

Deliverable 4.4

TRAINING HUBS FEASIBILITY STUDIES

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Training Hubs feasibility studies

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INTRODUCTION

Project SWAP openly addresses capacity building of partners based in Cambodia, Thailand and Vietnam with regard to developing the Higher Education sector within society at large, by pursuing two main regional thematic priorities:

- 1. university-enterprise cooperation, entrepreneurship and employability of graduates; and
- 2. definition, implementation and monitoring of the reform policies.

Thanks to its multi-actor approach based on a quadruple-helix structure, SWAP aims at the improvement of knowledge, competences and skills in the field of solid waste management by:

- developing modern teaching and learning technologies and tools, including specific methods required to address the needs of specific target groups in Southeast Asia;
- providing governance models, to modernise, increase and sustain the quality of institutions in the Higher Education sector.

The first priority above is addressed either by developing educational products at different levels and by establishing regional "Training Hubs for Sustainable Solid Waste Management and Policies", physical places where training can occur, services can be delivered, and Academy, VET and the labour market can meet and cooperate, in a true multi-stakeholder environment, well beyond the project duration. Such spaces are intended to support the multi-stakeholder approach of the project: academy professors and researchers, VET trainers, students will access and exploit the OOLMS (Open Online learning Management System, that is, the learning platform of the project), while universities, training providers, local institutions, companies and associations will cooperate to physically start the Training Hubs and govern them, complementing technical contents with the topics of sustainability, occupational health, emission control, safety issues and business creation in the sector, overall increasing the knowhow and skills of the graduates in the sector.

This deliverable explores the concrete feasibility of 6 Training Hubs, 2 per partner country in Asia. It is a direct output of Task 4.2, and is composed by 6 feasibility studies, one per Training Hub. Each study follows a common pattern (index of content), but is declined according to strategic choices made by each Asian country partners. In any case, each study states for each Hub-to-be, at least: needs analysis, risk analysis, goals, training and/or services offered, resources required (human, premises, material, equipment, time, etc.), business plan (including as a minimum costs foreseen, funding sources and budget recovery plan), indicators of success, monitoring and evaluation plan.

Training Hubs have been designed by conveying indications and experience coming from the EU partners (e.g. quality standards, management procedures, etc.) and needs/requirements driven by local contexts in Vietnam, Cambodia and Thailand. The design process follows a full PDCA approach, starting from the needs analysis embedded in previous project activities, and keeping into account quality standards the Hubs should fulfil. At this stage, partners started defining goals and indicators of success (e.g. number of training courses delivered vs. proposed, expected number of participants, etc.), followed by a first, overall identification of tasks, programmes, services to be delivered. In this phase, a number of strategic choices were made by the Asian partners, regarding e.g.:

- the scope of each hub;
- the structure, role and responsibilities of players participating in governance bodies;
- the resources required: human, premises, financial sustainability, etc.

Downstream this planning phase, partners will go on further detailing their Hubs, like for example refining the number and type of programmes to be delivered, a forecast on the number of participants, and –most important– of funding sources. In parallel with the above, governance teams will be built, ideally representing all typologies of stakeholders involved. Their work will be supported not only by guidance from EU partners, but also by management guidelines which will represent the subsequent project deliverable D4.5. Then, the Asian partners will immediately start the design and preparation of their programmes, the search for potential participants/students, and the corresponding advertisement campaign. This will allow for a more precise dimensioning of the number of training courses and services that will be delivered. Functioning and results will be monitored by governance bodies (that will also include associated partners, on a voluntary basis), and will end up in a Report on implementation and functioning of training hubs (deliverable D4.6) which will also be a tool for sustainability, providing for information and suggestions for reviewing the full model and for future development.

In the development of the feasibility studies, partners interacted most in the starting, and in the collection and review phases, to ensure comparability among the 6 different documents. However, each study was developed independently by the corresponding partner.

In all countries, each University chose the leading domain for the corresponding Training Hub, based on own specialisation and skills and on the local, regional or national needs and development priorities. Corresponding criteria are described in each study. More in details, the 6 hubs will specialise as follows:

| Country | University | Training Hub domain | |
|-----------|--|--|--|
| Carebadia | RUA – Royal University of Agriculture | Municipal Solid Waste Management | |
| Cambodia | UHST – University of Heng Samrin Thbongkhmum | Waste management through segregation and recycling | |
| Thailand | CMU - Chiang Mai University | Plastic waste segregation and circular-based utilization | |
| | MJU - Maejo University | Agricultural waste utilization | |
| | HUAF - Hue University of Agriculture and Forestry | Solid Waste Management | |
| Vietnam | TUAF - Thai Nguyen University of Agriculture and Forestry | Municipal Solid Waste Management | |

Each study is available in English and in the national language of the correspondent counties, and will form the basis for gaining consensus and commitment by all shareholders, investors, donors who will physically "set-up" the Hubs (finding the rooms/buildings, buying/renting furniture and equipment, hiring workers, etc.).



RUA Training Hub Municipal Solid Waste Management Feasibility Study

English version

Training Hubs feasibility studies



RUA Training Hub

Municipal Solid Waste Management Feasibility Study

| Project Acronym | SWAP |
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ABSTRACT

Municipal Solid Waste (MSW) is a growing problem in developing countries as the population increases and more waste is generated every day. The waste is composed of many different components; however, at least 60% of it is food waste that can be converted into valuable products. This helps to reduce the amount of waste, reduce the environmental impact and generate income. One of the promising waste utilization technologies is composting, which can convert food waste into fertiliser for crops. However, suitable composting technologies are not widely available, or it is usually carried out only with crop residues. Technical assistance in making compost from municipal solid waste is key to raising awareness of waste management and changing people's behaviour in dealing with waste. Therefore, the RUA -Training Centre was established with the aim of providing training in the field of waste management and, in particular, compost production. The scope is not only limited to training, but also focuses on providing technical knowledge, skills, advice and extension services to all individual farmers, farming communities, NGOs and related stakeholders to maintain the functionality of the centre. Taking into account social, economic and environmental aspects, the establishment of this centre will have many positive impacts that will ultimately contribute to better waste management in line with the country's policies.

KEYWORDS

Composting, Food waste, Municipal Solid Waste, Fertilizer, Cost-benefit, Business Plan.

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1 Need Analysis

Municipal solid waste (MSW) is considered one of the major challenges in developing countries (Singh et al., 2018). In 2020, global solid waste generation is expected to be around 2.24 billion tons, with an average weight of 0.97 kg/person/day. This figure is expected to increase by 73% from 2020 to 3.88 billion tons in 2050 (World Bank, 2020). There is a strong correlation between the increase in municipal waste and the growing population (Supangkat and Herdiansyah, 2020). Improper management of MSW can lead to soil, air, and water pollution, health problems, and greenhouse gas (GHG) emissions. When landfills are not properly sealed, leachate - a liquid pollutant - seeps into groundwater and kills plants and animals. Statistically, 80% of the waste found in the ocean comes from islands (Waste and Recycling Services). To solve waste problems, recycling is considered one of the most effective methods to reduce greenhouse gas emissions (Chen and Lin, 2008).

The MSW management system in Phnom Penh, Cambodia, collects all types of waste and deposits it in a large open landfill that does not have a suitable soil liner to control leachate and greenhouse gas emissions. The existing landfill does not meet global technical standards (IGES, 2018). According to the Global Business Network Programme (GBN), Phnom Penh is expected to generate 4.09 tonnes of household waste annually, with an average of 0.73 kg of waste generated per person per day. Currently, waste is treated in three ways: Landfilling, recycling, and incineration, but most is dumped in open dumps without proper management (GBN, 2019).

There are several studies on municipal solid waste management in large cities in Cambodia, especially in Phnom Penh. One study predicts that the amount of MSW in Phnom Penh could increase to 1.24 kg/person/day by 2030. Although there are differences in the composition of MSW, it can be concluded that more than 50% of all waste generated per capita is food waste. Singh et al. (2018) found that food waste accounts for 51.9%, while Sang-Arun et al. (2011) and Seng et al. (2020) found that food waste accounts for 64.0% and 63.3%, respectively, in Phnom Penh. Of all food waste, 76% consists of vegetables, sugarcane, corn, fruits, and coconut shells (Sang-Arun et al., 2011), while 70% of food waste comes from households, stores and market (Singh et al.,).

| Food waste | Reference |
|------------|-------------------------|
| 51.90% | Singh et al. (2018) |
| 63.30% | Seng et al. (2020) |
| 64% | Sang-Arun et al. (2011) |
| 60% | Average |

Table 1: Food waste in municipal solid waste studies in Phnom Penh, Cambodia.

One of the priorities proposed by the Phnom Penh Municipality for appropriate and efficient food waste management is composting (Seng et al., 2020). Composting can reduce waste volume by 30-50%, and the final product can be used as fertilizer to increase crop yields and improve soil.



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Since composting can reduce waste volume, it is also a good source of nutrients for plants as it contains about 2% N, 0.5-1% P, and 2% K (Britannica, 2022). Compost contains 40-60% organic matter, which is a source of plant nutrients and can be used for soil improvement. The ratio of carbon to nitrogen (C:N) is 10-15:1, which means that the available nitrogen is released quickly enough for plant uptake, although chemical fertilizers act faster. Most plants and vegetables require a soil pH of 5.8-6.5 (Kluepfel and Lippert, 2012) or 5.5-7.5 (Penas and Lindgren, 1990), so composting can create such an environment for plant growth because it has a pH of 6-8 (USDA, 2000).

Table 2: Compost composition

| Compost | Value |
|------------------------|---------|
| рН | 6-8 |
| C:N | 10-15:1 |
| Organic matter content | 40-60% |
| reduce waste | 30-50% |

Source: USDA (2000)

In Phnom Penh, there are two facilities that produce compost to treat food waste. These include the NGO Community Sanitation and Recycling Organization (CSARO) and TwinAgri, a Singapore company. In the long term, however, other facilities should be considered for appropriate municipal waste management.

2 Risk Analysis

Risk analysis is an important tool for business start-up, as it can be used to evaluate and determine the probability of a negative event. Thus, a suitable solution or an alternative way can be found to make the business a success. Risk in business consists of two parts. The first part is the probability that something will go wrong, and the second part is the negative consequences if something does go wrong. Using risk analysis tools can help manage risk and minimize its impact on our plans.

The risk analysis process consists of five phases: Identifying the risk, Analyzing the risk, Assessing the risk, Addressing the risk, and Reviewing the risk to ensure a solution is applied correctly. To drive a business model related to compost, as described in this training, risk analysis is applied to identify the challenges in starting a compost business and propose a solution to those challenges to make the business successful.

The five steps of the risk analysis process are described below:

Risk identification phase: In Phnom Penh, food waste outweighs other waste, so obtaining
raw materials for composting is not really a problem. However, dealing with it can pose some
issues, such as appropriate techniques for collecting, transporting, separating, screening,
processing, and storing food waste, all of which require expertise and a budget for initial
investment. The location where food waste is generated must also be considered, as this is
strongly related to transportation routes, which can be very costly. In addition to the initial

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investment, profit and years of cost recovery will also be considered as one of the main factors in deciding whether to start the business.

