhance knowledge on sustainable consumption and production. The SWAP Project aims to significantly improve sustainable waste management practices, enhance capacity building efforts, and contribute to environmental sustainability and economic development in the target countries.

Implementation

The implementation phase of the SWAP-Project involved several key steps to address the gaps in education and training on sustainable waste management in Vietnam, Thailand, and Cambodia. The first step involved conducting comprehensive research on the state of education in waste management across the partner countries, the findings have been summarized in the Report “Education on Solid Waste Management. The case of Vietnam, Cambodia and Thailand (D1.1)”. This report aimed to assess the current status of waste management teaching and training at Higher Education Institutions (HEIs) and understand the available information related to the informal waste sector. The project identified the courses offered by HEIs in the partner countries, including our partner institutions, RUA, UHST, CMU, MJU, TUAJ, and HUAJ. The focus was on degree courses related to environmental issues, including Bachelor (BSc), Master (MSc), and Technical and Vocational Education and Training (TVET) programs.

Additionally, the project conducted surveys to identify the needs and expectations of industries in the Southeast Asian countries regarding graduate knowledge and skills. The findings highlighted areas for improvement in the curriculum and graduates' skills, emphasizing the importance of lifelong learning, problem-solving, and waste management skills, which is further explained in the Deliverable “Solid Waste Management in Southeast Asia: What does the industry expect? (D1.2)”. Based on these findings, the project developed educational products at the Bachelor's and Master's levels to address the identified gaps. The curriculum development process involved workshops where the structure and expertise level of the educational products were defined in collaboration with Asian and European partners.

The educational products are divided into nine TVET, twenty Bachelor, and twelve Master lectures, providing a wide range of topics. These include an Introduction to Sustainable Solid Waste Management and Circular Economy, Secondary raw materials and life cycle – A circular economy for resource recovery, lectures covering waste types and streams, waste collection, transportation and transfer, biomass, and waste-associated regulations tailored to specific countries. Additionally, topics such as treatment of organic waste, Mechanical-Biological-Treatment, waste-to-energy, basic packaging waste, and various practical exercises like WEEE dismantling and plastic waste upcycling are covered. Master topics include Packaging Waste, Urban Mining, Industrial and Hazardous Waste Management, Technology of Thermal Waste Treatment and Emission Control, and Biological Treatment Plant Design. The curriculum also addresses logistics, policies, and tools for the circular economy, as well as international waste management. And TVET explores stakeholder engagement in the Solid Waste Management sector, with a special focus on identifying, involving, and maintaining regular and valuable relationships with all participants in the process. Tailored for TVET students



(including young adults and adults), the module adopts a practical approach, offering examples, exercises, and opportunities for personal reflection and deepening of understanding.

Two train-the-local trainer sessions in Vietnam and Cambodia have been conducted in July 2022, in which the European partners TUHH, POLIBA, IFOA and EUROtraining did teach parts of their developed contents for the Bachelor, Master and TVET courses, to local trainers. The participants could ask questions, and strengthen the knowledge exchange within the partners countries. After the training one pilot semester (T 2.3) was conducted, in which the content was taught and feedback from students was collected. This feedback was then shared with the consortium to improve the courses continually (T 2.2). In Hamburg in Dec. 2022, a Seminar for improvement of educational product and study visit to an waste incineration plant have been conducted (T 2.2).

Furthermore, the project set up an Open On-line Learning Management System (OOLMS) to store and share all educational materials and ensure access for the public (D 4.1). All material is there available and accessible by everyone. On July 5th 2022 a workshop was conducted to ensure compliance with Creative Commons licenses for all online material and also a user handbook (D4.2) for the platform was created. Simultaneously, training hubs (T 4.2) were developed at each institution to provide practical-oriented education and training on sustainable waste management. The hubs were equipped based on the individual needs of the partner countries, and TVET courses were implemented and further developed under this initiative (T3.3). In line with the training hub set up, guidelines for developing and implementing of training hubs were provided. And various workshops and training sessions were organized both (online and in-person) to train individuals and disseminate the project outcomes. Also, other stakeholders have been invited to the trainings and meetings from environmental agencies and municipalities to ensure a broad collaboration and knowledge exchange within the consortium and other stakeholders. A variety of dissemination activities, public events and raising awareness in young generations have been conducted. Overall, the implementation phase of the SWAP Project focused on developing and delivering educational products, setting up training hubs, and conducting workshops and training sessions to improve education and training on sustainable waste management and disseminate those activities in the target countries.

Results

The Project has yielded substantial results in Vietnam, Thailand, and Cambodia, aiming to enhance capacity and improve education and training in sustainable waste management. One of the primary achievements of the SWAP Project was the development and implementation of new training and teaching programs focusing on sustainable solid waste management on Bachelor and Master levels (D2.2). In total 32 lectures have been developed by the consortium. These programs integrated technical education with training sessions aimed at fostering entrepreneurship and business start-ups within the waste management sector. Additionally, the project implemented measures and inclusion policies targeting the informal sector, promoting safer and healthier work practices while introducing informal workers to newly developed Technical and Vocational Education and Training (TVET) products (D3.2 and D3.3). The project also focused on updating and implementing courses to address gaps in waste management education. Several courses were enhanced to provide relevant and up-to-date



content, while new courses were introduced to meet the evolving needs of the sector. In total 13 Courses in the partner universities have been updated or newly developed. The establishment of training hubs (T4.2) in all partner countries was another significant milestone achieved by the project. These hubs served as centers for conducting training sessions and workshops, facilitating hands-on learning experiences for participants. Additionally, an open-online learning management system was implemented, hosted by the Hamburg Open Online University (HOOU), providing access to the quality educational material for all levels (BA, MA, TVET), thus enhancing their skills and knowledge in waste management (T4.1). To support the implementation of courses and programs effectively into the OOLMS, the project partners from (IFOA) developed user handbook (D4.3) and a course designer handbook (D4.3). New teaching methodologies, such as practical exercises and problem-based learning, have been introduced to the partners. To promote this type of teaching, additional guidelines and trainings have been provided on those concepts, before the partners developed their country specific examples of practical exercises and problem-based learning courses. Besides those results, the project also prioritized raising awareness among young generations both in Asia and Europe through various activities. By engaging with students and school kids, NGOs, enterprises and other stakeholders, the project aimed to achieve a sense of responsibility and commitment to sustainable waste management practices, thereby fostering a culture of environmental awareness. This collaboration aimed to fulfil the need for specialized personnel in waste management, ensuring alignment with industry demands and promoting sustainable practices. Additionally, the project successfully disseminated project results and sustainability concepts in waste management, contributing to broader knowledge sharing and awareness-raising efforts. Through the holistic structure of the project, the project did provide high quality educational products and tools and pave the way to support relevant policies.

2. Horizontal Issues

Previous recommendation/follow-up

The recommendations provided by the European education and culture executive agency (EACEA) helped in guiding the SWAP- Project towards achieving its objectives effectively. In response to the previous recommendations on the mid-term technical report, the consortium made several adjustments and improvements throughout the project duration.

Prior to the project proposal, one of the identified challenges was the lack of a preliminary list of courses to be developed or updated, along with their relevant content. To address this issue, the partners conducted a comprehensive study to assess the country-specific needs in Vietnam, Cambodia, and Thailand (T1.4) This study, along with an online workshop conducted in September 2021, helped identify the specific needs and develop a list of missing courses during the initial phase of the project (D2.1).

Throughout the project duration, efforts were made to clarify the accreditation process for the participating universities. While challenges persisted, such as the lengthy accreditation process in Vietnam (5 years), progress was made, and the accreditation process was either completed or initiated



with the set time frame. The project also compiled a list of courses implemented and the number of students trained, providing evidence of the project's impact and outcomes (See annex c).

In response to the recommendation regarding dissemination activities, the consortium increased its efforts to disseminate project outcomes further. Additional dissemination activities were organized during the project duration, contributing to the wider visibility and impact of the project. Those activities have been also published on social media accounts of the project. With this the traffic on our website and also our social media accounts did rise significantly in the project's duration, due to the number of posts and also efforts regarding a SWAP contest for students, to develop an innovative waste management idea. The contest was launched in November 2023 and the final winners of the competition were at the final meeting in Chiang Mai in January 2024.

We took the recommendations from the Agency seriously and uploaded more project results into the result section on the website. Another improvement point from the EACEA was to have a clear overview of all project partner university with their links. This was already installed in the beginning of the project, by clicking on each individual logo of the project partners (bottom of each page) the user will be led to the partner university. Also there is an overview installed under the "About" Section as well as under "News" Section under "Partners". Changing the "Partners" section to have an additional place on the website was unfortunately not possible after the set-up of the website was already made. With this the solution was to bring the link with the description of each partner to the front.

Furthermore, the external quality assurance review has been carried out shortly after the submission of the mid-term report on 12th of December 2022. A one day workshop was conducted from the *University of Natural Resources and Life Sciences, Vienna (BOKU)* with individual interviews of the project partners. The mid-term evaluation carried out valuable insights on the improvement areas of the project, and the evaluation findings were carefully considered and actions were taken to address the identified weaknesses and challenges. Some challenges identified were the language barriers within the partners, the different working cultures and the different backgrounds of project members. To tackle those challenges, more individual online meetings and meetings with the WP leaders have been conducted. For more efficient communication, Telegram chats have been used more often. The second stage of the evaluation took place at the project end. The final external project evaluation was undertaken on the basis of a review of project outputs (deliverables, teaching materials, dissemination materials, other) and a quality workshop with a general discussion with the members of the Quality Management Board, on Dec 15th and 18th 2023. The evaluation was positive and the evaluator reported: 'The project achievements demonstrate, that all project targets were reached, as visible from the list of deliverables. A comprehensive set of academic courses (newly developed and updated) are a major outcome of the project. The training hubs have been installed and a list of activities underpins a successful planning and implementation of the hubs. Further information about the evaluation finding can be found in the end report section under Quality (D5.4).

Regarding the purchase of equipment, there was no further equipment purchased than in the original plan, when savings are made, they will be returned to the EACEA.



Additionally, the sustainability of the project is addressed in the D6.6 the “Implementation and sustainability and exploitation plan” which summarizes the exploitation strategy of the project. Like the maintenance of the number of students enrolment, the maintenance of research and technology advances as well as broadening audience of TVET courses and the maintaining of the training hubs, strengthen regional and international networking and the Website and social platforms maintenance.

Financial rules and cooperation with partners were closely monitored and adhered to, with regular checks, every six months, all supporting documents, have been sent first by email, checked from the coordinator P1 in regards to the financial rules and also the contents provided for the time sheets. After the first round of feedback, the documents have been printed and collected either in person in one of the management board meetings (MBM) or sent via mail. After they arrived at TUHH (P1) they have been final checked by the administration.

Additionally, efforts to create synergies with two other Erasmus+ projects dealing with waste management related topics (GREENUS and UnWaste) were made to maximize impact. The project coordinators did meet online and exchange their best practice experiences. From the Asian side, two of our project partners attended cluster meetings from the EACEA in Vietnam and Thailand. Our Cambodian partners from COMPOSTED represented the project on the Waste Summit 2022. We also gained attention on the international symposium on waste management, resource recovery and sustainable landfilling 2023. In which three of our European partners (TUHH, POLIBA, IFOA) presented the projects and its outcomes on the conferences in a workshop called “Solid Waste Management in Southeast Asian countries”. The publications written during the projects are “Capacity building in municipal solid waste management in Asian countries of Vietnam, Cambodia and Thailand: The state of the art and the case of the Erasmus+ “SWAP” project”, “Discussing the possibility of extending the European vision of solid waste management to the Asian countries of Vietnam, Cambodia and Thailand”, and “Achieving Sustainability in capacity building projects: Sharing educational products and tools in the SWAP project”.