- Risk analysis phase: this tool is used to sort out different risks and evaluate them in terms of time, technology and immediate budget for food waste management.
- Risk Assessment Phase: After listing the risks by priority, an appropriate assessment is made for each composting startup. For a business, the initial investment is a major challenge, so a small startup with locally available materials is considered the most appropriate and economical path.
- Risk management phase: to ensure that compost production can be carried out in a costeffective manner, both technical and financial support is urgently needed. Technical support is provided through skill development, which is the main objective of this training course. Although financial support is not mentioned in the course, the right ways for a composting company to make a wise and less costly investment and decision are highlighted.
- Risk Assessment Phase: Several options for starting a business are suggested and various possible success scenarios are created. These scenarios are closely related to the cost-benefit analysis. The benefits are not only related to economic aspects, but also highlight the importance of composting operations in reducing environmental and health problems.



Figure 1: The process for risk analysis in the establishment of a company in the field of compost production

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3 Goal

The goal of this hub is to provide research, innovation and business services in the field of waste management in Cambodia. The specific objectives are:

- 1. provide training services to government institutions, non-governmental organisations, communities, the private sector, local people, and informal workers in the field of waste management;
- 2. Establish research partnerships among development partners, the public, private, and informal sectors;
- 3. Supporting business plans for SMEs (small and medium enterprises).

4 Training and/or Services Offered

RUA Training Hub is to raise awareness about municipal waste and create related business opportunities. To this end, various participants are selected, including students, farmers, agricultural cooperatives, agricultural communities, NGOs, entrepreneurs and relevant stakeholders. The facility used for this training is located at RUA, Phnom Penh and has the necessary equipment for practice. The training course offered by this Hub is compost production, which includes theory, practice, and field visits.





4.1 Human resources

The training is designed and delivered by experienced lecturers and experts from RUA together with experts from COMPOSTED. They have years of experience in teaching, experimentation and compost production. There will be at least two lecturers in a course to ensure a diverse knowledge and the right answers for the participants.

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4.2 Facility and training period

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

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

4.3 Training material and equipment

For the training activities, a hall will be available to accommodate participants and have adequate lighting and space. Presentation slides and LCD will be used for the training, and classes will be conducted in Khmer. Participants will first be given a pre-test to assess their knowledge of composting, and after the course they will assess their knowledge in a post-test. This can also be used for project evaluation. During the composting exercises, a compost house is used and raw materials from the communities, mainly from the nearby wet market, are prepared for the exercises. During this exercise, the waste is separated, screened, and mixed to ensure the proper mix for composting.

4.4 Type of trainee

To raise awareness of MSW and create relevant business opportunities, various groups of trainees will be selected, including students, farmers, agricultural cooperatives, farming communities, NGOs, entrepreneurs, relevant stakeholders, and development partners. To facilitate close collaboration, the different groups of trainees are connected through social media such as Telegram. The main purpose is to keep in touch with them, share experiences, and keep them updated on their progress even after the training.

4.5 Service provision for the hub sustainability

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

The training course will be self-financing after the completion of the project through the revenue generated from the course offering. The RUA -training centre intends to offer at least 6 training courses per year. With a minimum of 15 participants per course, approximately \$4,500 USD per year will be generated as revenue. Of this amount, 25% will be used to cover training fees for the

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experts, another 25% will be used for depreciation costs of all materials and equipment used for the training courses, and another 25% will be used for internal administration and operation of the training centre RUA. The rest will be saved for later use. The number of courses will not be limited to 6, but this is just the beginning. When the training centre RUA is better equipped and more experienced, the courses will be expanded to include more participants to generate more revenue and provide more expertise on MWS. In the long term, other services such as consulting and feasibility studies will be offered to people who want to start a waste management business.



Figure 3: RUA-Training Hub's relevant partners

5 Structure of Training Hub

The RUA -Training Hub is established under the direct management of the Center for Agricultural and Environmental Studies under the mandate of the Faculty of Forestry, RUA, in Phnom Penh. The top-down management structure for the RUA - training hub is shown in Figure 4. This hub is divided into three units: Administration and Finance, Knowledge Management, and Technical. The Administration and Finance unit is responsible for all kinds of paperwork needed in the hub, communicating with relevant stakeholders such as resources, trainees from different institutions, organizing all kinds of trainings, and managing the financial flow of the hub. The Knowledge Management Unit is responsible for storing all resources related to the development of the courses and for publishing all activities carried out within the hub. The last unit includes the formation of a resource group and the collection of all necessary training materials to ensure that the course is appropriately delivered to the target audience.





Figure 4: RUA Training Hub's structure

6 Business Plan

A business plan is a clear written document that takes into account all the important factors affecting the business. It is of great importance in developing a roadmap to achieve the hub's goal. However, the business plan used in this hub focuses specifically on cost-benefit analysis for better decision making before starting a composting business. Two aspects are discussed below:

- Defining the amounts of food waste collected and treated annually, as well as quantifying the amounts of compost produced with an estimated selling price.
- Estimating investment costs such as purchase prices for equipment, installation, facility, and materials. Revenue and payback period are also taken into account before deciding to make the investments.

To compare different businesses and choose the one which is economically profitable, several formulas are used as criteria for better decision.

6.1 Theory and Formulae for Business Plan

6.1.1 Total costs

Investment costs involve identifying initial costs needed to purchase equipment and build a facility and variable costs necessary for smooth annual operation. In this regard, fixed costs (FC) and variable costs (VC) are taken into account. FC is referred to as any cost that is fixed on annual basis although there is no production activity. Meanwhile, VC represents any cost that is incurred whenever this are production activities.

FC = DC + O&M + HIT

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Where

- FC is fixed cost (USD/year)
- DC is depreciation cost (USD/year)
- O&M is cost for annual operation and maintenance of the production
- HIT is a combination of housing, interest rate, and tax. Housing is any cost incurred for the facility. Meanwhile, I is an interest rate paid per year (USD/year), and T is tax on business activities (USD/year). It can be zero, if taxes are not imposed.

$$TC = FC + VC \tag{2}$$

6.1.2 Revenue

Revenue for this business is based on the quantity of compost produced annual and its selling price. This revenue calculation is a gross income, which does not subtract O&M cost yet. If O&M cost is subtracted, net cost savings will be obtained.

$$TR = P \times Q \tag{3}$$

$$NS = TR - O\&M \tag{4}$$

Where:

- TR is total revenue (USD/year)
- P is compost selling price (USD/T)
- Q is quantity produced per year (T/year)
- NS is net cost saving (USD/year)

6.1.3 Simple Payback Period

Simple Payback Period (SPP) is a kind of economic tool used to determine the number of years when initial investment is fully recovered.

$$SPP = \frac{INVESTMENT}{NS}$$
(5)

Where:

- SPP is simple payback period (year)
- Investment or initial investment (USD)
- NS is net cost saving (USD/year)

6.1.4 Break-even point

A break-even point is a kind of economic formula used to determine necessary quantity of goods or service, from which spending can be fully recovered. In other words, a break-even point represents a threshold in which costs and revenues are equal. Above this threshold, the business seems to make profit, and below this threshold, the business seems to lose profit.

$$BE = \frac{FC}{P - VC}$$

(6)

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Where

- BE is break-even point (T/year)
- FC is fixed cost (USD/year)
- P is a selling price (USD/T)
- VC represents combined costs for one-unit production (USD/T)

6.1.5 Business Case Study

COMPOSTED is a non-governmental organization established in Cambodia in 2000 to combat the waste crisis and protect the environment by improving soil fertility and increasing agricultural production through the use of compost (COMPED, 2013). In this case study, the focus is on the compost business of COMPOSTED in Battambang. According to a study, the monthly compost production is 10 tons/month or 120 tons/year, while the compost price is 130 USD/ton (GGCI, 2019). With this figure, COMPOSTED can generate 15,600 USD/year as gross revenue, and when the operation and maintenance cost (1,206 USD/year) is deducted, the net revenue is estimated to be 14,395 USD/year. Since the total project budget is \$25,316, excluding labor and input costs, the simple payback period is estimated to be 1.6 years, which is very realistic for the operation of the business. Based on this case study, it can be concluded that the compost business is profitable if all the necessary equipment is in place and a sufficient amount of compost is produced per year so that high revenues can be generated

| Investment costs | Unit | Amount | O&M | Life (year) | Depreciation |
|-------------------------------------|----------|--------|-------|-------------|--------------|
| Compost house | USD | 2,000 | 5% | 10 | 200 |
| Shedder | USD | 5,000 | 5% | 10 | 500 |
| Wheel loader | USD | 12,900 | 5% | 10 | 1,290 |
| Screening machine | USD | 6,000 | 5% | 10 | 600 |
| Composting thermometer | USD | 210 | 5% | 5 | 42 |
| Sub-total | | 24,110 | 1,206 | | 2,432 |
| Contingencies (5% of investment) | USD | 1,206 | | 10 | 121 |
| Total project budget | | 25,316 | | | 2,553 |
| Annual income | Unit | Amount | | | |
| Compost product | T/year | 120 | | | |
| Compost price | USD/T | 130 | | | |
| Revenue | USD/year | 15,600 | | | |
| Net cost savings | USD/year | 14,395 | | | |
| Simple Payback period | years | 1.6 | | | |

Table 3: Cost-benefit analysis for the compost business through COMPOSTED

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7 Indicators of Success

Indicators of success can be determined based on several criteria, ranging from the design of the course, to the selection of participants, to the application and integration of the knowledge acquired in the course into their current work. Once the composting course has been implemented, the success indicators must be identified and evaluated so that the course can be adjusted as needed in the future. Technically, each success indicator is a value that is measurable and can represent the progress of the activity toward a desired impact of the project. There are several criteria for evaluating success indicators. The term success means any desired achievement. This can be a positive change in behavior or an improvement in institutional performance. In this way, the desired impact can be shared with the community and, with proper planning, is permanent.

Indicators of success in the design of this training course include the composition of participants from different institutions, the percentage of those who complete the course from time to time, the percentage of those who change their behavior related to MSW management, the percentage of those who apply the knowledge to improve their composting business or start a new business. Other indicators of success are the analysis of the evolution of the number of those who apply the knowledge from year to year in their business and the profit from that business. All these factors affect the success and benefits of the course, as it contributes to the proper management of municipal waste, which can reduce all types of pollution and greenhouse gas emissions. To ensure that these indicators can be evaluated, a series of questionnaires were designed and used to record the periods before and after participation in the course.

A mixture of the participants: To ensure that the proposed course can help solve MSW problems and generate income from them, participants selected for the course must include individual farmers, farming communities, NGOs, businesses, and related stakeholders. Also, at least onethird of the participants of each course must be female, as this concept is good for decision making within the family.