Transversal issues

The project aims to address critical transversal issues in sustainable development, unemployment, and social cohesion, with a specific focus on solid waste management (SWM). At the heart of the project is the endeavour to elevate waste management practices to a higher educational level. This involves supporting the implementation of effective waste management strategies and providing training for qualified personnel, thereby creating employment opportunities. Notably, the project addresses both formal and informal sectors, recognizing the urgent need to improve waste management systems and conditions for workers.

Informal workers, who constitute a significant portion of the workforce in SWM across these countries, often operate without adequate safety equipment and job security. The International Labour Office (ILO) contributed to the definition of the scale of the non-agricultural informal employment in Southeast Asia region, highlighting that 46.6 % of informally employed workers are involved in the informal sector, 12.2 % are involved in the formal sector and 4.7 % are working in households. In response, the project includes initiatives to educate and empower informal workers. Collaborating



with NGOs like COMPOSTED and the educational Institutes of EUROtraining and IFOA, which are specialised on Vocational Training, the project incorporates their insights into the needs of informal workers, ensuring these perspectives are integrated into training sessions.

Furthermore, the project extends its reach to various groups, including farmers, through Technical and Vocational Education and Training (TVET) courses. However, challenges arose initially, particularly in countries like Thailand and Vietnam where distinctions between TVET and traditional university courses were not well-defined. Despite these challenges, institutions like TUAF successfully trained farmers, albeit facing obstacles such as limited availability due to their work schedules. To incentivize participation, strategies evolved from monetary compensation to providing seeds for agricultural use.

The project also addresses key implementation challenges in SWM processes, including source separation, collection logistics, and landfill management. Through enhanced education and training, the project aims to strengthen the sector's capabilities, leading to a healthier society and sustainable development. Knowledge exchange among partner countries facilitates the adoption of best practices and innovative waste treatment methods, contributing significantly to environmental protection and controlled waste management.

Moreover, by training individuals in both theory and practice, the project fosters the development of new technologies and promotes knowledge exchange within partner countries. This not only supports SDG 1 (No Poverty) by creating new job opportunities but also contributes to SDG 3 (Good Health and Well-being) through improved working conditions in the recycling sector. Indirectly, the project aligns with SDG 6 (Clean Water and Sanitation) by preventing waste contamination of water bodies.

Additionally, the project's focus on climate action, particularly in reducing CO₂ emissions through sustainable waste management practices, aligns with SDG 13 (Climate Action). By promoting resource conservation, material cycle closure, and environmentally sound waste disposal, the project positively impacts SDG 12 (Responsible Consumption and Production) as well. The project's multifaceted approach to addressing transversal issues in sustainable development, unemployment, and social cohesion through enhanced SWM practices underscores its significant contribution to achieving the SDGs.

Involvement of people with fewer opportunities

The project plays a crucial role in addressing the needs of marginalized groups, particularly the informal sector, which significantly contributes to SWM in low-income and transition countries. This sector encompasses individuals engaged in waste picking, collection, and subsequent activities along the recycling value chain, such as processing recyclables. For many, waste serves as their primary source of income, highlighting the importance of this sector for their livelihoods.

Despite their integral role, individuals in the informal sector face precarious working conditions and lack access to essential services like public health insurance and social security. They often operate without proper protective gear or formal contracts and are predominantly from ethnic or religious



minority groups, exacerbating their social deprivation. SWAP acknowledges and supports this vulnerable group, along with other marginalized populations like the long-term unemployed.

One of SWAP's objectives is to promote entrepreneurship within the informal sector through the establishment of cooperatives in SWM. This initiative aims to transition informal activities into formal structures, thereby enhancing the sector's sustainability and improving workers' socio-economic conditions. Additionally, the project developed training materials (D3.3) focused on enhancing occupational health and safety standards for workers, ensuring their well-being in the workplace.

The project addresses critical challenges faced by informal workers. Through targeted trainings for the informal workers and TVET courses, the projects equips them with essential skills and knowledge, leading to improve work environments and overall well-being.

Refugees

Not applicable

Least Developed countries and regions

The project has actively involved institutions located in least developed countries (LDCs), specifically targeting the least developed regions within partner countries, with a focus on Cambodia. Two universities, namely the RUA and UHST, situated near Phnom Penh, along with the NGO, COMPOSTED, have played pivotal roles in both project implementation and dissemination.

To facilitate knowledge transfer and capacity building, two training hubs were established within these universities. On the campus of RUA, the training hub is located in the Centre of Agricultural and Environmental Studies, which has sufficient space and equipment for the learning process and practices. The physical space which is called "CAES-RUA" set up a room to organise seminars and training courses for the theoretical part with 100m² and a large composting house for practical courses with 140m².

At the UHST Campus, the training hub was established under the management of the Faculty of Agriculture. The office space of the training hub is (4 m*5 m), and the composting house size was (11m *22m). The UHST training hub resources, including training rooms, laboratory, computer, projector and IT system is located at laboratory of Faculty of Agriculture of the University. All lab equipment and tools including the existing one and equipment from SWAP budgets has been used during the training. The training hub was established to support the university by providing capacity building on solid waste management, including waste management technologies, building research partnership among relevant stakeholders, including students, farmers, agricultural cooperatives, agricultural communities, NGOs, entrepreneurs, relevant stakeholders and development partners. These hubs serve as platforms not only for project-related training but also for broader educational initiatives targeting informal workers, thus enhancing the project's reach and impact.



Moreover, the NGO;COMPOSTED has been instrumental in disseminating project outcomes and engaging with stakeholders at various levels. This includes participation in the annual Cambodian Waste Summit, where project findings are shared with the public and other environmental organizations. Governmental organizations like the Department of Higher Education, Ministry of Education, Youth and Sport in Cambodia, and the Environmental Protection Agency in Vietnam, have also been actively involved, with representatives attending train-the-trainer sessions and participating in raising awareness events to enhance collaboration and knowledge exchange.

Looking ahead, there are plans to further leverage the established training hubs and partnerships with local institutions to continue disseminating project results and expanding outreach efforts. This includes ongoing engagement with governmental organizations, NGOs, educational institutions, and other stakeholders to ensure sustained impact and promote continuous learning and improvement in solid waste management practices within Cambodia. Alliances within the partner countries have been in place, with the MJU university in Thailand. Two memorandum of Understanding (MOU) made between Maejo University and University of Heng Samrin Thbongkhmum, Cambodia and between Maejo University and RUA, Cambodia. The general understanding is extension and strengthening of academic and scientific exchange and cooperation is highly desired and is expected to be of mutual benefit as following; A) Exchange of Faculty members B) Collaboration of science and technology transfer C) Exchange students (undergraduate and graduate) D) Collaboration of research activities E) Organization of joint academic and scientific activities F) Other activities as agreed upon by both parties. Also the European partners from Germany (TUHH), Thailand (MJU,CMU) and both Cambodian (RUA, UHST) universities are working on another project proposal regarding polymer recycling.

Innovation

The project innovation is the adoption of a multi-stakeholder governance approach, integrating various educational institutions, like universities, training experts and NGOs. Not only higher education concepts have been installed, but also vocational training entities, and informal worker groups are addressed. Both in the real world with practical exercise but also through the OOLMS platform, which ensures that all materials are available online and accessible without subscription costs, for everyone.

This innovative collaboration enables the project to address specific and localized challenges related to sustainable solid waste management effectively. By developing new curricula and adapting existing programs to enhance attractiveness in the labour market, the project addresses not only university-level students but also trainees at tertiary levels and informal workers. The inclusion of local industry representatives ensures feedback on specific requirements for skilled personnel, thereby tailoring training initiatives to meet local needs effectively. One notable aspect of innovation is the establishment of local training hubs utilizing equipment funded by the EACEA. These hubs are designed to be sustainable in the long run and are envisioned to serve as models for implementation across Asian countries. This approach fosters knowledge sharing and capacity building, contributing to the project's overall impact and sustainability.

Furthermore, the project innovatively engages the younger generation by raising awareness and integrating educational initiatives targeting schoolchildren. By instilling environmental consciousness



from a young age, the project cultivates a culture of sustainability and empowers future leaders to address waste management challenges effectively. Moreover, the project's innovative multi-stakeholder governance teams ensure diverse perspectives and motivations are considered in decision-making processes. Collaboration between Asian and European partners enhances the project's efficacy and fosters mutual learning and exchange of best practices.

The innovative character lies in its targeted approach to addressing capacity gaps in sustainable waste management through effective educational programs. Collaborations with European organizations renowned for their expertise in waste management, such as the Hamburg University of Technology (TUHH), Polytechnic University di Bari (POLIBA), Eurotraining, and Institute for Training of Business Operators (IFOA) further enhance the project's innovative solutions. Operating on a regional scale while considering local specialities demonstrates an innovative approach, acknowledging the diversity within regions and adapting strategies accordingly. This emphasis on localized solutions within a regional framework distinguishes the project as an innovative endeavor in promoting capacity building for sustainable waste management.

3. Award Criteria

Relevance of the results

The achievements and results of the project were significant across all partner institutions in Thailand, Vietnam, and Cambodia.

In *Thailand*, the Chiang Mai University (CMU) listed three main achievements and results of the SWAP-Project. a) 1. Various courses, ranging from those for Bachelor and Master students, TVETs and informal workers, have been developed. These courses enable CMU, especially Department of Environmental Engineering, to improve the curriculum and trainings offered to students and trainees on the field of solid waste management. 2. The establishment of the training hub equipped with several equipment. Along with teaching materials developed in the project. This training hub has been used to disseminate knowledges, both theoretical and practical ones, to various levels of trainees. This will help to enhance the capability of engineers, workers and industrial sectors in managing solid waste, which is very important and in line with the government's environmental policy. 3. This project helps to promote the collaboration among CMU, stakeholders and partners both in Southeast Asia and EU. This relationship has great potential for further cooperation not only in building capacity but also in conducting research in the field of waste management and utilization, which is a globally hot issue.

b) As a country, the Thai's government has set a plan to develop according to the circular economy model. This plan is in line with the sustainable development goals promoted in several countries around the world. To respond to this policy, CMU has set the vision to become "A Leading University Committed to Social Responsibility for Sustainable Development through Innovation". Achievements of the SWAP project in developing teaching materials, improving capability of the lecturers/trainers, setting up the training hub and creating the collaboration with stakeholders and partners in the field of solid waste management can obviously play an important role in supporting the objectives set for Thailand and CMU as the HEI. c) There have been no changes that have affected the projects relevance.



The *Majo University* (MJU) listed the following as the main results a): 1. The courses and curriculums which have been developed and implemented, and also the equipment which was bought. 2. The developed Training hubs and awareness activities for young generations, farmers and communities on a regional level and 3. The future cooperation between MJU, who signed a Memorandums of Understanding (MOUs) and the Partners from Cambodia, **RUA and UHST**. b) Moving forward to be a leading university in agricultural training and education and striving to achieve eco-university and agricultural sustainability. It is of the utmost importance that the academic staff, students, as well as associated workers at MJU have the knowledge and proper skills in waste management from domestic waste to agricultural waste management. The development of courses and curricula on solid waste management, along with all equipment supported by the project, can drive the university policy and roadmap. Additionally, raising awareness among staff, students, and the younger generation in surrounding communities on waste management, as part of the training and activities, could contribute to improved waste management for the university and the country. Academic service is one of the university staff's duties to help and serve the communities using their knowledge and skills. This can be the solution for solving the environmental problems in Thai's communities and Thai's agricultural area and can generate further income for university and community. MOUs between universities can foster positive collaborations with Asian partners, encompassing knowledge exchange, staff and student mobilities, and research development.

For *Vietnam's Thai Nguyen University of Agriculture and Forestry (TUAF)*, a) the main achievements are listed as 1. Awareness Raising on Solid Waste Management: The project successfully increased awareness on solid waste management among both academic students and non-academic sectors. Through targeted educational programs, workshops, and outreach initiatives, the project contributed to a better understanding of the importance of responsible waste management practices. 2. Improved Training Quality with Provided Equipment and Updated Materials: The project has significantly enhanced the quality of training in the field of solid waste management by providing state-of-the-art equipment and updating educational materials. This improvement ensures that students and professionals have access to the latest tools and knowledge, thereby enhancing their skills and competencies. This achievement has a direct impact on institutional development and contributes to building a skilled workforce capable of addressing contemporary challenges in waste management. 3. Extended Network at National and International Levels: The project successfully expanded its network, fostering collaborations and partnerships both nationally and internationally. This achievement is crucial for the exchange of ideas, best practices, and resources. At the national level, the extended network enhances cooperation among various stakeholders, including government bodies, and private enterprises. Internationally, the project's networking efforts contribute to a global exchange of knowledge and innovative solutions in the field of solid waste management among partners in Southeast Asia and Europe.

For TUAF the relevance to National Policy b):

- Aligns with national environmental policies and goals, contributing to sustainable waste management practices outlined in national agendas.
- Supports the institution's commitment to environmental stewardship and community engagement, reflecting a holistic approach to education and societal responsibility.
- Addresses the need for a skilled workforce in waste management, aligning with national strategies for human resource development.



- Reflects the institution's commitment to academic excellence and innovation by providing state-of-the-art equipment and updated materials, ensuring graduates meet industry standards.
- Enhances the institution's reputation as a hub for cutting-edge education, attracting international students and fostering global partnerships in research and education.
- Aligns with the institution's goal of leveraging a broad network for research, funding, and collaborative projects.

Also in *Vietnam* the Hue University of Agriculture and Forestry (HUAF) recorded their three achievements in the project and identified it as: a) 1. Modernizing and updating academic courses and the development of new TVET programs in the field of SWM and policies are especially important. 2. Enhancing capacity for university staff in teaching and research through study visits and training activities. 3. Raising awareness for young generations including university students and pupils of secondary and high schools towards environmental protection. b) On the relevant policy areas HUAF mentioned, that according to the Decree No. 08/2022/NĐ-CP of Prime Minister on the laws of environmental protection dated 10th January 2022, the achievements of the SWAP project have contributed to meet the objectives of this Decree. Moreover, updating the existing academic courses and developing new TVET are one of the strategic priorities of our university aiming at meeting the labour needs in market.

In *Cambodia* the main achievement have been identified for the Royal University of Agriculture (RUA) as 1. The set-up of the Training Hubs 2. Development of new course syllabus for sustainable solid waste management and circular economy, integrate into academic level (Master of Climate Change and Sustainable Development in the faculty of forestry) as well as the development of new TVET course for non-academic level and informal sector. 2. Exchange knowledge and experience on course improvements.

For the Partners of University of Heng Samrin Thbongkhmum (UHST) 1. The set up of a Training Hub for sustainable solid waste management at Faculty of Agriculture for continuing the support its faculty and other relevant stakeholders at both national and regional levels. 2. The SWAP projected support the university developing new courses for sustainable solid waste management and circular economy, and it was integrated into academic program of Department of Agricultural Economics (Faculty of Agriculture) and also developed new TVET course on sustainable Solid waste management for non-academic level and informal sector at the Institute of Vocational and Professional Training. 3. Built collaboration with SWAP partners for exchange knowledge and sharing experience on course improvements and future opportunity among the partners.

In Cambodia on a national level, the project did have an impact. Based on the 10-year strategic plan 2022-2030, the university's curriculum must meet the minimum national standard. SWAP supports modernizing its curriculum and an increase of student enrolment, together with employability graduate students according to graduate tracer study every year.

During the course of the project, there was no change affecting the project's relevance. Conversely, the project's relevance has strengthened even further, as solid waste management plays a crucial role in reducing carbon emissions, which is a global mega-trend. The COVID-19 pandemic has introduced significant challenges, particularly in the area of face-to-face meetings and in-person activities. To adapt to this change, the project implemented alternative strategies to maintain its effectiveness and relevance:



- Utilize video conferencing tools, webinars, and online collaboration platforms to conduct meetings, workshops, and training sessions. This approach allows for continued interaction while adhering to safety guidelines.

- Shift to digital channels for awareness campaigns.

Regional cooperation

The engagement in Erasmus+ cooperation has led to different regional cooperation initiatives for the institutions involved. *Cambodia & Thailand*: UHST and MJU signed MoU between the university for area of future collaboration including exchange student, academic staff on tissue culture, and some area in the in the research.

Vietnam: HUAF has signed a contract with VIPESCO company for the transfer of technology on organic fertilizer production from agricultural waste. This agreement enhances cooperation between academia and industry, promoting sustainable agricultural practices and waste management solutions. TUAF also signed MoU with EJC company and Khoi Nguyen Science and Technology Joint Stock Company in training for students and research collaboration in waste management.

Thailand & Germany: (CMU) had not signed any formal agreements during the project, the collaboration with the (TUHH) extended to students exchange during the visit to Hamburg, in December 2022. Additionally, a Ph.D. student from CMU's Department of Environmental Engineering worked in TUHH's laboratory for three months from January to March 2023. Furthermore, during the final project meeting in January 2024, all partners agreed to cooperate in preparing a proposal for a research grant, which aims to foster future collaboration in education and research. The proposal is now in the final stages and includes (due to the funding rules) Thailand, Germany, Turkey and Malaysia. Also the Faculty of Engineering at CMU signed a (MOU) with *Tha Chiang Tong* company, owner of the Ban Tarn Sanitary Landfill in Chiang Mai. This agreement facilitates cooperation in research and academic activities, with the company providing valuable information and requirements for the SWAP project, contributing to solid waste management initiatives.

Thailand & Cambodia: (MJU) signed two (MOUs) with (UHST) and (RUA) in Cambodia. These agreements aim to extend and strengthen academic and scientific exchange and cooperation. The MOUs include provisions for: Exchange of faculty members, Collaboration on science and technology transfer, Exchange of undergraduate and graduate students, Collaboration on research activities, Organization of joint academic and scientific activities, and other mutually agreed-upon activities. These agreements highlight the commitment of the institutions to foster collaboration in education and research, promoting knowledge exchange, capacity building, and mutual benefit among the participating institutions in the region. Also, MJU has established an MOU with Advanced Info Service Public Company Limited (AIS) for E-waste management through a blockchain platform. This collaboration aims to address challenges related to electronic waste management, leveraging innovative technologies to promote sustainability.



Some institutions have invited experts from private sectors like Mr. Trinnawat Suwanprik Representative from Chiang Mai Municipality, to share insights on solid waste management, business start-up, and technical aspects in the final event and a local start-up.

Quality of the project implementation

Description of the implemented activities

WP1 was completed before the mid-term evaluation report (Mid-Term Report) was submitted.

In WP2, after the mid-term report and the train the trainer's session (D 2.2), discussions arose regarding whether the teaching material needed to be translated into the local language after the delivering of the material. All partners unanimously agreed that translation was necessary if the material was taught in the local language. If the material was taught in English a translation was not needed. For instance, partner universities in Thailand deliver their master courses in English. Shortly after the submission of the mid-term report in December 2022, activities took place in Hamburg, including the academic staff training and seminars to improving the education products and study visit in Hamburg. 11 Students from Asian countries participated in this seminar, to present their feedback in front of the consortium about the courses in the pilot semester (T 2.3). The students from CMU and MJU, presented their feedback and the consortium members discussed how to further improve the material. The feedback contained for example to incorporating more pictures, videos, and detailed explanations as main improvements. One challenge for the courses which was identified is that some of the lectures literature is not accessible from all over the world and also translations was missing. One solution for the translation was to emphasise that for some parts of textbook online, translation-tools could be used and to overcome the literature access problem. TUHH provided an additional document "[Additional Supporting Documents](#)" with helpful links and textbooks to further readings. All six universities conducted the pilot semester runs (T 2.3) between (M 11- M36). This task was completed by M35. The output of this activities has been summaries in the Report "Improvement of the developed academic educational products" (D 2.3). The Report was submitted in M36 instead of M24. Since the development of the material and the training sessions have been delayed due to COVID-19. The accreditation of the material (T2.4 Accreditation of the developed educational products) also took time, since the accreditation process takes up to five years for partner countries like Vietnam; however, all universities could prove that they started the accreditation process for the developed products until M36. The accreditation documents can be found here: <https://cloud.tuhh.de/index.php/s/WHoDBKwAQpGpBk>. The process is already in place and four out of the six universities already proved their accreditation.

In WP3, educational material regarding the educational products for informal works (D3.3) have been prepared with a delay for one month in (M23). On the consortium meeting in Chaing Mai Thailand in June 2023, the task focusing on the implementation, monitoring and improvement of the TVET products and qualifications has been discussed during the meeting, it was discovered that the concept of TVET course at universities had its difficulties to implement, regarding organizational objectives.



After the meeting and training on the activities, the preparatory activities for implementation of those new courses gained new motivation. The implementation of the developed material at “pilot” courses was conducted until (M23). The trainees answered a questionnaire for feedback (T 3.3). The evaluation of the survey took place, and the main outcome was the Report (D 3.4) "Improvement of the developed training products," should have been delivered by the end of (M24), as this report relied on feedback from students and with this it was dependent on the academic calendars, the submission faced a delay until (M36).

In WP4, the task T 4.1, the implementation and customization of an Open Online Learning Management System (OOLMS), was completed by the beginning of 2023 (before the mid-term report). At first, the platform was just available in German, which led to the fact that the two deliverables (D 4.2 and D 4.3), which were designed to provide guidance for lecturers and students how to use the platform, also included translations for the main users. Then, in August 2023, shortly after the platform was completed, the platform provider from the Hamburg Online Open University requested that all material and structures from the old platform be moved to the a new one. This required uploading the platform structure and all content again, along with adding new content. Which led to an additional workload, but it also made it possible to access the platform in English, which was not possible with the previous version. Additionally, by the project's end, an agreement was signed among partners, specifying representative persons with access to the website, rules for present and future management, usage and updates, and access to all educational material. Partners agreed to update it regularly for two years (T 4.1). Also, in WP4, the "Implementation of Training Hubs for Sustainable Solid Waste Management and Policies" has been completed, the quality standards of the training hubs, detailed information about the goals, tasks, programmes, local needs, staff and financial sustainability have been identified, the hub was physically set up and the first trainings occurred. Guidelines for the management of multi-stakeholder governance teams (D 4.5) were implemented and distributed through all partners. The training materials and guidelines were submitted and distributed by all project partners. All activities and objective recommendations about the implementation and functioning of the training hubs are explained in Report (D 4.6), delivered in January 2024, though information from the Cambodian partners was initially missing, delaying the report's completion.

In WP5, all quality assurance committee meetings were conducted until June 2023, with the last meeting held in Thailand to ensure in-person attendance by all consortium members (M 30 instead of M29). On December 12, 2022 a quality workshop was held at the TU Hamburg in Hamburg with a one-day quality workshop and individual interview with the consortium. The report was delivered (January 23) and the final evaluation took place on 15th and 18th of December 2023, and the report was delivered in January 2024 (M36). Due to the delays in the rest of the deliverables, it was important to allow the evaluation to review all deliverables. This report is not part of the internal evaluation process. The internal quality continuous monitoring was conducted until the project's end, and it included an online evaluation process of all deliverables, milestone report etc. The deliverable leader handed in the deliverable to the consortium and they had to read and give in a first stage a fast evaluation of the product. Then the deliverable leader was contacted to make changes according to the feedback of the



consortium. The findings and evaluation of the process can be found here <https://cloud.tuhh.de/index.php/s/By93n6ycZgAfpC7>.

In WP6, various public events and awareness-raising events were implemented throughout the project's duration, including at schools, public organizations, conferences, environmental days, and universities, as well as through social media activities and local news broadcasts. The Sustainability and Exploitation Plan (D.6.4), was designed and submitted in October 2023 (M34). The SWAP website and its contents will be further used, updated, and sustained by the partners from Thailand; MJU, to ensure its usage in representative countries like Thailand.