Percentage of successful trainees: For each training, most of the trainees must fully participate in the training, while at least 80% of them must score at least 80 out of 100 on the post-test. At least 50% of all trainees, half of whom are female, are fully engaged in composting practices. This can be determined from the observation and checklists by the trainers.

Percentage of trainees changing their behaviour in municipal waste management: This indicator can be determined in a continuous process. The best way to check this is to use communication platforms such as Telegram and Facebook to share knowledge and update progress after the course. Participants are asked a series of predetermined questions online to identify behavioural changes. In some cases, phone interviews are also conducted to gather this information. For confirmation, at least 3 participants are contacted for visits to determine their current status six months after the training. A good indicator of success is that at least 50% of participants have changed their waste management behaviour six months after the training.

Percentage of training participants applying their knowledge to improve their composting practises: This indicator is also determined by the fact that participants use the communication platform to update their activities or business related to waste management and compost

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production. At least one-third of the participants in each training apply the knowledge to improve their compost business.

Tendency of trainees to apply the knowledge in their business: This indicator depends on data collected in previous years. Therefore, it can be determined at the earliest two years after the implementation of the first training course in order to monitor the evolution. The project implementation is a success if the trend shows an increasing tendency and the indicator for the trend from year to year is increasing.

Business Profit: this indicator includes two different scenarios: for those who already have a relevant business and for those who do not. In the first scenario, it means that the project has contributed to income generation if the income from the corresponding business has increased by at least 20% after attending the training course. If the training participants who are not yet making compost are able to start a business, this is an indication of the impact of the project. For those who will be making compost for their crops, a good indicator of success is a 50% reduction in the use of chemical fertilizers.



Figure 5: A set of indicators necessary for showing the success of the Training Hub

8 Monitoring and Evaluation Plan

Monitoring and evaluation (M&E) plans are essential to successful project implementation because they help define, implement, track, and improve M&E strategies to achieve desired results and achieve required impacts. A well-functioning M&E system is an important component of good project/programme management and accountability.

To ensure that the training course is a success, monitoring and evaluation activities are conducted during and after the course. Improvement in knowledge is monitored through pre and post course testing.

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An effective M&E process consists of 6 steps that will be used as the training tool for this course. The M&E system and framework will cover the six key points. This course aims to reduce municipal solid waste through composting and create a business opportunity for all relevant stakeholders in the country. The detailed M&E system and framework for this work are provided below:

- Offer training services for government institution, NGOs, communities, private sectors, local people and informal workers on solid waste management Provide training courses, hand-on training, and visit exchange
- Building collaboration on research partnership amongst development partners, public, private and informal sector
- Support business plan for SMEs (Small Medium Enterprises)



Figure 6 – M&E plan

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RUA Training Hub Municipal Solid Waste Management Feasibility Study

Khmer version

Training Hubs feasibility studies



ការសិក្សាលទ្ធភាពនៃការបង្កើតមង្ឈមណ្ឌលបណ្ដុះបណ្ដាល នៅសាកលវិទ្យាល័យភូមិន្ទុកសិកម្ម

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| | លោកស្រី យុត្ថា នីដា |







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ជំនាន់

| ជំនាន់ | កាលបរិច្ឆេទ | អ្នកនិពន្ធចម្បង | សេចក្តីសង្ខេបនៃបច្ឆប្បន្នភាព |
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Deliverable 4.4 – Training Hubs Feasibility Studies





សង្ខេប

សំរាម សំណល់រឹងទីក្រុង (MSW) គឺជាបញ្ហាដែលកំពុងកើនឡើងនៅក្នុងប្រទេសកំពុងអភិវឌ្ឍន៍ ដោយសារតែកំនើនប្រជាជន ហើយកាកសំណល់កាន់តែច្រើនត្រូវបានបង្កើតជារៀងរាល់ថ្ងៃ។ កាកសំណល់មានធាតុផ្សំផ្សេងៗគ្នាជាច្រើន ប៉ុន្តែយ៉ាងហោចណាស់ 60% គឹជាកាកសំណល់អាហារដែលអាចបំប្លែងទៅជាផលិតផលមានតម្លៃផ្សេងៗ។ នេះដួយកាត់បន្ថយបរិមាណកាកសំណល់ កាត់បន្ថយផលប៉ះពាល់បរិស្ថាន និងបង្កើតប្រាក់ចំណូល។ បច្ចេកវិទ្យាប្រើប្រាស់កាកសំណល់ដំណេគជ័យមួយគឺការផលិតជីកំប៉ុស ដែលអាចបំប្លែងកាកសំណល់អាហារទៅជាជីសម្រាប់ដំណាំ។ ទោះជាយ៉ាងណាក៍ដោយ បច្ចេកវិទ្យាជីកំប៉ុសដែលសមរម្យមិនមានយ៉ាងទួលំទួលាយទេ ឬជាធម្មតាវាត្រូវបានអនុវត្តតែជាមួយសំណល់ដំណាំប៉ុណ្ណោះ។ ជំនួយបច្ចេកទេសក្នុងការផលិតជីកំប៉ុសពីសំរាម សំណល់រឹងទីក្រុង គឹជាគន្លឹះក្នុងការលើកកម្ពស់ការយល់ដឹងអំពីការគ្រប់គ្រងសំណល់ និងការផ្តាស់ប្តូរូអាកប្បកិរិយារបស់មនុស្សក្នុងការដោះស្រាយបញ្ហាសំរាម។ ដូច្នេះ មង្ឃមណ្ឌលបណ្តុះបណ្តាល RUA ត្រូវបានបង្កើតឡើងក្នុងគោលបំណងផ្តល់ការបណ្តុះបណ្តាលក្នុងវិស័យគ្រប់គ្រងកាកសំណល់ និងជាពិសេសការផលិតដីកំប៉ុស។ វិសាលភាពមិនត្រឹមតែមានកម្រិតលើការបណ្តុះបណ្តាលប៉ុណ្ណោះទេ ប៉ុន្តែថែមទាំងផ្តោតលើការផ្តល់ចំណេះឌឹង ជំនាញ ដំបូន្មាន និងសេវាកម្មបន្ថែមផងដែរ ដល់កសិករ សហគមន៍កសិកម្ម អង្គការមិនមែនរដ្ឋាភិបាល និងអ្នកពាក់ព័ន្ធនានា ដើម្បីរក្សាមុខងាររបស់មង្ឃមណ្ឌល។ ដោយគិតគួរពីទិដ្ឋភាពសង្គម សេដ្ឋកិច្ច និងបរិស្ថាន ការបង្កើតមង្ឃមណ្ឌលនេះនឹងមានផលប៉ះពាល់ជាវិជ្ជមានជាច្រើន ដែលចុងក្រោយនឹងរួមចំណែកដល់ការគ្រប់គ្រងកាកសំណល់ឱ្យកាន់តែប្រសើរឡើង ស្របតាមគោលនយោបាយរបស់ប្រទេស។

ពាក្យគន្លិ៍ះ

ជីកំប៉ុស្តិ៍ កាកសំណល់អាហារ សំរាម សំណល់រឹងទីក្រុង ថ្លៃដើមអត្ថប្រយោជន៍ និងផែនការអាជីវកម្ម។

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ការគាំទ្ររបស់គណៈកម្មការសហគមអឺរ៉ុបសម្រាប់ការផលិតការបោះពុម្ពនេះ ប៉ុន្តែមិនទទួលខុសត្រូវលើខ្លឹមសារដែលមាននៅក្នុងឯកសារនេះទេ។ ឯកសារនេះឆ្លុះបញ្ចាំងពីគំនិត ទស្សន: និងការយល់ឃើញរបស់អ្នកនិពន្ធតែប៉ុណ្ណោះ ហើយគណៈកម្មការមិនទទួលខុសត្រូវចំពោះការប្រើប្រាស់ណាមួយពីព័ត៌មានដែលមាននៅក្នុងឯកសា រនេះឡើយ។

ឯកសារនេះអាចមានសម្ភារ ដែលជាកម្មសិទ្ធិបញ្ញារបស់ភាគី SWAP Consortium ហើយមិនអាចផលិតឡើងវិញ ឬចម្លងដោយគ្មានការអនុញ្ញាតឡើយ។ គ្រប់ភាគី SWAP Consortium បានយល់ព្រមលើការបោះពុម្ពផ្សាយពេញលេញនៃឯកសារនេះ។





ការប្រើប្រាស់ព័ត៌មានផ្នែកណាមួយនៃឯកសារនេះសម្រាប់ការផ្សព្វផ្សាយពាណិដ្ឋកម្មតម្រូវឱ្យមានអា ផ្លាប័ណ្ណពីម្ចាស់ព័ត៌មានជាមុនសិន។

សម្ព័ន្ធ SWAP ទាំងមូល ឬភាគីជាក់លាក់នៃសម្ព័ន្ធ SWAP ធានាថាព័ត៌មានដែលមាននៅក្នុងឯកសារនេះ អាចប្រើប្រាស់បាន ឬការប្រើប្រាស់ព័ត៌មាននោះមិនមានហានិភ័យ និងមិនទទួលខុសត្រូវចំពោះការបាត់បង់ ឬការខូចខាតណាមួយឡើយ។

ការទទួលស្គាល់

ឯកសារនេះគឺជាសមិទ្ធផលដែលត្រូវបានបង្កើតឡើងដោយគម្រោង SWAP។ គម្រោងនេះផ្តល់សហមូលនិធិដោយកម្មវិធី Erasmus+ នៃសហភាពអឺរ៉ុបក្រោមការអំពាវនាវសម្រាប់សំណើ EAC/A02/2019 និងអនុវត្តគម្រោងលេខ 618723-EPP-1-2020-1-DE-EPPKA2-CBHE-JP។

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តារាងមាតិកា

| ជន | ຄືສີ | | |
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| ពា | ក្បគន្លឺ | a 9 9 | |
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| ១ | ការរំ | វិភាគតម្រូវការ | 5 |
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| ៣ | គោ | លដៅ | |
| ଜ | ការ | បណ្តុះបណ្តាល និង/ឬសេវាកម្មត្រូវបានផ្តល់ជូន | |
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| C | ៤.៣ | សម្ភារបណ្តុះបណ្តាល និងឧបករណ៍ | |
| C | હ.હ | ប្រភេទនៃសិក្ខាកាម | |
| C | ૡૼૣૡ | ការផ្តល់សេវាសម្រាប់និរន្តរភាពនៃមដ្ឃមណ្ឌល | |
| ಷ | រចន | ទាសម្ព័ន្ធនៃមជ្ឈមណ្ឌលបណ្ដុះបណ្ដាល | |
| р | ផែន | នការអាជីវកម្ម | |
| L G | อ.ฺ๏ | ទ្រឹស្តី និងរូបមន្តសម្រាប់ផែនការអាជីវកម្ម | |
| 10 | ໑຺໑຺໑ | ការចំណាយសរុប | |
| 10 | ច.ច.ច | ចំណូល | |
| L G | ១.១.៣ | រយ:ពេលសងក្រលប់សាមញ្ញ | |
| L | ୭.୭.୯ | ចំណុចរួចដើម | |
| 10 | ១.២ | ករណីសិក្សាអាជីវកម្ម | |
| ៧ | សូច | នាករនៃភាពដោគដ័យ | |
| ៨ | ផែន | ទការតាមដាន និងវាយតម្លៃ | |
| ឯዮ | ាសាររ | យាង | |

១ ការវិភាគតម្រូវការ

សំណល់រីងទីក្រុង សំរាម (MSW) ត្រូវបានចាត់ទុកថាជាបញ្ហាប្រឈមដ៍សំខាន់មួយនៅក្នុងប្រទេសកំពុងអភិវឌ្ឍន៍ (Singh et al., ការបង្កើតសំណល់រីងសកលត្រូវបានគេរំពឹងឋានឹងមានប្រហែល 2018)។ នៅឆ្នាំ 2020 2.24 ជាមួយនឹងទម្ងន់ជាមធ្យម គីឡូក្រាម/នាក់/ថ្ងៃ។ ពាន់លានតោន 0.97 តូលេខនេះត្រូវបានគេរំពឹងឋានឹងកើនឡើង 73% ពីឆ្នាំ 2020 ដល់ 3.88 ពាន់លានតោនក្នុងឆ្នាំ 2050 មានទំនាក់ទំនងយ៉ាងរឹងមាំរវាងការកើនឡើងនៃកាកសំណល់ទីក្រុង (World 2020)។ Bank, Page | 5 Deliverable 4.4 – Training Hubs Feasibility Studies

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និងចំនួនប្រជាជនដែលកំពុងកើនឡើង (Supangkat and Herdiansyah, 2020)។ ការគ្រប់គ្រងមិនត្រឹមត្រូវនៃ MSW អាចនាំឱ្យមានការបំពុលឌី ខ្យល់ និងទីក បញ្ហាសុខភាព និងការបំភាយឧស្ថ័នផ្ទះកញ្ចក់ (GHG)។ នៅពេលដែលកន្លែងចាក់សំរាមមិនត្រូវបានផ្សារភ្ជាប់ត្រឹមត្រូវ ទីកកខ្វក់ ដែលជាសារធាតុបំពុលរាវ ជ្រាបចូលទៅក្នុងទឹកក្រោមឌី និងសម្លាប់រុក្ខជាតិ និងសក្វ។ តាមស្ថិតិ 80% នៃកាកសំណល់ដែលរកឃើញក្នុងមហាសមុទ្របានមកពីកោះ (សេវាកម្មកាកសំណល់ និងកែច្នៃឡើងវិញ)។ ដើម្បីដោះស្រាយបញ្ហាកាកសំណល់ ការកែច្នៃត្រូវបានចាត់ទុកថាជាវិធីសាស្ត្រដ៍មានប្រសិទ្ធភាពបំផុតមួយក្នុងការកាត់បន្ថយការបំភាយ ឧស្ថ័នផ្ទះកញ្ចក់ (Chen and Lin, 2008)។

ប្រព័ន្ធគ្រប់គ្រង MSW នៅក្នុងទីក្រុងភ្នំពេញ ប្រទេសកម្លុជា ប្រមូលកាកសំណល់គ្រប់ប្រភេទ ហើយយកទៅដាក់ក្នុងកន្លែងចាក់សំរាមបើកចំហង៍ធំមួយ ដែលមិនមានស្រទាប់ដីសមស្រប ដើម្បីគ្រប់គ្រងការបញ្ចេញទឹករំអិល និងឧស្ម័នផ្ទះកញ្ចក់។ កន្លែងចាក់សំរាមដែលមានស្រាប់មិនបំពេញតាមស្តង់ដារបច្ចេកទេសសកលទេ (IGES, 2018)។ យោងតាមកម្មវិធីបណ្តាញធ្យរកិចូសកល (GBN) ទីក្រុងភ្នំពេញត្រូវបានគេរំពឹងឋានឹងបង្កើតកាកសំណល់តាមផ្ទះចំនួន កោនក្នុងមួយឆ្នាំ 4.09 ជាមធ្យម 0.73 គីឡាក្រាមនៃសំណល់ដែលបានបង្កើតក្នុងមនុស្សម្នាក់ក្នុងមួយថ្លៃ។ បច្ចុប្បន្ននេះ កាកសំណល់ត្រូវបានព្យាបាលតាមបីវិធី៖ ការចាក់សំរាម ការកែច្នៃឡើងវិញ និងការដុតបំផ្កាញ ប៉ុន្តែភាគច្រើនត្រូវបានបោះចោលក្នុងកន្លែងចាក់សំរាមដោយគ្មានការគ្រប់គ្រងត្រឹមត្រូវ (GBN, 2019)។

មានការសិក្សាជាច្រើនស្តីពីការគ្រប់គ្រងសំណល់រឹងរបស់ក្រុងនៅតាមទីក្រុងធំៗក្នុងប្រទេសក ជាពិសេសនៅរាជធានីភ្នំពេញ។ ការសិក្សាមួយព្យាករណ៍ថាបរិមាណ ម្រដា MSW នៅភ្នំពេញអាចកើនឡើងដល់ គីឡូក្រាម/នាក់/ថ្លៃ 1.24 នៅឆ្នាំ 20304 ទោះបីជាមានភាពខុសគ្នានៅក្នុងសមាសភាព MSW កំដោយវាអាចសន្និដ្ឋានបានថាច្រើនជាង 50% នៃកាកសំណល់ទាំងអស់ដែលបង្កើតបានក្នុងមនុស្សម្នាក់ៗគឺជាអាហារ។ កាកសំណល់។ Singh et al ។ (2018) បានរកឃើញថាកាកសំណល់អាហារមាន 51.9% ខណៈដែល Sang-Arun et al. (2011) និង Seng (២០២០) បានរកឃើញថា កាកសំណល់អាហារមាន <u>୭୯</u>୦% et al , និង ៦៣.៣% រៀងគ្នានៅរាជធានីភ្នំពេញ។ ក្នុងចំណោមកាកសំណល់អាហារទាំងអស់ 76% មានបន្លែ អំពៅ ពោត ផ្លែឈើ និងសំបកដួង (Sang-Arun et al., 2011) ខណ: 70% នៃកាកសំណល់អាហារបានមកពីគ្រួសារ ហាង និងទីផ្សារ (Singh et al.,)

| កាកសំណល់ចំណីអាហារ | ឯកសារយោង |
|-------------------|-------------------------|
| 51.90% | Singh et al. (2018) |
| 63.30% | Seng et al. (2020) |
| 64% | Sang-Arun et al. (2011) |
| 60% | មធ្យម |

តារាងទី១៖ កាកសំណល់អាហារក្នុងការសិក្សាអំពីសំណល់រឹងក្រុងក្នុងរាជធានីភ្នំពេញ ប្រទេសកម្ពុជា

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- អាទិភាពមួយក្នុងចំណោមអាទិភាពនានាដែលស្នើឡើងដោយសាលារាងធានីភ្នំពេញសម្រាប់ ការគ្រប់គ្រងសំណល់អាហារសមស្រប និងមានប្រសិទ្ធភាពគីការធ្វើដីកំប៉ុស (Seng et al., 2020)។ ជីកំប៉ុសអាចកាត់បន្ថយបរិមាណកាកសំណល់បាន 30-50% ហើយផលិតផលចុងក្រោយអាចប្រើជាជីដើម្បីបង្កើនទិន្នផលដំណាំ និងធ្វើអោយដីប្រសើរឡើង។

ដោយសារដីកំប៉ុសអាចកាត់បន្ថយបរិមាណកាកសំណល់
 វាកំជាប្រភពសារធាតុចិញ្ចិមដ៍ល្អសម្រាប់រុក្ខជាតិផងដែរ ព្រោះវាមានប្រហែល 2% N, 0.5-1%
 P, និង 2% K (Britannica, 2022)។ ដីកំប៉ុសមានសារធាតុសរីរាង្កពី 40-60%
 ដែលជាប្រភពនៃសារធាតុចិញ្ចិមរុក្ខជាតិ និងអាចប្រើប្រាស់សម្រាប់កែលម្អដី។
 សមាមាត្រនៃកាបូនទៅអាសូត (C:N) គី 10-15:1
 ដែលមានន័យថាអាសូតដែលមានត្រូវបានបញ្ចេញយ៉ាងលឿនគ្រប់គ្រាន់សម្រាប់ការស្រូបយក
 រុក្ខជាតិ ទោះបីជាដីគីមីធ្វើសកម្មភាពលឿនជាងកំដោយ។ រុក្ខជាតិ
 និងបន្លែភាគច្រើនត្រូវការ pH ដី 5.8-6.5 (Kluepfel and Lippert, 2012) ឬ 5.5-7.5 (Penas and Lindgren, 1990)
 ដូច្នេះជីកំប៉ុសអាចបង្កើតបរិយាកាសបែបនេះសម្រាប់ការលូតលាស់របស់រុក្ខជាតិព្រោះវាមាន

рН 6-8 (USDA, 2000) ч

តារាងទី 2: សមាសធាតុជីកំប៉ុស្តិ៍

| កំប៉ុស្តិ៍ | តម្លៃ |
|---------------------------|---------|
| рН | 6-8 |
| C:N | 10-15:1 |
| ខ្លឹមសារនៃសារធាតុសរីរាង្គ | 40-60% |
| កាត់បន្ថយកាកសំណល់ | 30-50% |

ប្រភព៖ USDA (2000)

មានស្ថាប័នពាក់ព័ន្ធចំនួនពីរដែលផលិតដីកំប៉ុស្តិ៍ដើម្បីកែច្នៃកាកសំណល់អាហារនៅភ្នំពេញគឺ NGO Community Sanitation and Recycling Organization (CSARO) និង TwinAgri ដែលជាក្រុមហ៊ុនសិង្ហបុរី។ ទោះជាយ៉ាងណាក៍ដោយ ក្នុងរយ:ពេលវែង ស្ថាប័នពាក់ព័ន្ធផ្សេងទៀតគួរតែត្រូវបានពិចារណាសម្រាប់ការគ្រប់គ្រងកាកសំណល់ទីក្រុងឱ្យបានស មស្រប។