In WP7, responsibilities within the partners remained mostly unchanged, except for another change in staff of the coordination organisation P1 (TUHH) during the month 25 of the project. More individual meetings with partners and work package leaders occurred, and communication channels primarily used Telegram. Monthly management board meetings were restructured, with more updates and improvements discussed. Additionally, more individual meetings with WP leaders, task leaders, and partners were implemented. The report (D 7.2) "Management Manual" have been developed and submitted in a timely in M32. The submission of the final report D7.6, was postponed from 14/03/2024 to 14/06/2024 with an amendment approved by the EACEA.

Quality Assurance Measures

The quality assurance process within the project has been robust and comprehensive, ensuring that all activities and outputs meet the desired standards. The external evaluation report played a crucial role in identifying areas of success and areas for improvement, and its recommendations have been carefully considered for future projects.

Process management within the project was generally effective, with active participation and interest from partners. Regular meetings and communication, both in-person and through platforms like Telegram, facilitated coordination and cooperation. Informal collaboration was well-developed, creating a friendly atmosphere conducive to networking and knowledge transfer. Strong support from partners, particularly from COMPOSTED and European partners, contributed to the project's success. However, there were challenges such as slow response times from some partners, language barriers, underutilization of the online learning platform, delays in delivering results, and the need for more training. Excessive documentation and reporting requirements also posed challenges, exacerbated by initial setbacks due to COVID-19 restrictions on travel. To improve cooperation, suggestions include holding more meetings with work package (WP) leaders, emphasizing face-to-face interactions for better mutual understanding, and ensuring fast communication through platforms like Telegram and WhatsApp. Involving community, NGO, and private sector stakeholders could enhance collaboration, along with better support from funding agencies like EACEA and increased opportunities for travel to understand partner countries better.

Regarding outputs and products, the external evaluation highlighted various aspects, such as the urgent needs of waste management in Southeast Asia and educational needs at universities. The evaluation workshop conducted in December 2022 provided valuable insights into waste management



needs and educational priorities. Participants identified key waste streams and processes requiring attention, along with topics to be emphasized in university education and vocational training. While most partners had a clear understanding of their responsibilities, challenges remained in ensuring the long-term sustainability of TVET courses beyond the project's end, particularly in securing funding and developing business plans.

The final evaluation of the project in December 2023 reaffirmed the achievements and challenges identified earlier. Project targets were successfully met, with a comprehensive set of academic courses developed and implemented, and training hubs established. The consortium demonstrated efficient cooperation despite geographical distances, although challenges such as excessive documentation requirements were noted. Strategies for the future include addressing various waste streams, transitioning to recycling, integrating circular economy concepts, and focusing on rural areas with less developed infrastructure.

Internally, the project implemented a quality control plan (QCP) approved by project quality managers, outlining procedures for monitoring and evaluating deliverables and milestones. The Quality Management Board (QMB) and WP leaders were responsible for overseeing the quality assurance process, ensuring timely completion of deliverables, identifying and addressing problems, and verifying corrective actions. While most deliverables underwent internal quality assessment, challenges were encountered in meeting all quality control requirements.

Overall, the quality assurance process within the project was comprehensive and effective, contributing to the successful implementation of activities and the achievement of project objectives. Recommendations from external evaluations and internal quality assessments will inform future projects, ensuring continuous improvement and sustained impact beyond the project's end. Quality Reports can be found under WP 5 – annex c.

Equipment

During the course of the project, significant investments were made in acquiring various pieces of equipment across different partner institutions:

Chiang Mai University (CMU): At CMU, a diverse range of equipment has been acquired and is being utilized across the Department of Environmental Engineering. This includes laptops, a shredder, extruders, 3D filament making sets, air and fume equipment sets, 3D printers, molds, projectors, wall screens, and more. Additional equipment to be procured includes a sorting table, wrench sets, voltmeter, cordless screwdriver, among others, tailored to meet the specific needs of biogas and CBG production and plastic waste upcycling. The installation of this equipment at CMU's lab hall aims to support training and research activities, with plans to accommodate approximately 50 individuals annually for plastic waste upcycling and 120 individuals for courses related to e-waste disassembly, biogas, and CBG production.



Maejo University (MJU): MJU's equipment acquisitions cater to the training hub within the Faculty of Science, emphasizing environmental technology and biotechnology programs. These resources, including plastics shredder machines, pyrolysis furnace, infrared temperature measurement tools, and soil pH meters, are utilized for educational purposes across various training locations within the university campus. Additionally, future purchases are planned to enhance teaching and research capabilities, targeting waste recycling, agricultural waste utilization, and value-added product development.

Thai Nguyen University of Agriculture and Forestry (TUAF): TUAF's procurement focuses on waste treatment and management, with equipment such as waste crushers, biochar machines, UAVs, and pollutant analysis tools. These resources are intended to support practical training and scientific research for undergraduate and postgraduate students, as well as workshops for government staff and farmers. TUAF emphasizes regular maintenance and management of equipment to ensure its effectiveness in the Environment Faculty laboratory.

Hue University of Agriculture and Forestry (HUAF): HUAF's equipment acquisitions, including a universal oven and handheld water quality meters, are intended for academic and student use within the Faculty of Land Resources and Agricultural Environment. Office equipment such as laptops, printers, and webcams support the university's training hub established for the project, aiming to enhance teaching and research capabilities.

University of Heng Samrin Thbongkhmum (UHST): UHST's equipment acquisitions are streamlined, with the company providing both the equipment and services on how to use and maintain it. This approach ensures seamless integration of the equipment into educational activities without significant challenges reported.

Throughout the implementation of the project, several challenges were encountered related to the installation and use of equipment:

- CMU faced challenges related to training operators for plastic upcycling equipment, ensuring safety measures, and addressing infrastructure needs through government budget allocation for a dedicated installation room.
- MJU experienced changes in equipment type, transitioning from a Natural Recycled Material Die Casting Machine to a Plastic Injection Machine, requiring adjustments in training and operation procedures.
- HUAF navigated decision-making processes for equipment installation locations and procurement, along with time-consuming VAT refund procedures.
- TUAF identified lengthy procurement procedures as a challenge in acquiring necessary equipment.
- RUA and UHST encountered minimal challenges, with the latter benefiting from streamlined equipment services provided by the supplier.



Curriculum development

Listed below are the Academic courses developed and implemented by the project.

CMU – Thailand

1.
 - a) **253743: Circular Economy and Sustainable Resource and Waste Management**
 - b) New
 - c) 3 credits (45h of teaching)
 - d) Master
 - e) Link for learning outcomes and textbook are not available due to the regulation of Chiang Mai University.
 - f) Slide prepared by Lecturer using information from SWAP project
 - g) Accreditation is complete Link: <https://cloud.tuhh.de/index.php/s/WHoDBKwAQPbGpBk>
2.
 - a) **253441: Solid Waste Management**
 - b) Updated (20% of course update compared to the previous version)
 - c) 3 credits (45h of teaching)
 - d) Bachelor
 - e) Link for learning outcomes and textbook are not available due to the regulation of Chiang Mai University.
 - f) N.A.
 - g) Accreditation is complete Link: <https://cloud.tuhh.de/index.php/s/WHoDBKwAQPbGpBk>
3.
 - a) **253456: Fundamental of Material Flow Analysis and Life Cycle Assessment**
 - b) Updated (20% of course update compared to the previous version)
 - a) 3 credits (45h of teaching)
 - b) Bachelor
 - c) Link for learning outcomes and textbook are not available due to the regulation of Chiang Mai University
 - d) 1) apply the concept of life cycle assessment to quantify the environmental impacts of a given case study. 2) apply Material Flow Analysis to analyse and solve environmental problem.
 - e) Accreditation is complete Link: <https://cloud.tuhh.de/index.php/s/WHoDBKwAQPbGpBk>

MJU – Thailand

4.
 - a) **Solid Waste Management Aspects in Circular Economy**
 - b) Course Status: New
 - c) 3 credits (45h of teaching)
 - d) Bachelor
 - e) <http://www.education.mju.ac.th/www/ProgramStructure.aspx?ProgramID=60304020>
 - f) Teaching/Training Methodology :lecture with powerpoint using SWAP materials long side with project based learning from local community
 - g) Accreditation complete Link: <https://cloud.tuhh.de/index.php/s/WHoDBKwAQPbGpBk>



5.

a) Pollution prevention

- b) Updated (20% of course update compared to the previous version)
- c) 3 credits (45h of teaching)
- d) Bachelor
- e) <http://www.education.mju.ac.th/www/ProgramStructure.aspx?ProgramID=60304020>
- f) Teaching/Training methodology: lecture with powerpoint prepared by lecturer and use some update information from SWAP materials long side with case studies and group brainstorming
- g) Accreditation complete Link: <https://cloud.tuhh.de/index.php/s/WHoDBKwAQpBpBk>

6.

a) Solid and hazardous waste disposal and management

- b) Updated (20 % of course update compared to the previous version)
- c) 3 credits (45h of teaching)
- d) Master
- e) <http://www.education.mju.ac.th/www/ProgramStructure.aspx?ProgramID=60604122>
- f) Teaching/Training methodology: lecture with powerpoint prepared by lecturer and use some update information from SWAP materials long side with case studies, group brainstorming and Laboratory practise
- g) Accreditation complete Link: <https://cloud.tuhh.de/index.php/s/WHoDBKwAQpBpBk>

7.

a) Environmental pollution treatment technologies

- b) Updated (25% of course update compared to the previous version)
- c) 3 credits (45h of teaching)
- d) Master
- e) <http://www.education.mju.ac.th/www/ProgramStructure.aspx?ProgramID=65604122>
- f) Teaching /Training methodology: lecture with powerpoint prepared by lecturer and use some update information from SWAP materials long side with case studies and project based
- g) Accreditation complete link: <https://cloud.tuhh.de/index.php/s/WHoDBKwAQpBpBk>

UHST – Cambodia

8.

a) Introduction to Sustainable Solid Waste Management and Circular Economy

- b) New
- c) 3 Credits (45 hrs, 30 hrs for practical)
- d) Bachelor
- e) Links is not allowed due to policy of the university, but it already intergreted into curriculum for Faculty of Agriculture.



- f) Lecture and practical work
- g) The lecture is already integrated into the curriculum

9.

- a) Introduction to Sustainable Solid Waste Management**
- b) New
- c) No credit, 16 hrs
- d) TVET
- e) Links is not allowed due to policy of the university, but it already included into curriculum for the Institute of Vocational and Professional Training
- f) Sustainable Solid Waste Management a course that is included in the second year with two weeks. The purpose of this Sustainable Solid Waste Management lesson is to help students develop a decision support system for sustainable municipal solid waste management, applied for solving the problem including cost minimization, landfill minimization and emission minimization and capacity building resource for keeping disposal facilities to determined incineration, anaerobic digestion, sanitary landfill and recycling activities.
- g) It is already integrated into curriculum for the Institute of Vocational and Professional Training

RUA – Cambodia

10.

- a) Sustainable Solid Waste Management and Circular Economy**
- b) New
- c) N.a.
- d) Master
- e) N.a.
- f) Understand the importance of sound waste management in relation to SDGs and reduction of poverty. Identify tools that can be used on effective planning for waste management. Discuss how to promote effective governance of waste among key stakeholders. Identify Policy instruments to be used on waste management and waste reduction. Discuss how circular economy approaches can be supported through waste management. Understand the importance of biowaste management and its contribution to economic growth
- g) Accreditation is complete Link: <https://cloud.tuhh.de/index.php/s/WHoDBKwAQpBpBk>

TUAF – Vietnam

11.

- a) Waste resources management**
- b) Updates (10% of course update compared to the previous version)
- c) 2 ECTS
- d) Master



- e) N.a. (the course links are not available for others)
- f) Teaching Methodology: Theory, practical and project-based
- g) Accreditation takes 5 years, the process in ongoing

12.