២ ការវិភាគហានិភ័យ

ការវិភាគហានិភ័យគឺជាឧបករណ៍ដ៍សំខាន់សម្រាប់ការចាប់ផ្តើមអាជីវកម្មព្រោះវាអាចត្រូវបាន ប្រើដើម្បីវាយតម្លៃ និងកំណត់ប្រូបាប៊លីតេនៃព្រឹត្តិការណ៍អវិជ្ជមាន។ ដូច្នេះ ដំណោះស្រាយសមស្រប ឬវិធីជំនួសអាចត្រូវបានរកឃើញដើម្បីធ្វើឱ្យអាជីវកម្មទទួលបានដោគជ័យ។ ហានិភ័យក្នុងអាជីវកម្មមានពីរផ្នែក។ ផ្នែកទីមួយគីជាប្រូបាប៊លីតេដែលថាមានអ្វីមួយខុស ហើយផ្នែកទីពីរគឺជាផលវិបាកអវិជ្ជមានប្រសិនបើមានអ្វីមួយខុស។

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ការប្រើប្រាស់ឧបករណ៍វិភាគហានិភ័យអាចងួយគ្រប់គ្រងហានិភ័យនិងកាត់បន្ថយផលប៉ះពាល់របស់វា មកលើផែនការរបស់យើង។ ដំណើរការវិភាគហានិភ័យមានប្រាំដំណាក់កាល៖ ការកំណត់ហានិភ័យ ការវិភាគហានិភ័យ ការវាយតម្លៃហានិភ័យ ការដោះស្រាយហានិភ័យ និងការត្រួតពិនិត្យហានិភ័យ ដើម្បីធានាថាដំណោះស្រាយត្រូវបានអនុវត្តយ៉ាងត្រឹមត្រូវ។

ដើម្បីជំរុញគំរូអាជីវកម្មទាក់ទំងនឹងជីក់ប៉ុស ដូចដែលបានរៀបរាប់នៅក្នុងវគ្គបណ្ដុះបណ្ដាលនេះ ការវិភាគហានិភ័យត្រូវបានអនុវត្តដើម្បីកំណត់បញ្ហាប្រឈមក្នុងការចាប់ផ្ដើមអាជីវកម្មជីកំប៉ុស និងស្នើដំណោះស្រាយចំពោះបញ្ហាប្រឈមទាំងនោះដើម្បីធ្វើឱ្យអាជីវកម្មទទួលបានដោគដ័យ។

ជំហានទាំងប្រាំនៃដំណើរការវិភាគហានិភ័យត្រូវបានពិពណ៍នាដូចខាងក្រោម៖

- ដំណាក់កាលកំណត់ហានិភ័យ៖ នៅរាងធានីភ្នំពេញ កាកសំណល់អាហារមានបរិមាណលើសកាកសំណល់ផ្សេងទៀត ដូច្នេះការទទួលបានវត្តធាតុដើមសម្រាប់ធ្វើដីកំប៉ុសពិតជាមិនមែនជាបញ្ហានោះទេ។ ទោះជាយ៉ាងណាក់ដោយ ការដោះស្រាយវាអាចបង្កបញ្ហាមួយចំនួន ដូចជាបច្ចេកទេសសមស្របក្នុងការប្រមូល ដីកងញ្ញន ការបំបែក ការពិនិត្យ ការកែច្នៃ និងការរក្សាទុកកាកសំណល់អាហារ ដែលទាំងអស់នេះទាមទារជំនាញ និងថវិកាសម្រាប់ការវិនិយោគដំបូង។ ទីតាំងដែលកាកសំណល់អាហារត្រូវបានបង្កើតក៍ត្រូវយកមកពិចារណាផងដែរ ព្រោះនេះទាក់ទងយ៉ាងខ្លាំងទៅនឹងផ្លូវដីកងញ្ញន ដែលអាចចំណាយប្រាក់ច្រើន។ បន្ថែមពីលើការវិនិយោគដំបូង ប្រាក់ចំណេញ និងឆ្នាំនៃការងើបឡើងវិញនៃការចំណាយក៍នឹងត្រូវបានចាត់ទុកថាជាកត្តាចម្បងមួយ ក្នុងការសម្រេចចិត្តថាតើត្រូវចាប់ផ្តើមអាជីវកម្មដែរឬទេ។
 ដំណត់កាលវិភាគហេនិភ័យនេះគាវបានឃើរទីអាតមៀបហេនិភ័យផេង។គាត់
- ដំណាក់កាលវិភាគហានិភ័យ៖ ឧបករណ៍នេះត្រូវបានប្រើដើម្បីតម្រៀបហានិភ័យផ្សេងៗគ្នា និងវាយតម្លៃវាតាមពេលវេលា បច្ចេកវិទ្យា និងថវិកាបន្ទាន់សម្រាប់ការគ្រប់គ្រងសំណល់អាហារ។
- ដំណាក់កាលវាយតម្លៃហានិភ័យ៖ បន្ទាប់ពីរាយបញ្ជីហានិភ័យតាមអាទិភាព ការវាយតម្លៃសមស្របមួយត្រូវបានធ្វើឡើងសម្រាប់ការចាប់ផ្តើមជីកំប៉ុសនីមួយៗ។ សម្រាប់អាជីវកម្មមួយ ការវិនិយោគដំបូងគឺជាបញ្ហាប្រឈមដ៍សំខាន់ ដូច្នេះការចាប់ផ្តើមតូចមួយជាមួយនឹងសម្ភារ:ដែលអាចរកបានក្នុងមូលដ្ឋានត្រូវបានចា ត់ទុកថាជាផ្លូវសមស្របបំផុត និងសន្សំសំចៃបំផុត។
- ដំណាក់កាលគ្រប់គ្រងហានិភ័យ៖
 ដើម្បីធានាថាការផលិតជីកំប៉ុសអាចត្រូវបានអនុវត្តប្រកបដោយប្រសិទ្ធភាព
 ទាំងផ្នែកបច្ចេកទេស និងហិរញ្ឈវត្ថាគឺត្រូវការជាបន្ទាន់។
 ការគាំទ្រផ្នែកបច្ចេកទេសត្រូវបានផ្តល់តាមរយ:ការអភិវឌ្ឍន៍ជំនាញ
 ដែលជាគោលបំណងសំខាន់នៃវគ្គបណ្តុះបណ្តាលនេះ។
 ទោះបីជាជំនួយផ្នែកហិរញ្ញវត្ថាមិនត្រូវបានផេលីកឡើងនៅក្នុងវគ្គសិក្សាក៍ដោយ
 វិធីសាស្ត្រត្រឹមត្រូវសម្រាប់ក្រុមហ៊ុនជីកំប៉ុសដើម្បីធ្វើការវិនិយោគ
 និងការសម្រេចចិត្តប្រកបដោយប្រាថ្នា និងចំណាយតិចត្រូវបានគូសបញ្ញាក់។

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ដំណាក់កាលវាយតម្លៃហានិភ័យ៖
ជម្រើសដាច្រើនសម្រាប់ការចាប់ផ្តើមអាដីវកម្មត្រូវបានស្នើ
ហើយសេណារីយ៉ូដោគដ័យផ្សេងៗត្រូវបានបង្កើតឡើង។
សេណារីយ៉ូទាំងនេះទាក់ទងយ៉ាងដិតស្និទ្ធទៅនឹងការវិភាគតម្លៃ-អត្ថប្រយោដន៍។
អត្ថប្រយោដន៍មិនត្រឹមតែទាក់ទងនឹងទិដ្ឋភាពសេដ្ឋកិច្ចប៉ុណ្ណោះទេ
ប៉ុន្តែថែមទាំងបង្ហាញពីសារ:សំខាន់នៃប្រតិបត្តិការដីកំប៉ុសក្នុងការកាត់បន្ថយបញ្ហាបរិ
ស្ថាន និងសុខភាព។

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គឺជាមជ្យមណ្ឌលបណ្ដុះបណ្ដាល RUA Training Hub RUA ដែលរៀបចំបង្កើតឡើងដើម្បីលើកកម្ពស់ការយល់ដឹងអំពីកាកសំណល់ទីក្រុង និងបង្កើតឱកាសអាជីវកម្មដែលពាក់ព័ន្ធ។ អ្នកចូលរួមអាចជាសិស្ស/និស្សិត កសិករ សហករណ៍កសិកម្ម សហគមន៍កសិកម្ម អង្គការក្រៅរដ្ឋាភិបាល សហគ្រិន វិស័យសាធារណនិងឯកជន និងអ្នកពាក់ព័ន្ធនានា។

៤ ការបណ្តុះបណ្តាល និង/ឬសេវាកម្មត្រូវបានផ្តល់ដូន

- និងមធ្យម)។
- និងក្រៅផ្លូវការ។ គាំទ្រផែនការអាជីវកម្មសម្រាប់សហគ្រាសធុនតួច និងមធ្យម (សហគ្រាសធុនតួច
- វិស័យឯកជន ប្រជាជនមូលដ្ឋាន និងកម្មករក្រៅផ្លូវការក្នុងវិស័យគ្រប់គ្រងកាកសំណល់។ 2. បង្កើតភាពជាដៃគូស្រាវជ្រាវក្នុងចំណោមដៃគូអភិវឌ្ឍន៍ វិស័យសាធារណៈ ឯកជន
- ផ្តល់សេវាបណ្តុះបណ្តាលដល់ស្ថាប័នរដ្ឋាភិបាល អង្គការមិនមែនរដ្ឋាភិបាល សហគមន៍

គោលដៅនៃមដម្រណ្ឌលនេះគឺដើម្បីផ្តល់នូវការស្រាវជ្រាវ ការច្នៃប្រឌិត និងសេវាកម្មអាជីវកម្មក្នុងវិស័យគ្រប់គ្រងកាកសំណល់ក្នុងប្រទេសកម្ពុជា។ គោលបំណងជាក់លាក់គឺ៖

៣ គោលដៅ

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រូបភាពទី១៖ ដំណើរការសម្រាប់ការវិភាគហានិភ័យក្នុងការបង្កើតក្រុមហ៊ុនក្នុងវិស័យផលិតកម្មដីកំប៉ុស្តិ៍



ផ្តល់សេណារីយ៉ូជាច្រើនសម្រាប់អាជីវកម្មផលិតជីកំប៉ុសសម្រាប់ ការសម្រេចចិត្តប្រកបងោយឧត្តមគតិ









កន្លែងប្រើប្រាស់សម្រាប់វគ្គបណ្ដុះបណ្ដាលនេះមានទីតាំងនៅសាកលវិទ្យាល័យភូមិន្ទកសិកម្ម រាជធានីភ្នំពេញ និងមានឧបករណ៍ចាំបាច់សម្រាប់ការអនុវត្តផ្ទាល់ វគ្គបណ្ដុះបណ្ដាលដែលផ្ដល់ដោយមជ្ឈមណ្ឌលនេះគឺការផលិតជីកំប៉ុស្ដិ៍ ដែលរួមមានទ្រឹស្ដី ការអនុវត្ដ និងការចុះទីវាល។



វគ្គបណ្តុះបណ្តាលនេះត្រូវបានរៀបចំ និងផ្តល់ដោយសាស្ត្រាចារ្យដែលមានបទពិសោធន៍ និងអ្នកងំនាញមកពី RUA រួមជាមួយអ្នកងំនាញមកពី COMPOSTED ។ ពួកគេមានបទពិសោធន៍ជាច្រើនឆ្នាំក្នុងការបង្រៀន ការពិសោធន៍ និងការផលិតដីកំប៉ុស្តិ៍។ វានឹងមានសាស្ត្រាចារ្យយ៉ាងហោចណាស់ពីរនាក់នៅក្នុងវគ្គសិក្សាមួយ ដើម្បីធានាបាននូវចំណេះដឹងចម្រុះ និងចម្លើយត្រឹមត្រូវសម្រាប់អ្នកចូលរួម។

៤ ២ រយៈពេលបរិក្ខារ និងវគ្គបណ្តុះបណ្តាល

មង្ឃមណ្ឌលបណ្តុះបណ្តាលស្ថិតនៅក្នុងមង្ឃមណ្ឌលសិក្សាស្រាវជ្រាវកសិកម្ម និងបរិស្ថាន ដែលមានទីតាំង និងឧបករណ៍គ្រប់គ្រាន់សម្រាប់ដំណើរការសិក្សា និងការអនុវត្ត។ ដំណាក់កាលដំបូងនៃមង្ឃមណ្ឌលបណ្ណុះបណ្តាលនេះ នឹងផ្តល់ដូននូវវគ្គសិក្សាខ្លីមួយស្តីពីការផលិតដីកំប៉ុស្តិ៍ដែលត្រូវបានរៀបចំឡើងក្នុងរយៈពេលពីរថ្ងៃ ដែលរួមមានមួយថ្ងៃសម្រាប់ទ្រឹស្តី និងទស្សនកិច្ចសិក្សានៅបរិវេណសាលា

និងមួយថ្ងៃសម្រាប់ការអនុវត្ត។ ក្នុងរយ:ពេលវែង វគ្គសិក្សា

និងសេវាកម្មផ្សេងៗទៀតនឹងត្រូវផ្តល់ជូនសម្រាប់ការគ្រប់គ្រងសំរាមទីក្រុងឱ្យកាន់តែមានប្រសិទ្ធភា ព និងប្រសើរឡើង។

ដើម្បីទាក់ទាញអ្នកចូលរួមឱ្យចូលរៀនវគ្គដែលបានគ្រោងទុក វិធីសាស្ត្រផ្សព្វផ្សាយផ្សេងៗនឹងត្រូវបានប្រើ។

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Deliverable 4.4 – Training Hubs Feasibility Studies

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វិធីសាស្ត្រង៍មានប្រសិទ្ធភាពបំផុតមួយគឺការផ្សាយពាណិដ្ឋកម្មតាមរយៈប្រព័ន្ធផ្សព្វផ្សាយសង្គម ដែលវគ្គបណ្តុះបណ្តាលនាពេលខាងមុខត្រូវបានប្រកាសជាមួយនឹងព័ត៌មានលម្អិត។ លើសពីនេះ ផ្ទាំងរូបភាពក៍នឹងត្រូវបានប្រើប្រាស់ផងដែរ ដោយអង្គការ សហគមន៍កសិកម្ម និងស្ថាប័នពាក់ព័ន្ធនានាត្រូវបានផ្តល់ជូនជាមួយនឹងផ្ទាំងរូបភាពដែលបានបោះពុម្ភ ដើម្បីផ្តល់ព័ត៌មានអំពីកម្មវិធីបណ្តុះបណ្តាល។

៤.៣ សម្ភារបណ្ដុះបណ្ដាល និងឧបករណ៍

សម្រាប់សកម្មភាពហ្វីកហ្វីន សាលមួយនឹងមានសម្រាប់ផ្ទុកអ្នកចូលរួម និងមានភ្លើងបំភ្លឺ និងកន្លែងទំនេរគ្រប់គ្រាន់។ ស្លាយធ្វើបទបង្ហាញ និង LCD នឹងត្រូវប្រើប្រាស់សម្រាប់ការបណ្តុះបណ្តាល ហើយថ្នាក់រៀននឹងធ្វើឡើងជាភាសាខ្មែរ។ សិក្ខាកាមនឹងទទួលបានការធ្វើតេស្តជាមុន ដើម្បីវាយតម្លៃចំណេះឌីងរបស់ពួកគេអំពីការធ្វើជីកំប៉ុស្តិ៍ ហើយបន្ទាប់ពីវគ្គបណ្តុះបណ្តាល ពួកគេនឹងវាយតម្លៃចំណេះឌីងរបស់ពួកគេនៅក្នុងការធ្វើតេស្តក្រោយការប្រឡង។ នេះក៍អាចត្រូវបានប្រើសម្រាប់ការវាយតម្លៃគម្រោងផងដែរ។ ក្នុងអំឡុងពេលលំហាត់ជីកំប៉ុស្តិ៍ ផ្ទះជីកំប៉ុស្តិ៍មួយត្រូវបានប្រើប្រាស់ ហើយវត្ថាជាតុឌើមពីសហគមន៍ដែលភាគច្រើនមកពីផ្សារសើមក្បែរនោះត្រូវបានរៀបចំសម្រាប់លំហា

ដើម្បីធានាបាននូវល្បាយក្រឹមត្រូវសម្រាប់ការធ្វើដីកំប៉ុស្តិ៍។

៤.៤ ប្រភេទនៃសិក្ខាកាម

ដើម្បីបង្កើនការយល់ដឹងអំពី និងបង្កើតឱកាសអាជីវកម្មដែលពាក់ព័ន្ធ MSW សិក្កាកាមជាច្រើនក្រុមនឹងត្រូវបានជ្រើសរើស រួមទាំងនិស្សិត កសិករ សហករណ៍កសិកម្ម សហគមន៍កសិកម្ អង្គការក្រៅរដ្ឋាភិបាល សហគ្រិន និងដៃគូអភិវឌ្ឍន៍។ អ្នកពាក់ព័ន្ធ ដើម្បីជួយសម្រួលដល់កិច្ចសហការយ៉ាងជិតស្និទ្ធ ក្រុមសិក្ខាកាមផ្សេងៗត្រូវបានភ្ជាប់គ្នាតាមរយៈប្រព័ន្ធផ្សព្វផ្សាយសង្គមដូចជា Telegram ជាឌើម។ គោលបំណងសំខាន់គឺរក្សាទំនាក់ទំនងជាមួយពួកគេ ចែករំលែកបទពិសោធន៍ និងរក្សាឱ្យពួកគេធ្វើបចូបន្រ្តភាពអំពីវឌ្ឍនភាពរបស់ពួកគេ សូម្បីតែបន្ទាប់ពីការបណ្តុះបណ្តាលក៍ដោយ។

៤ ៥ ការផ្តល់សេវាសម្រាប់និរន្តរភាពនៃមជ្ឈមណ្ឌល

ដើម្បីជានាបាននូវការអនុវត្តគម្រោងដោយរលូន អ្នកចូលរួមសរុបពី 15-20 នាក់មកពីស្ថាប័ន/វិស័យផ្សេងៗនឹងត្រូវបានអនុញ្ញាតឱ្យចូលរួមក្នុងវគ្គនេះ។ ក្នុងឆ្នាំដំបូង សិក្ខាកាមនឹងទទួលបានវគ្គសិក្សាដោយបញ្ណុះតម្លៃ 50% (25 ដុល្លារក្នុងមួយវគ្គបណ្ណុះបណ្តាល) ដោយសារតែតម្រូវការក្នុងការកសាងសមត្ថភាព

និងកែលម្អបរិក្ខារនានាក្នុងអំឡុងពេលអនុវត្តគម្រោង។ បន្ទាប់មក អ្នកចូលរួមម្នាក់ៗនឹងត្រូវគិតប្រាក់ 50 ដុល្លាវ/នាក់ក្នុងមួយវគ្គ សម្រាប់ការផ្តល់សេវា និងការសម្របសម្រួល បើទោះបីដាវគ្គសិក្សាត្រូវបានបញ្ចប់ក៍ដោយ។ វិធីសាស្ត្រនេះអាចរួមចំណែកដល់និរន្តរភាពនៃគម្រោង និងសមរម្យសម្រាប់ការផ្ទេរចំណេះដឹងដើម្បីចាប់ផ្តើម ឬកែលមួអាជីវកម្ម។

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វគ្គបណ្ដុះបណ្ដាលនឹងផ្ដល់ហិរព្ឈប្បទានដោយខ្លួនឯងបន្ទាប់ពីការបញ្ចប់គម្រោងតាមរយៈប្រាក់ ចំណូលដែលទទួលបានពីការផ្ដល់ដូនវគ្គសិក្សា។ មង្ឃមណ្ឌលបណ្ដុះបណ្ដាល RUA មានបំណងផ្ដល់ដូនយ៉ាងហោចណាស់ 6 វគ្គបណ្ដុះបណ្ដាលក្នុងមួយឆ្នាំ។ ជាមួយនឹងអ្នកចូលរួមយ៉ាងតិច 15 នាក់ក្នុងមួយវគ្គ ប្រហែល \$4,500 USD ក្នុងមួយឆ្នាំនឹងត្រូវបានបង្កើតជាប្រាក់ចំណូល។ ក្នុងចំណោមចំនួននេះ ២៥% នឹងត្រូវប្រើប្រាស់សម្រាប់ចំណាយលើថ្លៃបណ្ដុះបណ្ដាលសម្រាប់អ្នកជំនាញ ២៥% ខៀតនឹងប្រើប្រាស់សម្រាប់វគ្គបណ្ដុះបណ្ដាល និង ២៥%

ទៀតប្រើប្រាស់សម្រាប់ការគ្រប់គ្រងផ្ទៃក្នុង និងប្រតិបត្តិការរបស់ មង្ឈមណ្ឌលបណ្ដុះបណ្ដាល RUA ។ នៅសល់នឹងត្រូវបានរក្សាទុកសម្រាប់ការប្រើប្រាស់នៅពេលក្រោយ។ ចំនួនវគ្គសិក្សានឹងមិនត្រូវបានកំណត់ត្រឹម 6 នោះទេ ប៉ុន្តែនេះគ្រាន់តែជាការចាប់ផ្តើមប៉ុណ្ណោះ។

ទេរួនក្តេសេរូកនាក់កាងកែក្រេខ ។ នេះសេ ខ្មុំរុទ្ឋសេរការការពារទាំខារដូខខ្មុំរុដ្ឋកេរ នៅពេលដែលមង្ឃមណ្ឌលបណ្តុះបណ្តាល RUA ត្រូវបានបំពាក់កាន់តែប្រសើរ និងមានបទពិសោធន៍កាន់តែច្រើន

វគ្គសិក្សានឹងត្រូវបានពង្រីកដើម្បីរួមបញ្ឈលអ្នកចូលរួមកាន់តែច្រើន ដើម្បីបង្កើតប្រាក់ចំណូលបន្ថែម និងផ្តល់ជំនាញបន្ថែមលើ MWS ។ ក្នុងរយ:ពេលវែង សេវាកម្មផ្សេងទៀតដូចជាការប្រីក្សា និងការសិក្សាលទ្ធភាពនឹងត្រូវបានផ្តល់ដូនដល់អ្នកដែលចង់ចាប់ផ្តើមអាជីវកម្មគ្រប់គ្រងកាកសំណ ល់។