- a) **Solid waste management and treatment**
- b) Updated (30% of course update compared to the previous version)
- c) 2 ECTS
- d) Bachelor
- e) N.a. (the course links are just available for students)
- f) Teaching Methodology: Theory, practical and project-based
- g) Accreditation takes 5 years, the process in ongoing

13.

- a) **Environmental Microbiology**
- b) Updated (10% of course update compared to the previous version)
- c) 3 ECTS
- d) Bachelor
- e) N.a. (the course links are not available for others)
- f) Teaching Methodology: Theory, practical and project-based
- g) Accreditation takes 5 years, the process in ongoing

HUAF – Vietnam

14.

- a) **Environment and Sustainable Development**
- b) Updated
- c) 2 credits
- d) Master
- e) N.a. (the course links are just available for students)
- f) Teaching Methodology: Handout, lecturing, practice, group discussion
- g) Approved by University Committee of Science and Training

15.

- a) **Environmental Management of Urban and Industrial zone**
- b) Updated (50% of course update compared to the previous version)
- c) 2 credits
- d) Bachelor
- e) N.a. (the course links are just available for students)
- f) Teaching Methodology: Handout, lecturing, practice, group discussion
- g) Approved by University Committee of Science and Training



16.

- a) **Solid Waste Management**
- b) Updated (20% of course update compared to the previous version)
- c) 2 credits
- d) Bachelor
- e) N.a. (the course links are just available for students)
- f) Teaching Methodology: Handout, lecturing, practice, group discussion and experiments
- g) Approved by University Committee of Science and Training

Teaching/Training Activities

Throughout the duration of the project, teaching and training activities were conducted among the partner institutions, spanning various topics related to solid waste management (SWM). These activities were initiated following the mid-term technical report provided in December 2023. On the Meeting in Hamburg in December 2022. Feedback from Thai students highlighted areas for improvement in teaching materials, including the incorporation of information on the impact of COVID-19 on waste management, the enhancement of presentations with visuals and case studies, and the provision of more practical exercises. Partners collaborated to address this feedback, sharing references and resources to enhance the quality and effectiveness of teaching materials.

One of the training sessions commenced with a meeting of all Asian partners in Phnom Penh from the 29th to the 31st of March 2023, where discussions revolved around the establishment and operation of training hubs. During this session, partners received training on multi-stakeholder governance teams through online and hybrid platforms facilitated by experts from Italy (IFOA). Topics covered included sharing experiences regarding training hubs and devising business plans for their sustainable operation in the future (D.4.4 and T4.2 and T4.3).

Further training and discussions took place in Thailand, specifically at Maejo University (MJU) from the 20th to 23rd of June 2023. Here, the focus was on TVET programs, with updates on course implementation and the quality of educational materials. Additionally, a site visit was organized for the consortium members from MJU and a local waste plant, the *Energy Research and Development Institute of Nakornping*, providing valuable insights into the practical aspects of waste management in Chiang Mai.

TEVET Courses have been conducted in partners countries about the following topics and participants numbers:

CMU: 16th July 2023

Topic: Biogas technology: principle, design and operation; 42 Trainees, 34 Students and 8 participants form the Enterprise and Industry sector.

MJU: March- April 2023



Waste utilization non degree module; Organic waste treatment technology; 60 Trainees 13 Students, 27 Enterprises industries, 2 government sectors and 16 farmers, 2 others

HUAF: 17-18 May 2023

Agricultural Waste Utilization into Organic Fertilizer for Crop Production, Trainees: 36, Students/ Graduates: 23, Enterprise/ Industry Sector: 5 Government Sector: 5

TUAF: 18th-21st September 2023

Waste Classification and Organic Waste Treatment, Trainees: 72, Students/ Graduates: 4, Government Sector: 2, Farmers: 64, Others (e.g. Office Worker, Jobless): 2

RUA: 10th March 2023

Course Conducted: Compost Production for Sustainable Agriculture, Trainees: 44, Students/ Graduates: 31, Enterprise/ Industry Sector: 4, Others (e.g. Office Worker, Jobless): 4

USTH: 29th September - 14th October 2023 Course Conducted: Introduction to Solid Waste Management, Trainees: 19, Students/ Graduates: 19

In total number of Trainees: 273, Students/ Graduates: 124 Enterprise/ Industry Sector: 43, Government Sector: 9, Farmers: 80, Others (e.g. Office Worker, Jobless): 8

In June 2023, training and discussions were held at the UHST, involving both European and Cambodian partners. Topics of discussion included the contribution of compost business plans to local communities, the benefits of compost, and the sustainability of training hubs. This session aimed to explore ways in which the business plan for compost production could positively impact the local community and ensure the long-term sustainability of training activities.

The final meeting, held in January 2024, featured the SWAP award ceremony and included training sessions on the problems, challenges, and solutions in SWM, both in Asia and Europe. These sessions also addressed issues related to the implementation of courses, providing valuable insights into overcoming barriers in the field of SWM.

The selection of participants for training activities varied across partner institutions. In Thailand, at CMU, Bachelor courses were compulsory, while elective Master courses were open to all enrolled students. Information on courses was disseminated through social media platforms, targeting participants with qualifications in environmental engineering or related fields. At MJU, needs assessments were conducted within the community to identify training needs, with subjects selected based on community needs, resource availability, and policies. Similar needs assessments were conducted at Hue University of Agriculture and Forestry (HUAF), with a focus on identifying the specific requirements of the target audience. The selection of participants for TVET courses at TUAF was based on their interest in transitioning to organic farming practices or their current involvement in organic farming. At UHST, participants were students enrolled in the Environmental Science program.

The project significantly contributed to enhancing staff competencies and understanding of education policies, practices, and systems. New teaching and learning methodologies, especially problem-based learning and practical exercises, were introduced, improving staff competencies and enhancing



teaching and management practices within the consortium. Lecturers also gained skills in online teaching tools, such as *Mentimeter* and *Kahoot*, further enhancing their teaching capabilities.

The impact of training activities on student learning was evident through increased knowledge and awareness of SWM issues. Students appreciated the practical experience and problem-based learning provided during training sessions, along with the use of video clips and practical tasks. Feedback from students highlighted the need for improvements in visual aids, language clarity, and comparative information.

Governance reform

The governance reform within the project led to some institutional changes in several universities, focusing on the establishment of new training hubs. As a part of EU co-funded Erasmus+ program Capacity Building in Higher Education project SWAP, a training hub on "Solid Waste Management" has been established and operated at HUAF in Vietnam. The lab of SWAP training hub is located at the Department of Crop Science (30 m²). Another larger room is assigned to the SWAP Training Hub for seminars, workshops, or meetings (60 m²). Besides, the experimental site is implemented at the Centre for Agricultural Research and Services (18.000 m²), about 15 km from the main campus. In terms of equipment, we could exploit the available equipment from the University and the equipment funded by the SWAP project of Erasmus+ program. Presently, the SWAP training hub has been operated with the financial support from the University and SWAP project. After ending the SWAP project, its earnings for the projection for the next 3 to 5 years will come from fees from training activities; consultant and technology transfer services or research projects.

TUAF in Vietnam established the Solid Waste Management Training Hub with the support of Sustainable Solid Waste Management and Policy project (SWAP) in early 2023. As part of this endeavour, they have inaugurated the training hub at Thai Nguyen University, managed by the Faculty of Environment. This hub features an administrative office and a laboratory for experiments and training on the second floor of the Faculty of Environment building. The training hub is equipped with equipment including research tools, computers, and specialized tools for agriculture and forestry studies such as, Solid waste crushers, Biochar/AC production equipment (Incinerator), drone for waste volume estimation, an administrative room, a training room, computer and projector. The Training Hub operates under the guidance of the University Director Board and is managed by the Faculty of Environment. The faculty's lecturers and staff play a pivotal role in facilitating the training hub's activities. They actively contribute through short training sessions, public awareness programs, and seek collaborative opportunities with industry stakeholders. These dedicated efforts from the faculty members significantly support and enhance the operations and initiatives of the training hub. After ending the project, the finance for Training Hub's operation will also come from fees from training activities; consultant and technology transfer services or research projects. The staff are available from our university and may invite key stakeholders to involve in. The training hub is financially supported by the Mountainous Resources Environment Center and Faculty of Environment, Thai Nguyen University of Agriculture and Forestry.



CMU Thailand established a new training hub within the Department of Environmental Engineering, emphasizing solid waste management, waste utilization, upcycling, and environmental impact assessment. Furthermore, the Environmental Engineering Department secured a government budget to construct dedicated rooms and acquire equipment for the training hub. Construction is set to commence in April 2024. There is no need for specific staff arrangement as existing lecturers are capable of handling the training courses. The institutional level was not affected by any changes. However, it also supported the university internal regulation on solid waste management, especially waste from the dormitory as the university had about 700 students staying at the dormitory. On the faculty level, the project disseminated about solid waste management to academic staff and students also.

MJU, Variances in financial documents, processes, and regulations were identified between MJU and the country, highlighting the need for alignment and standardization. Financial support for the training hub during the SWAP project was provided by both the project itself and university funds. Post-project, operational finances will be sustained through fees generated by training activities, consultancy services, technology transfer, or research projects. University staff will be utilized for staffing arrangements, with key stakeholders invited to participate as necessary. The principal objective of the MJU training hub is to address environmental concerns related to the management of agricultural waste, with a concurrent emphasis on promoting sustainability for the community. The course content is designed to enhance and fortify the capabilities and competence.

At the UHST Campus in Cambodia, the training hub was established under the management of the Faculty of Agriculture. The office space of the training hub is 4 m*5 m, and the composting house size was 11m *22m. The UHST training hub resources, including training rooms, laboratory, computer, projector and IT system is located at the laboratory of the Faculty of Agriculture of the University. All lab equipment and tools including the existing one and equipment from SWAP budgets will be used during the training. The training hub was established to support the University by providing capacity building on solid waste management, including waste management technologies, building research partnership among relevant stakeholders, including students, farmers, agricultural cooperatives, agricultural communities, NGOs, entrepreneurs, relevant stakeholders and development partners. The equipment of the SWAP training hub provided by SWAP project funds under the Erasmus+ program. The equipment of the training hub are follows: high-end laptop, LCD projector, smart TV, compost house, double shaft shredder, extruder, wheel loader, screening machine, and other hand tools including sorting table, whiteboard, a set of wrenches, volt meter, personal protective equipment, cordless screwdriver, and a set of screwdrivers. No changes affected the institutional level even the establishment of the hub. However, it also supported the university internal regulation on solid waste management, especially waste from the dormitory as the university had about 700 students staying at the dormitory.

The training hub at RUA is located in the Center for Agricultural and Environmental Studies, which has sufficient space and equipment for the learning process and practices. There was also a physical space



set up: *CAES-RUA* set up a room to organize seminars or training courses in theory for about 100m² and a larger composting house for practice is about 140m².

In conclusion, the governance reform and institutional changes brought about by the SWAP project have not only established new training hubs but also fostered a culture of lifelong learning and environmental responsibility within the participating universities. These changes are instrumental in advancing sustainable waste management practices and contributing to broader environmental sustainability goals.

Links with society

The SWAP project was designed not only to advance academic knowledge but also to establish meaningful connections with society through collaborative efforts across partner institutions. These efforts aimed to address real-world challenges in waste management while fostering sustainable practices within communities. The Project produced a [video](#) to share the projects goals.

At CMU in Thailand, the Faculty of Engineering forged a partnership by signing a MOU with Tha Chiang Tong company, the owner of Ban Tarn Sanitary Landfill in Chiang Mai. This MOU facilitated collaboration in research and other academic activities related to waste management, ensuring stakeholder input.

Similarly, MJU in Thailand collaborated with Advanced Info Service Public Company Limited (AIS) to tackle e-waste management through a blockchain platform. This innovative approach demonstrated the university's commitment to addressing emerging challenges in waste management while leveraging technology for sustainable solutions and help raising an awareness from young generation.