រូបភាពទី 2៖ ការបណ្ដុះបណ្ដាល/ការផ្ដល់សេវានៅក្នុង RUA -Training Hub និងដៃគូពាក់ព័ន្ធ

៥ រចនាសម្ព័ន្ធនៃមជ្ឈមណ្ឌលបណ្តុះបណ្តាល

RUA -Training Hub ត្រូវបានបង្កើតឡើងក្រោមការគ្រប់គ្រងផ្ទាល់របស់មង្ឈមណ្ឌលសិក្សា កសិកម្មនិងបរិស្ថានក្រោមអាណត្តិរបស់មហាវិទ្យាល័យរុក្ខាសាស្ត្រ RUA ក្នុងរាជធានីភ្នំពេញ។ រចនាសម្ព័ន្ធនៃ RUA -Training Hub មានដូចខាងក្រោម៖

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ផែនការអាជីវកម្ គឹជាឯកសារសរសេរច្បាស់លាស់ដែលគិតគួរពីកត្តាសំខាន់ៗទាំងអស់ដែលប៉ះពាល់ដល់អាជីវកម្ម។ វាមានសារ:សំខាន់ខ្លាំងណាស់ក្លុងការអភិវឌ្ឍន៍ផែនទីបង្ហាញផ្លូវ ដើម្បីសម្រេចបាននូវគោលដៅរបស់មង្គមណ្ឌល។ ទោះជាយ៉ាងណាក៍ដោយ ផែនការអាជីវកម្មដែលបានប្រើនៅក្នុងមជ្យមណ្ឌលនេះផ្នោតជាពិសេសលើការវិភាគតម្លៃ-អត្ថប្រយោងន៍សម្រាប់ការសម្រេចចិត្តកាន់តែប្រសើរឡើងមុនពេលចាប់ផ្តើមអាជីវកម្មដីកំប៉ុស្តិ៍។ ទិដ្ឋភាពពីរត្រូវបានពិភាក្សាដូចខាងក្រោម៖ Page | 14

៦ ផែនការអាជីវកម្ម

ដើម្បីធានាថាវគ្គសិក្សាត្រូវបានចែកចាយយ៉ាងត្រឹមត្រូវទៅកាន់ទស្សនិកជនគោលដៅ។

អង្គភាពចុងក្រោយរួមមានការបង្កើតក្រមធនធាន និងការប្រមូលសម្ភារ:បណ្ណុះបណ្តាលចាំបាច់ទាំងអស់

ការអភិវឌ្ឍន៍វគ្គសិក្សា និងសម្រាប់ការបោះពុម្ពផ្សាយសកម្មភាពទាំងអស់ដែលបានអនុវត្តនៅក្នុងមង្ឈមណ្ឌល។

ទទួលខុសត្រូវលើឯកសារគ្រប់ប្រភេទដែលត្រូវការនៅក្នុងមងម្រណ្ឌល ទំនាក់ទំនងជាមួយភាគីពាក់ព័ន្ធ សិក្កាកាមមកពីស្ថាប័នផ្សេងៗ ដួចជាធនធាន រៀបចំការបណ្ដុះបណ្ដាលគ្រប់ប្រភេទ និងគ្រប់គ្រងលំហូរហិរញវត្ថុនៃមងម្រណ្ឌល។ អង្គភាពគ្រប់គ្រងចំណេះឌឹងមានទំនួលខុសត្រូវក្នុងការរក្សាទុកធនធានទាំងអស់ដែលទាក់ទងនឹង

មដ្ឃមណ្ឌលបណ្ដុះបណ្ដាលត្រូវបានបង្ហាញក្នុងរូបភាពទី 3 មង្ឃមណ្ឌលនេះត្រូវបានបែងចែកជាបីអង្គភាព៖ និងហិរញ្ញវត្ថ អង្គភាពរដ្ឋបាល អង្គភាពគ្រប់គ្រងចំណេះឌឹង និងអង្គភាពបច្ចេកទេសា អង្គភាពរដ្ឋបាល និងហិរញវត្ថ

រូបភាពទី 3៖ រចនាសម្ព័ន្ធរបស់ RUA Training Hub

រចនាសម្ព័ន្ធគ្រប់គ្រងពីលើចុះក្រោមសម្រាប់







RUA

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កំណត់បរិមាណសំណល់អាហារដែលប្រមូលបាន និងព្យាបាលជារៀងរាល់ឆ្នាំ ព្រមទាំងកំណត់បរិមាណដីកំប៉ុស្តិ៍ដែលផលិតដោយតម្លៃលក់ប៉ាន់ស្មាន។ ការប៉ាន់ប្រមាណការចំណាយលើការវិនិយោគដូចជាតម្លៃទិញឧបករណ៍ ការដំឡើង គ្រឿងបរិក្ខារ និងសម្នារ:។ ប្រាក់ចំណូល និងរយៈពេលសងត្រលប់ក៍ត្រូវយកមកគិតផងដែរ មុននឹងសម្រេចចិត្តធ្វើការវិនិយោគ។

និងជ្រើសរើសមួយណាដែលចំណេញខាងសេដុកិច្ច <u>ដើម្បីប្រៀប</u>ធៀបអាជីវកម្មផ្សេងៗគ្នា រូបមន្តជាច្រើនត្រូវបានប្រើជាលក្ខណៈវិនិច្ឆ័យសម្រាប់ការសម្រេចចិត្តកាន់តែប្រសើរ។

៦.១ ទ្រឹស្ដី និងរូបមន្តសម្រាប់ផែនការអាជីវកម្

៦.១.១ ការចំណាយសរុប

ការចំណាយលើការវិនិយោគពាក់ព័ន្ធនឹងការកំណត់តម្លៃដំបូងដែលត្រូវការដើម្បីទិញឧបករណ៍ និងសាងសង់ឧបករណ៍ និងការចំណាយអថេរដែលចាំបាច់សម្រាប់ប្រតិបត្តិការប្រចាំឆ្នាំដោយរលូន។ ក្នុងន័យនេះ ការចំណាយថេរ (FC) និងថ្លៃឌើមអថេរ (VC) ត្រូវបានយកមកពិចារណា។ FC ត្រូវបានគេ ចាត់ទុកថាជាការចំណាយណាមួយដែលត្រូវបានជួសជុលលើមូលដ្ឋានប្រចាំឆ្នាំ ទោះបីជាមិនមាន សកម្មភាពជលិតកំដោយ។ ទនិ៍មនឹងនេះ VC តំណាងឱ្យការចំណាយណាមួយដែលកើតឡើងនៅពេលណាដែលនេះដាសកម្មភាពផលិតកម្ម។

$$FC = DC + 0\&M + HIT \tag{1}$$

កាលបើ

- FC គឺជាថ្លៃដើមថេរ (USD/ឆ្នាំ)
- DC គឺជាតម្លៃរំលោះ (USD/ឆ្នាំ)
- O&M គឺជាការចំណាយសម្រាប់ប្រតិបត្តិការប្រចាំឆ្នាំ និងការថែទាំផលិតកម្ម
- គឺជាការរួមបញ្ឈូលគ្នានៃលំនៅដ្ឋាន អត្រាការប្រាក់ និងពន្ធ។ HIT លំនៅឋានគឺជាការចំណាយណាមួយដែលកើតឡើងសម្រាប់គ្រឿងបរិក្ខារ។ ទន្ទឹមនឹងនេះដែរ ខ្ញុំគឺជាអត្រាការប្រាក់ដែលបានបង់ក្លុងមួយឆ្នាំ (USD/ឆ្នាំ) ហើយ T គឺជាពន្ធលើសកម្មភាពអាជីវកម្ម (USD/ឆ្នាំ)។ វាអាចជាសូន្យ ប្រសិនបើពន្ធមិនត្រូវបានដាក់។

$$TC = FC + VC \tag{2}$$

៦.១.២ ចំណូល

ប្រាក់ចំណូលសម្រាប់អាជីវកម្មនេះគឺផ្អែកលើបរិមាណជីកំប៉ុសដែលផលិតប្រចាំឆ្នាំ និងតម្លៃលក់របស់វា។ ការគណនាប្រាក់ចំណូលនេះគឺជាចំណូលសរុប ដែលមិនទាន់ដកថ្លៃ 0&M នៅឡើយទេ។ ប្រសិនបើការចំណាយ O&M ត្រូវបានដក ការសន្សថ្លៃដើមសុទ្ធនឹងត្រូវបានទទួល។

$$TR = P \times Q \tag{3}$$
$$NS = TR - O\&M \tag{4}$$

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ដែល៖

- TR គឺជាចំណូលសរុប (USD/ឆ្នាំ)
- P គីជាតម្លៃលក់ជីកំប៉ុស្តិ៍ (USD/T)
- Q គីជាបរិមាណផលិតក្លុងមួយឆ្នាំ (T/year)
- NS គីជាការសន្សំការចំណាយសុទ្ធ (USD/ឆ្នាំ)

៦.១.៣ រយៈពេលសងគ្រលប់សាមញ្ហ

Simple Payback Period (SPP) គីជាប្រភេទនៃឧបករណ៍សេដ្ឋកិច្ចដែលប្រើដើម្បីកំណត់ចំនួនឆ្នាំនៅពេលដែលការវិនិយោគដំបូងក្រូវ បានស្តារឡើងវិញពេញលេញ។

$$SPP = \frac{INVESTMENT}{NS}$$
(5)

ដែល៖

- SPP គឺជារយ:ពេលសងក្រលប់ធម្មតា (ឆ្នាំ)
- ការវិនិយោគ ឬការវិនិយោគដំបូង (USD)
- NS គឺជាការសន្សំការចំណាយសុទ្ធ (USD/ឆ្នាំ)

៦.១.៤ ចំណុចរួចឌើម

ចំនុចរួចដើម គឺជារូបមន្តសេដ្ឋកិច្ចមួយប្រភេទដែលប្រើដើម្បីកំណត់បរិមាណចាំបាច់នៃទំនិញ ឬសេវាកម្ម ដែលការចំណាយអាចទទួលបានមកវិញទាំងស្រុង។ ម្យ៉ាងវិញទៀត ចំនុចបំបែកតំណាងឱ្យកម្រិតដែលការចំណាយ និងប្រាក់ចំណូលស្មើគ្នា។ លើសពីកម្រិតនេះ អាជីវកម្មហាក់ដូចជាទទួលបានប្រាក់ចំណេញ ហើយនៅក្រោមកម្រិតនេះ អាជីវកម្មហាក់ដូចជាបាត់បង់ប្រាក់ចំណេញ។

$$BE = \frac{FC}{P - VC} \tag{6}$$

កាលបើ

- BE គីជាចំណុចចំណេញ (T/ឆ្នាំ)
- FC គឺជាថ្លៃដើមថេរ (USD/ឆ្នាំ)
- P គីជាតម្លៃលក់ (USD/T)
- VC តំណាងឱ្យការចំណាយរួមគ្នាសម្រាប់ការផលិតតែមួយឯកតា (USD/T)