In Vietnam, HUAF partnered with VIPESCO company to transfer technology related to organic fertilizer production from agricultural waste. This collaboration not only promoted sustainable agricultural practices but also contributed to reducing waste through effective utilization. Additionally, efforts were made across partner institutions to engage with private sectors and industry experts, although specific contracts were not detailed. These collaborations aimed to gather insights on solid waste management, business start-ups, and technical aspects, fostering networks and future cooperation opportunities for lecturers and students.

TUAF has signed agreements with several industry partners, including EJC Company and Khoi Nguyen Science and Technology Joint Stock Company, focusing on student training and research collaboration in waste management. This collaboration has resulted in offering 10-20 internships to students during the project period. Additionally, one employment fair were organized, drawing participation from numerous companies interested in recruiting graduates. Moreover, TUAF has established partnerships with local authorities and NGOs to implement community-based projects involving students in waste



management activities. These initiatives have led to tangible improvements in local communities and provided students with hands-on experience in tackling societal challenges.

Moreover, the SWAP project supported lifelong learning initiatives within the institutions by establishing six training hubs and offering courses related to solid waste management. In all, 15 training, information and awareness raising activities were delivered on the occasion of, or after the official inauguration of each training hub, involving over 1.000 people among university students, TVET learners, adults, citizens and informal workers and external stakeholders and decision makers. Others were developed and delivered even before, but are not counted here. The six training hubs and their participant rates are: CMU- Plastic waste segregation and circular based utilization (11 participants), MJU – Agricultural waste utilization (33 participants), HUAF – Solid Waste Management (112 participants), TUAF – Municipal Solid Waste Management (532 participants), RUA – Municipal Solid Waste Management (86 participants), UHST – Waste management through segregation and recycling (254 participants). This provided individuals with the opportunity to continually acquire new skills and knowledge, enhancing their employability and adaptability in a dynamic job market. For example, Agricultural waste utilization into organic fertilizer for crop production and Compost Production for Sustainable Agriculture.

Furthermore, the project facilitated the integration of education, research, and innovation, known as the "knowledge triangle." Through research activities, curriculum development, and technology transfer, higher education institutions generated new knowledge and implemented innovative practices in solid waste management. Collaboration agreements with non-academic stakeholders such as Tha Chiang Tong company, AIS, and VIPESCO company provided students with valuable opportunities for real-world projects, internships, and research activities aligned with industry needs. This practical engagement enhanced students' competitiveness in the job market upon graduation.

Institutionalizing these links with non-academic stakeholders was vital for ensuring ongoing cooperation in research, technology transfer, and other academic activities. MOUs and agreements formalized these collaborations, fostering sustained engagement with society. Also the raising awareness activities across all countries with students trained, public events and training at local schools ensured the outreach of the project and the universities in the partner countries. HUAF organized 3 events on raising awareness.

Thailand- Throughout the project, we hosted and organized numerous awareness-raising activities tailored to various audiences, including school students, university students, faculty and local communities. Maejo University (MJU) joined forces with Chiang Mai University (CMU) to celebrate the first SWAP dissemination event on September 14, 2021. The 2 Thailand-based institutions launched the first public event via Zoom meeting with 146 participants from various provinces. The opening remarks were given by "Top" Pipat Apiruktanakorn and "Noon" Siraphun Wattanajinda, the renowned actor and actress, as well as the executives of KidKid Co., Ltd., one of the leading "ECO" enterprises in Thailand. SWAP team Thailand; MJU, together with CMU, organized events and activities to raise awareness on solid waste management for school students and university students during Thailand National Science Day. The event was held at the Faculty of Science, Maejo University, from the 18th to



the 20th of August, 2022. This event not only gained a lot of interest from primary school, secondary school, and high school students to join the competition but also gathered a large number of participants - a total of 14,390 participants from schools in Northern Thailand. MJU hosted MJU Green & Clean food festival during 27-28 October 2022, with reaching the local communities and university staff and students around 10000 each day. Also, each year, MJU continually joined the event at Dara academy ChiangMai school. The topic for dissemination booth is related to waste management and raising the awareness of young generation on zero waste through a fun and hand-on activity, reaching over 1000 participants each year. CMU together with MJU organized Photo contest in the topic of waste your waste is such awaste to raise the awareness on young generation, with more than 25 participants from various audiences.

Looking ahead, ongoing efforts to engage with private sectors and industry experts aim to establish networks and foster future cooperation opportunities. This collaborative approach ensures that higher education institutions remain responsive to the evolving needs of society and the labour market, continuing to make meaningful contributions to waste management and sustainability initiatives. By adopting an open collaboration approach, these institutions remain agile and responsive to the evolving needs of society and the labour market.

Involvement of partners and stakeholders

The ongoing global pandemic of Covid-19 has posed significant challenges to collaborative projects worldwide, and the SWAP project was no exception. Despite the initial setbacks caused by the restrictions, alliance and work flow grew stronger after the opportunity for in-person meetings during the first train-the-local-trainer sessions in 2022, which was held in Vietnam. The face-to-face interaction fostered better communication, trust, and collaboration among partners.

The project benefited from the diverse range of topics and university experience brought from the partner insertions. Each partner university's unique strength and experiences, particularly in areas like agricultural waste management, contributed to a more comprehensive approach to addressing waste-related challenges. This led to the fact that due to the diverse backgrounds, some universities struggled with the implementation of new courses. For example, our Cambodian partners RUA and UHST did not have any waste related courses, and especially not related to plastic recycling and WEEE dismantling. Partners with less experience in certain areas were actively involved in collaborative efforts. This was facilitated through teaming up partner universities within countries and providing individualized support, including additional meetings, writing conscriptions, offering advice. We provided guidance, curated literature, and facilitated additional courses on topics such as waste management and creative commons licenses.

The Task Division and Responsibilities also played an important role in the involvement of partners, all partner institutions were actively involved in the project, with tasks and deliverables divided among them. While WP leaders had greater responsibility, every partner played a significant role in the project implementation. The diversity within project teams, both in terms of expertise and working cultures, was recognized as both a strength and a challenge. Efforts were made to ensure everyone was on the



same page through detailed task information dissemination via platforms like Telegram and arranging individual meetings as needed.

Furthermore, we asked the Asian partners how the European partners contribute to the project. They answered that the European partners played a pivotal role in the SWAP project, bringing invaluable expertise and resources to the table, thus significantly enhancing its outcomes and impact. With four EU partners actively engaged, each assumed the role of a (WP) leader, spearheading various aspects of the project with commendable proficiency. TUHH took on the coordination role and lead in WP 7, whereas WP2 consisted of EUROtraining, WP 4 consists of IFOA and the WP related to Quality (WP 5) was led by POLIBA. WP 3 and WP 6 was led by our Asian partners.

TUHH and POLIBA as universities provide courses on technical aspects on waste management. The representative assumed key roles as trainers during the “train the trainers” events, imparting invaluable knowledge and skills to project participants. EUROTRAINING enriched the training sessions as VET organizations with high expertise in education of adults. IFOA is also a VET organization with high expertise in adults training (37000 trained people, 108 international collaborations and collaboration with 1694 companies). They trained-on management aspects, technical vocational trainings, encompassing feasibility studies, economic analyses, risk management, and project planning, as well as lectures about safety and circular economy aspects. Leveraging their rich professional backgrounds and training acumen, these partners ensured that all courses and training materials were meticulously crafted to meet the project's objectives. Moreover, the European partners introduced cutting-edge technologies in solid waste management, encompassing processes such as source separation, recycling, treatment, and waste-to-energy conversion. These innovative solutions hold immense potential for revolutionizing waste management practices in Southeast Asian countries like Vietnam, Thailand, and Cambodia, fostering sustainable development and environmental stewardship.

Beyond technological advancements, the European partners facilitated international collaboration and networking opportunities, leveraging their extensive connections within academic and professional circles. By fostering partnerships and alliances across continents, they provided access to invaluable resources, expertise, and collaborative ventures. This global network not only enriched the project's outcomes but also paved the way for future collaborations and initiatives. In essence, the contributions of the European partners have been instrumental in ensuring the success and sustainability of the SWAP project. Their expertise, resources, and collaborative spirit have not only elevated the project's outcomes but also laid the foundation for enduring partnerships and transformative change in waste management practices on a global scale.

The involvement of public authorities responsible for solid waste management in Chiang Mai province and throughout Thailand has been integral to the success of the project, as these stakeholders provided invaluable insights, recommendations, and requirements essential for identifying the current landscape and needs in solid waste management. Within WP1, these stakeholders actively participated, offering their perspectives and expertise to inform project activities and priorities. Notably, the opinions of public authorities played a significant role in shaping the training topics



offered by the training hub and TVET programs at CMU highlighting their influence in driving the project's direction.

Furthermore, public authorities engaged in various outreach initiatives, including participation in public events, non-degree courses, and the training hub. By actively promoting these activities and facilitating community involvement, public authorities fostered widespread participation and awareness in waste management efforts. Additionally, collaborative efforts with the research team on agricultural waste management further emphasised their commitment to addressing multifaceted challenges in waste management comprehensively.

In Vietnam, public authorities including Environmental Protection Agency on provincial and commune levels participated in public awareness raising activities of the project.; Also, they contributed financially to the project through grants for TVET training. At the national level, we have coordinated nationwide awareness campaigns to educate citizens on waste management practices, emphasizing the importance of the 3R principles (reuse, recycle, and recover) and environmental conservation. Moreover, the enforcement of regulations has been emphasized, with national, regional, and local authorities collaborating to propose and enforce regulations aimed at enhancing waste management effectiveness and compliance.

Similarly, in Cambodia, public authorities at the national level, particularly the Department of Higher Education under the Ministry of Education, Youth, and Sport, played a pivotal role in supporting the project's objectives. Their involvement extended to curriculum development, conducting annual assessments, and providing vital support for quality assurance initiatives. Their participation in project meetings, including the final meeting in Chiang Mai, highlights their commitment to project outcomes and their role in shaping the future of waste management education and practices in Cambodia.

Overall, the active engagement of public authorities across Thailand, Vietnam, and Cambodia shows the collaborative nature of the SWAP project and its alignment with national priorities and objectives. Their contributions, both in terms of expertise and financial support, have been instrumental in driving the project's success and ensuring its sustainability beyond its implementation phase.

The engagement of students and various external stakeholders has been instrumental in shaping project management and implementation across multiple institutions within the SWAP project.

Chiang Mai University (CMU), Thailand:

- **Public Authorities:** Four public authorities actively contributed opinions, comments, and requirements, aiding in identifying gaps and necessary requirements in waste management.
- **Industries:** Three representatives from industries provided valuable insights, comments, and requirements, contributing to the identification of gaps and needs in waste management practices.
- **Solid Waste Management Companies:** Two companies offered opinions, comments, and requirements, assisting in the identification of gaps and necessary resources in waste management.



- **University Students:** A significant cohort of 129 university students participated by taking courses, testing teaching materials, and providing evaluations, thereby offering valuable feedback for course improvement.
- **School Students:** Three school students engaged in testing teaching materials and providing evaluations, contributing to the refinement of educational resources.
- **Other Participants:** Sixteen individuals, including community members, government representatives, and municipal officials, participated in courses, tested teaching materials, and provided evaluations, enriching the project's implementation through diverse perspectives and feedback.

Majo Universtiy (MJU), Thailand:

- **Students:** Engaged in learning, utilizing teaching materials, and evaluating courses and training hub offerings.
- **Alumni:** Utilized teaching materials and equipment for training hub and non-degree courses.
- **Informal Workers, SMEs, and Farmers:** Engaged in learning, utilizing teaching materials, and participating in training hub and TVET courses.
- **School Students:** Involved in learning, utilizing equipment, social platforms, and awareness-raising activities through posters.

Hue University of Agriculture and Forestry (HUAF), Vietnam:

- **Education and Awareness:** Organized training programs to introduce students and stakeholders to solid waste technologies and environmental impacts, while also engaging in awareness campaigns within universities and surrounding communities. Engaging students in proposing and implementing awareness campaigns within their universities or surrounding communities to spread information and encourage community 's responsibilities related to solid waste management
- **Participatory Planning:** Conducted workshops, meetings, surveys, and interviews to gather feedback and insights from students and stakeholders regarding potential challenges and opportunities in waste management.

Thai Nguyen University of Agriculture and Forestry (TUAF), Vietnam:

- **Public Authorities:** They actively engaged in public awareness campaigns and allocated financial support through grants specifically designated for Technical and Vocational Education and Training (TVET) programs.
- **Industries:** Industries offered valuable insights, feedback, and specific requirements, aiding in the identification of gaps and needs within waste management practices. Signing MoU to collaborate in training for TUAF students
- **University Students:** Both undergraduate and graduate students actively participated by attending courses, providing evaluations, and offering constructive feedback for course enhancement. Additionally, they engaged in public awareness activities and contests. The



student environmental club continues to maintain public awareness initiatives even after the project concludes.

- Other Participants: Farmers and local staff participated in TVET training sessions and provided evaluations, enriching the project's implementation with diverse perspectives and feedback.

University of Heng Samrin Thbongkhmum (UHST), Cambodia:

- **Students:** Participated in academic and TVET programs, received developed courses, applied problem-based learning, and practical exercises during their studies, and were evaluated for their contributions. A total of 19 students enrolled in academic programs and 20 students in TVET programs actively participated.

Looking ahead, the partnership shall continue in the future. We embark on new projects spanning Germany, Cambodia, and Thailand. The project website continues to serve as a hub of information, while the HOOU Platform and all Online Teaching material remains as a resource for ongoing initiative. The training hubs will be running in the future and exchanges and MOU are signed within partner countries.

Management of the grant

In the dynamic landscape of international collaborative projects, managing grants poses a multitude of challenges, ranging from administrative hurdles to cultural differences. The first challenge arose from the substantial workload associated with documentation and form-filling across all partner organizations. The process demanded particular attention to detail and unexpected labor intensiveness. Additionally, opening national tenders to procure equipment in Cambodia presented procedural hurdles. However, proactive measures were taken to streamline the process, ultimately resolving the issue.

One of our partners, COMPOSTED from Cambodia, underwent a name change mid-project. From the name COMPED to COMPOSTED. This seemingly minor alteration posed a significant obstacle as it hindered fund transfer procedures due to discrepancies in the EACEA online platform. Procuring large equipment, such as a wheel loader for the RUA, presented unique challenges. Ensuring the functionality of training hubs necessitated additional funds for constructing shelters to protect the equipment. Overcoming this obstacle required resourcefulness and strategic planning to allocate funds effectively while ensuring project continuity. The results of the external evaluation underscored the nature of reporting and administrative tasks, compounded by language barriers and diverse work ethics among consortium partners. To address these challenges, regular project meetings, known as Management Board (MBM) meetings, were convened monthly. These sessions facilitated the exchange of vital information and fostered a sense of collaboration and transparency among partners. Whether conducted online or in-person alongside teaching activities, these meetings served as crucial forums for resolving issues and aligning efforts. Leveraging modern communication tools proved instrumental in fostering seamless collaboration. Telegram, a cloud-based messaging service, emerged as an informal yet effective platform for real-time communication among project members. This agile



approach complemented traditional email correspondence, enabling swift dissemination of information and facilitating timely actions.

Challenges in the project have been identified as:

- **Slow Responsiveness:** Some partners exhibited delays in their responses, hindering the pace of project activities and decision-making processes.
- **Language Barriers:** Language differences posed a challenge to effective communication, requiring concerted efforts to bridge gaps and ensure clarity of understanding.
- **Underutilization of Online Learning Platforms:** The online learning platform saw limited usage, suggesting the need for greater promotion and training to maximize its potential for knowledge dissemination.
- **Delays in Deliverables:** Instances of delays in delivering results were noted, highlighting the importance of adhering to timelines and implementing strategies to mitigate setbacks.
- **Documentation Burden:** The excessive requirement for documentation and reporting imposed a significant administrative burden on consortium members, necessitating streamlined processes and clearer guidelines

We did overcome those challenges with a variety of solution and have some recommendations for enhanced Cooperation:

- **Increased Engagement with Work Package (WP) Leaders:** Facilitating more frequent meetings with WP leaders can enhance alignment and coordination within the consortium, ensuring clarity of objectives and responsibilities.
- **Prioritization of Face-to-Face Meetings:** Recognizing the importance of face-to-face interactions for fostering mutual understanding, efforts should be made to facilitate such meetings whenever feasible, allowing for more effective communication and relationship-building.
- **Enhanced Personal Contact:** Both formal and informal personal interactions should be encouraged to strengthen relationships and promote trust among consortium members.
- **Improved Communication Channels:** Embracing fast and efficient communication channels, such as social media platforms like Telegram and WhatsApp, can expedite information sharing and decision-making processes.
- **Wider Stakeholder Involvement:** Involving stakeholders from the community, NGOs, and the private sector can enrich collaboration, bring diverse perspectives, and enhance the relevance and impact of the project.
- **Advocacy for Better Support:** Advocating for improved support from funding agencies like EACEA can alleviate challenges and provide necessary resources for effective project implementation.



- **Increased Travel Opportunities:** Allowing for more travel days to partner countries can foster deeper understanding, cultural exchange, and stronger partnerships, facilitating smoother collaboration and project outcomes.

By addressing challenges, implementing recommended strategies, and fostering a culture of collaboration and innovation, we can optimize cooperation and maximize the impact of our collective efforts. Managing grants in international consortium projects entails navigating a complex landscape including challenges. However, through proactive problem-solving, effective communication, and collaborative efforts, these challenges can be overcome, leading to successful project outcomes.

IMPACT AND SUSTAINABILITY

Impact

The impact of the project resonates deeply at various levels, ranging from institutional advancements to individual growth, and even extends to national and regional spheres, fostering collaboration and knowledge exchange. In the partner institutions across the different countries of Cambodia, Thailand and Vietnam, the project has left a profound impact, evident in both institutional advancements and individual development. Each institution has witnessed tangible progress, with the implementation of new courses, initiatives, and facilities.

CMU: All the courses developed in the project have elevated the overall quality of CMU's curriculum in the solid waste management field. Wider range of current and up-to-date courses have become available to different student levels, i.e. Bachelor, Master, TVET and short to middle course trainings. The combination of lecture and practical activities using newly acquired instrument has significantly increased student engagement. The Department of Environmental Engineering has now been granted by the government with budget to construct the new training room, which should enable the department to become the leading training hub, especially in the plastic upcycling area. Also, a proposal for the joint funding research has been developed with MJU and TUHH for the production of bio-plastic from agricultural waste, which shows the positive impact of the SWAP collaboration.

MJU: the curriculum with educational products for university graduates (master and bachelor levels), vocational trainees and informal workers were developed and implemented. These curriculums were all accredited by university authority and continue to be used for teaching students in the field related to solid waste management and improve graduates 'employability. Research related to waste management have been conducting and have further collaboration for research funding, ie CMU-MJU_TUHH project proposal development on bio-plastic as well as staff and students exchanges between asian and EU partners. MJU training hub continues to conduct programs on agricultural waste management and domestic waste management for different target audiences such as student university, alumni and local communities.

UHST: The project played a key role in supporting the university's curriculum, and built the capacity of academic staff, particularly the lecturers who take lead on the courses approved under the support from SWAP. This led them to improve their field of expertise in waste management with problem-



based learning exercise and practical exercise provided to support their teaching and learning activities. In the training hub, where the student planned to start up business plan in the field of compost making at the university campus. This also support to the educational policies where they could be able to earn money during the BA study. The following are the key supports from the SWAP: Modernized curriculum, Set up course syllabus and teaching materials, Integrated courses to programs (Agricultural Economics and TVET program), Provided material for conducting business plan and implemented compost making, Set up rule and dissemination about solid waste management to students and lecturers, Provided training to students and lectures.

HUAF: 1. Institutional level: The SWAP projects provide valuable educational opportunities for students and staff to learn about environmental issues, solid waste reduction strategies, and sustainable practices. This can be integrated into academic curricula, research projects to help students and staff implement knowledge in practical problems 2. Individual level: Engaging in waste management activities provides students with hands-on learning experiences, allowing them to develop practical skills in waste reduction, recycling, recovery and composting 3. Regional level: Waste management projects foster community engagement and collaboration among different stakeholders within the region, including universities, businesses, non-profit organizations, and local communities. This promotes social integration, mutual support, and collective action towards common environmental goals.

TUAF: Through the project, TUAF lecturers were trained in new technologies in waste management, promoting practical training and project-based learning approaches. This has resulted in a transformation in teaching methodologies in waste management, fostering more dynamic and engaging educational experiences. Additionally, students have shown increased interest in the project, leading to greater participation in research and thesis projects related to waste topics. The university has also prioritized waste research, allocating grant funding for scientific research and fostering collaborations with companies to promote practical training and facilitate job recruitment in this field.

For students and staff members participating in the project, the impact has been transformative, offering enhanced learning opportunities, skill development, and exposure to innovative practices in waste management and related fields. On a broader scale, the project has catalysed networking and collaboration among organizations, associations, and institutions within the partner countries. This has led to the establishment of robust partnerships, facilitating the exchange of knowledge, resources, and best practices in waste management.

To measure the project's long-term impact, partner institutions have devised comprehensive metrics, focusing on student enrolment, course offerings, and ongoing monitoring and evaluation mechanisms. Targets have been set for student enrolment in bachelor's and master's degree programs across partner institutions, ensuring sustained engagement and uptake of newly introduced courses. In 2025 the courses shall reach in HUAF 75 students, TUAF 20, CMU 80, MJU 40, RUA 50 and UHST 30 students. Moreover, ongoing monitoring and evaluation structures, including feedback mechanisms embedded within lectures, enable continuous assessment and refinement of project outcomes. The project has gathered significant attention and recognition within partner institutions, facilitated by social media outreach, guest lectures, and collaborative initiatives. New courses introduced as part of the project



have enriched the academic curriculum, attracting interest from students and stakeholders alike. Internal visibility has been enhanced through the establishment of training hubs and the development of teaching materials, reinforcing the project's impact within institutional settings. The project's influence extends beyond academic circles, due to the participation in an international context. Influencing policy discussions, due to the discussion and invitation from local municipalities to the events and partnership between them and the consortium. As well as public awareness campaigns, in schools and farmers and industry practices at the national and regional levels. Collaborations with ministries, NGOs, and private sector entities have yielded tangible outcomes, including the initiation of additional projects and the promotion of sustainable practices such as Zero Waste activities. International visibility has been heightened through partnerships with universities in Asia and Europe, culminating in conference attendance, MoU agreements, and publications. The project's main benefits are reflected in the expansion of knowledge, the implementation of new courses, and the establishment of training hubs equipped with state-of-the-art facilities. Public awareness of waste management issues has been raised, while demand for specialized training, particularly in the farming sector, has surged. Through collaborative efforts and sustained engagement, the project has laid the groundwork for enduring partnerships, knowledge dissemination, and impactful interventions in waste management practices, both locally and globally.

Dissemination

The SWAP project has implemented dissemination activities to reach diverse stakeholders and maximize the project's impact. With a strategic communication strategy spanning three phases from 2021 to 2024, the project has effectively promoted its objectives, engaged stakeholders, and ensured sustainability beyond its duration. On a global scale, the project did achieve wide outreach through its social media accounts different groups. The geographical location from people who visited our website beside our project countries are India and Turkey. Additionally, the SWAP website will be moved from the servers from TUHH to MJU servers in Thailand to ensure accessibility and regular updates, facilitating usage by Asian universities after the project ended. To ensure the visibility of the projects activities, different social media platforms have been used too, such as Facebook, LinkedIn, Twitter and Instagram. Through those platforms, the project has seen substantial growth and engagement. For instance, in January, Instagram gained 158 followers, with a post reach of 493 clicks and an engagement of 204. Over the years, significant growth has been observed, with Facebook and Instagram reaching 8,155 views and 2,104 reaches, respectively, by January 2024. Analysis reveals that visitors to the platforms comprised 38.60% men and 61.40% women. Noteworthy to this success have been campaigns like the "Trashtag Challenge", in which project partners will post a before and after picture of a space that they cleared from litter. The challenge started on the Earth Day, on 22nd April and lasted for one week. The challenge was to collect waste/litter on public places and post a before and after collection picture. Hashtags have been used and also other companies, friends, and schools have been linked to the project. #trashtagchallenge #trashtag #SWAP #Earthday #SWAP #Erasmus+ #Waste #Litter #Environment.

On social media, the project team presented the different activities like, various training activities and workshops across partner locations, enhancing participants' knowledge and skills in waste



management. Additionally, train-the-local-trainer sessions held in Hanoi (2022), Phnom Penh (2022), Bangkok (2022) and Nikom Leu village (2023) were also presented on social media. Furthermore, T-VET training has empowered participants with practical skills.

A range of local public events, both online and in-person, have been pivotal in disseminating project outcomes. The project's Asian kick-off meeting in September 2021, held virtually due to the pandemic, set the stage for subsequent activities. Post-pandemic, in-person meetings and trainings resumed, such as the TVET training on agricultural waste utilization with 42 participants in Thailand. A Training Workshop on Waste Management and Compost Recycling held in Svay Leur District (Siem Reap, Cambodia) in December 2022 attracted participants from UHST and other partner universities. Beside other public events and campaigns took place on a local level like the "SWAP Waste to Artwork", which have garnered participation from schools, companies, and communities, fostering awareness and engagement. And a SWAP Photo challenge from Nov-Apr 2023 under the Title "wasting your waste is such a waste" students could win a prize when they handed in a creative idea. One of 25 Applicants a winner was picked. The Erasmus days 2023 in September took place in Greece and EUROtraining present and disseminated the project on a local level. The German "Girls Day" in April 2022 was used to disseminate the project under 125 school kids in the Hamburg university of Technology (TUHH), in which the girls had the opportunity to get to know technical topics, explore the university campus and activities, and get education about waste management and the international project SWAP.

In October 2023 the 19th international symposium on waste management and sustainable landfilling took place. Researchers from all around the globe participated there, and the partners from TUHH, POLIBA and IFOA presented our project in a workshop called "Waste Management in South-eastern countries". This was a great opportunity to enlarge the SWAP network and disseminate the project in the academic and industries world. Three publications have been written and published.

- "Capacity building in municipal solid waste management in Asian countries of Vietnam, Cambodia and Thailand: the state of the art and the case of Erasmus+ "SWAP" project".
- "Achieving sustainability in capacity building projects: sharing educational products and tools in the SWAP project".
- "Discussing the possibility of extending the European vision on solid waste management to the Asian countries of Vietnam, Cambodia and Thailand".

Participation in this international conferences and cluster meetings has broadened the project's reach and facilitated knowledge exchange. The project was represented at the Erasmus+ cluster meeting in Thailand and Vietnam (October-December 2023), where partners presented outcomes and networked with other institutions. The European Education and Culture Executive Agency conference in Hanoi (November 29-30, 2023) provided insights into policy contexts and future collaborations. Additionally, participation in the Erasmus+ cluster meeting in Bangkok (October 2, 2023) facilitated networking opportunities among Thai Higher Education Institutions involved in Capacity Building in Higher Education projects.



Other's dissemination measures taken were the website was developed, different roll-ups have been printed, as well as posters to ensure the visibility of the project. Also, SWAP t-shirts were printed, with the prior approval of the EACEA. The t-shirts have been given out to the trainers and will be reused to signal who is part of the teaching staff and ensure the recognition of the trainer, for example in the training hubs. Also, videos have been produced to ensure the projects visibility and it was used as dissemination material.

In conclusion, the dissemination activities of the SWAP project have been characterized by meticulous planning, strategic execution, and tangible outcomes. By leveraging social media, conducting training sessions, organizing public events, and participating in international conferences, the project has effectively communicated its objectives and achievements. These efforts have not only enhanced stakeholder engagement but have also laid the groundwork for long-term sustainability and impact in promoting sustainable waste management practices across partner countries and beyond.

Sustainability / exploitation of results

To ensure the sustainability of the projects, outcomes beyond the projects lifespan different steps have been taken into consideration and one report about the sustainability and exploitation of results has been written (D 6.4). Different target activities have been implemented, during 3 years, all partners developed and implemented academic courses at master, bachelor and TVET level. The SWAP curricula are 1) Introduction to Sustainable Solid Waste Management and Circular Economy, 2) Secondary Raw Materials Life Cycle - A Circular Economy for Resources, 3) Technical Aspects of Waste Management and 4) Advanced Waste Management Aspects in a Circular Economy. We launched the open online management system (HOOU), started the training hubs inauguration related business models and educational policies form the informal sector. Furthermore different public events, raising awareness activists and project dissemination on official website and social media platforms have been organized. To continue these activities and make the project sustainable is a challenge for all partner universities. A lack of funding, staff and time is seen as the most challenging parts. The main targets the exploitations strategies are thereby.

- 1) Continuation and further development of the SWAP curriculum and its principal outputs
- 2) The expansion and development of the established collaboration among European and Asian Higher Education Institutions (HEIs), as well as the engagement of other stakeholders throughout the project
- 3) Expanding cooperation between HEIs and relevant solid waste and informal workers businesses.
- 4) The exploitation strategy aims to realize the aforementioned objectives within the project's geographic scope and extending beyond it.

The targets audience of these activities is the

- *Academic staff* like researches, academics, teaching staff, innovation centre and services.
- *Citizens*, community and young generation.



- *Businesses*, for example industry and agencies and private and public organisation/NGOs as well as *cities*, from Asian partners, European partners, stakeholder/policy makers.

To ensure the sustainability of the project, the study program's developed curricula was all accredited by university authority. The developed curricula continues to be used for teaching students in the field of swm and improve graduates employability. The curricula, however, goes through updates and improvements every 5 years and 3 years for bachelor's degrees and master's degrees, respectively. To understand their needs and preferences for making continuous improvements, feedback from current perspective students and also other stakeholders are gathered.

Another strategy for the projects sustainability is the implementation of internship programs for students within government, private, sector, NGOs, community organizations or other Asian and EU partners university. We already had a student's exchange with CMU – TUHH and going to extend the MoU between MJU-RUA in 2024. These internships are demonstrated through the signing of MoU between the university or study program and respective institution. Beside the academic courses, also 12 TVET courses were developed and implemented. The TVET courses are stored on the HOUU platform in both national language and English to attract broader audiences. In 2022 and 2023, one TVET course of each Asian partners was organized and attracted more than 90 professionals from graduates, alumni, local industrial businesses/farmers per round. Their long-term impact, will be highly relying on the collaboration with industry partners to provide employment and also to improve the TVET courses. A good collaboration and capacity building from local training institutions and linkages with relevant government policies secure the ongoing support and achieve the number of participants. Furthermore, the establishment of training hubs within partner universities, serve as centers of excellence for vocational education and training in waste management. By integrating vocational courses with industry collaboration and entrepreneurship opportunities, the universities ensure the continuity of training beyond the project's duration. Moreover, the vocational courses offered through these hubs are designed to meet industry needs, thereby enhancing the employability of graduates. Partner universities have implemented robust public relations strategies, including dissemination activities and social media campaigns, to ensure continued awareness of the project outcomes. By consistently showcasing their achievements and engaging with stakeholders, the universities reinforce the project's credibility and relevance, thereby maximizing its long-term impact.

Besides the academic courses and TVET courses, marketing strategies and community outreach efforts play a crucial role in sustaining the project's impact. Partner universities have developed comprehensive marketing plans encompassing both online and offline channels to promote their academic programs, this will be continued in the future. Furthermore, partnerships with local schools, colleges, and community organizations increased awareness about waste management and education opportunities. By engaging with the community, the universities not only attract potential students but also foster a sense of ownership and support for the project's objectives. The project has achieved a multiplier effect through various initiatives aimed at amplifying its impact beyond the immediate target group. Coverage in local news and newspapers, organized visits to waste management plants (in Thailand, Cambodia, Vietnam, Germany), collaboration with NGOs and local stakeholders, and



engagement of local authorities and businesses in project activities have all contributed to expanding the project's reach and influence. These efforts have not only raised awareness about waste management issues but have also fostered partnerships and collaboration, thus multiplying the project's impact manifold. Partnerships with non-university stakeholders are crucial for ensuring the sustainability and scalability of project outcomes. These agreements outline mutual support and collaboration frameworks, ensuring that the project's benefits extend beyond the academic area. Moreover, non-university partners are actively involved in project activities such as dissemination, participant application, and evaluation, further strengthening the partnership and maximizing the project's impact. For example in the final SWAP event, a jury of European partners and Asian representative from the local municipality, evaluated the projects from Asian partners and selected the winners for the swap award and rewarded them with 1st, 2nd and 3rd price.

Concrete achievements include the development of accredited curricula, implementation of vocational courses, and sustained efforts in maintaining project visibility and relevance. The sustainability of the SWAP project outcomes is ensured through a multifaceted approach encompassing academic excellence, program diversity, affordability, effective marketing, vocational training, maintenance of project branding, and public relations. By leveraging these measures and fostering partnerships with non-university stakeholders, the partner countries maximize the project's long-term impact and contribute to sustainable waste management practices regionally and globally.

Unexpected outcomes/ spin-off effects

The implementation of SWAP has yielded diverse and unexpected outcomes across the participating universities. These outcomes span from academic collaborations to skill enhancement and entrepreneurial ventures, showcasing the project's multifaceted impact.

(CMU) Thailand: The project facilitated collaborative efforts between CMU and the Technical University of Hamburg (TUHH) through student exchange programs. Notably, a PhD student from CMU's Department of Environmental Engineering conducted a three-month research stint in TUHH's laboratory in early 2023. This exchange fostered cross-cultural learning and enriched research endeavors, contributing to the global knowledge pool in environmental engineering.

(MJU) Thailand: MJU project lead to additional research funding opportunities and expand its reach in future waste management initiatives. The project acted as a catalyst for securing research grants and establishing partnerships with relevant stakeholders, thereby enhancing MJU's research capabilities and influence in the field of waste management.

(HUAF) Vietnam: HUAF observed significant benefits for its students, particularly in terms of skill enhancement. Participating students gained valuable experience in project management, data analysis, and environmental assessment, augmenting their employability prospects. This skill development not only benefited individual students but also elevated the university's reputation, making its graduates more attractive to potential employers.



(TUAF) Vietnam: TUAF's establishment of a training hub emerged as a promising model for future initiatives within the institution and the wider academic community. This innovative approach to training and capacity building could serve as a blueprint for fostering efficient collaboration frameworks between universities and non-academic sectors, contributing to sustainable development goals.

(UHST) Cambodia: UHST reported an unforeseen positive outcome where students engaged in non-degree programs, specifically TVET, persisted in their compost-making businesses even after the conclusion of the project. This resilience demonstrated the sustainability and entrepreneurial acumen instilled in students, extending beyond the project's duration. By generating income through their businesses, students were able to support their studies and contribute to their communities' waste management efforts.

The project has resulted in positive outcomes that extend beyond its initial objectives. These outcomes include enhanced graduate employability, strengthened academic-industry collaborations, innovative training models, and sustainable entrepreneurial ventures. The project's unexpected outcomes show the importance of interdisciplinary collaboration and community engagement in addressing complex environmental challenges.