៦ ២ ករណីសិក្សាអាជីវកម្ម

COMPOSTED

គីជាអង្គការក្រៅរដ្ឋាភិបាលមួយដែលត្រូវបានបង្កើតឡើងនៅក្នុងប្រទេសកម្ពុជាក្នុងឆ្នាំ 2000 ដើម្បីប្រយុទ្ធប្រឆាំងនឹងវិបត្តិកាកសំណល់ និងការពារបរិស្ថានដោយការកែលម្អជីជាតិដី និងការបង្កើនផលិតកម្មកសិកម្មតាមរយ:ការប្រើប្រាស់កំប៉ុស្តិ៍ (COMPED, 2013)។ ក្នុងករណីសិក្សា

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នេះ ការផ្តោតលើអាងីវកម្មងីកំប៉ុស្តិ៍របស់ក្រុមហ៊ុន COMPOSTED នៅខេត្តបាត់ដំបង។ យោងតាមការសិក្សាមួយ ការផលិតដីកំប៉ុស្តិ៍ ប្រចាំខែគី 10 តោន/ខែ ឬ 120 តោន/ឆ្នាំ ខណ:តម្លៃដីកំប៉ុស្តិ៍គី 130 ដុល្លារ/តោន (GGCl, 2019)។

ជាមួយនឹងតួលេខនេះ COMPOSTED អាចបង្កើតបាន 15,600 ដុល្លារ/ឆ្នាំ ជាចំណូលសរុប ហើយនៅពេលដែលការចំណាយលើប្រតិបត្តិការ និងការថែទាំ (1,206 ដុល្លារ/ឆ្នាំ) ត្រូវបានកាត់ចេញ ប្រាក់ចំណូលសុទ្ធត្រូវបានប៉ាន់ស្មានថាមានចំនួន 14,395 ដុល្លារ/ឆ្នាំ។ ដោយសារថវិកាគម្រោងសរុបគឺ ដោយមិនរាប់បញ្ចូលថ្លៃពលកម្ និងថ្លៃឌើម \$25,316 នោះរយៈពេលសងក្រលប់ដ៍សាមព្វាត្រូវបានគេប៉ាន់ប្រមាណថាមាន 1.6 ឆ្នាំ ដែលមានភាពប្រាកដនិយមសម្រាប់ប្រតិបត្តិការអាជីវកម្ម។ ផ្នែកលើករណីសិក្សានេះ គេអាចសន្និដ្ឋានបានថា អាជីវកម្មជីកំប៉ស្ិ៍ មានជលចំណេញ ប្រសិនបើឧបករណ៍ចាំបាច់ទាំងអស់មាននៅនឹងកន្លែង ហើយបរិមាណជីកំប៉ុស្តិ៍ គ្រប់គ្រាន់ត្រូវបានផលិតក្នុងមួយឆ្នាំ ទើបអាចបង្កើតចំណូលបានខ្ពស់។

តារាងទី 3៖ ការវិភាគផ្លៃដើមសម្រាប់អាជីវកម្មជីកំប៉ុស្តិ៍ តាមរយៈ COMPOSTED

| ការចំណាយលើការវិនិយោគ | ឯកតា | ចំនួនទឹកប្រាក់ | O&M | ជីវិត (ឆ្នាំ) | វំលោះ |
|--------------------------------|--------------|----------------|-------|---------------|-------|
| រោងជីកំប៉ុស្តិ៍ | USD | 2,000 | 5% | 10 | 200 |
| Shedder | USD | 5,000 | 5% | 10 | 500 |
| Wheel loader | USD | 12,900 | 5% | 10 | 1,290 |
| ម៉ាស៊ីនបញ្ចាំង | USD | 6,000 | 5% | 10 | 600 |
| ទែម៉ូម៉ែត្រជីកំប៉ុស្តិ៍ | USD | 210 | 5% | 5 | 42 |
| សរុបរង | | 24,110 | 1,206 | | 2,432 |
| ភាពអាសន្ន (5% នៃការវិនិយោគ) | USD | 1,206 | | 10 | 121 |
| ថវិកាគម្រោងសរុប | | 25,316 | | | 2,553 |
| <mark>ចំន</mark> ូលប្រចាំឆ្នាំ | ឯកតា | ចំនួនទឹកប្រាក់ | | | |
| ផលិតផលជីកំប៉ុស្តិ៍ | កោន/ឆ្នាំ | 120 | | | |
| តម្លៃជីកំប៉ុស្តិ៍ | USD/កោន | 130 | | | |
| ក្រាក់ចំណូល | ឌុណ្ណរ/ឆ្នាំ | 15,600 | | | |
| ការសន្យ៉ថ្លៃដើមសុទ្ធ | ឌុណ្ណរ/ឆ្នាំ | 14,395 | | | |
| រយៈពេលសងក្រលប់សាមញ្ញ | ន្នាំ | 1.6 | | | |

៧ សូចនាករនៃភាពដោគជ័យ

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Deliverable 4.4 – Training Hubs Feasibility Studies

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សូចនាករនៃភាពដោគដ័យអាចត្រូវបានកំណត់ដោយផ្អែកលើលក្ខណៈវិនិច្ឆ័យជាច្រើន ចាប់ពីការរចនានៃវគ្គសិក្សា ការជ្រើសរើសអ្នកចូលរួម រហូតដល់ការដាក់ពាក្យ និងការរួមបញ្ឈលចំណេះដឹងដែលទទួលបានក្នុងវគ្គសិក្សាទៅក្នុងការងារបច្ចប្បន្នរបស់ពួកគេ។ នៅពេលដែលវគ្គសិក្សាដីកំប៉ុសត្រូវបានអនុវត្ត សូចនាករដោគដ័យត្រូវតែកំណត់ និងវាយតម្លៃ ដូច្នេះវគ្គសិក្សាអាចត្រូវបានកែសម្រួលតាមតម្រូវការនាពេលអនាគត។តាមបច្ចេកទេស សូចនាករដោគដ័យនីមួយៗគឺជាតម្លៃដែលអាចវាស់វែងបាន

និងអាចតំណាងឱ្យវឌ្ឍនភាពនៃសកម្មភាពឆ្ពោះទៅរកផលប៉ះពាល់ដែលចង់បាននៃគម្រោង។ មានលក្ខណៈវិនិច្ឆ័យជាច្រើនសម្រាប់ការវាយតម្លៃសូចនាករជោគជ័យ។ ពាក្យថា ជោគជ័យ មានន័យថា រាល់សមិទ្ធផលដែលចង់បាន។ នេះអាចជាការផ្លាស់ប្តូរូជាវិជ្ជមាននៅក្នុងអាកប្បកិរិយា ឬការធ្វើឱ្យប្រសើរឡើងក្នុងការអនុវត្តស្ថាប័ន។ តាមរបៀបនេះ

ផលប៉ះពាល់ដែលចង់បានអាចត្រូវបានចែករំលែកជាមួយសហគមន៍ ហើយជាមួយនឹងការធ្វើផែនការត្រឹមត្រូវ គឺមានលក្ខណ:អចិន្ត្រៃយ៍។

សូចនាករនៃភាពដោគដ័យក្នុងការរចនានៃវគ្គបណ្ដុះបណ្ដាលនេះរួមមានសមាសភាពអ្នកចូលរួ មមកពីស្ថាប័នផ្សេងៗគ្នា ភាគរយនៃអ្នកដែលបានបញ្ចប់វគ្គសិក្សាម្ដងម្កាល ភាគរយនៃអ្នកដែលផ្លាស់ប្ដូរូអាកប្បកិរិយារបស់ពួកគេទាក់ទងនឹងការគ្រប់គ្រង MSW ភាគរយនៃអ្នកដែល អនុវត្តចំណេះដឹងដើម្បីកែលម្អអាជីវកម្មជីកំប៉ុសរបស់ពួកគេ ឬចាប់ផ្ដើមអាជីវកម្មថ្មី។ សូចនាករផ្សេងទៀតនៃភាពដោគជ័យគឺការរិភាគលើការរិវត្តនៃចំនួនអ្នកដែលអនុវត្តចំណេះដឹងពីមួ យឆ្នាំទៅមួយឆ្នាំក្នុងអាជីវកម្មរបស់ពួកគេ និងប្រាក់ចំណេញពីអាជីវកម្មនោះ។ កត្តាទាំងអស់នេះដះឥទ្ធិពលដល់ភាពដោគជ័យ និងអត្ថប្រយោជន៍នៃវគ្គនេះ

ដែលអាចកាត់បន្ថយការបំពុលគ្រប់ប្រភេទ និងការបំភាយឧស្ម័នផ្ទះកញ្ចក់។ ដើម្បីជានាថាសូចនាករទាំងនេះអាចត្រូវបានវាយតម្លៃ កម្រងសំណួរជាច្រើនត្រូវបានរចនា និងប្រើដើម្បីកត់ត្រារយ:ពេលមុន និងក្រោយការចូលរួមក្នុងវគ្គសិក្សា។

ល្យាយនៃអ្នកចូលរួម៖ ដើម្បីធានាថាវគ្គសិក្សាដែលបានស្នើឡើងអាចងួយដោះស្រាយបញ្ហា MSW និងបង្កើតប្រាក់ចំណូលពីពួកគេ អនុទារមើនអនុសាធានិយនីមនាមស្នាក់ទេសចូរតែមួយអនុសាធានិតមូនចំពុំស្នាក់អនុសាធានិតមូនអនុស

អ្នកចូលរួមដែលត្រូវបានជ្រើសរើសសម្រាប់វគ្គសិក្សាត្រូវតែរួមបញ្ឈលកសិករម្នាក់ៗ សហគមន៍កសិកម្ម អង្គការក្រៅរដ្ឋាភិបាល អាជីវកម្ម និងអ្នកពាក់ព័ន្ធ។ ដូចគ្នានេះផងដែរ យ៉ាងហោចណាស់មួយភាគបីនៃអ្នកចូលរួមនៃវគ្គសិក្សានីមួយៗត្រូវតែជាស្ត្រី ព្រោះគំនិតនេះគឺលួសម្រាប់ការសម្រេចចិត្តក្នុងគ្រួសារ។

ភាគរយនៃសិក្ខាកាមដោគជ័យ៖ សម្រាប់វគ្គបណ្ដុះបណ្ដាលនីមួយៗ សិក្ខាកាមភាគច្រើនត្រូវតែចូលរួមយ៉ាងពេញលេញក្នុងការបណ្ដុះបណ្ដាល ខណៈដែលយ៉ាងហោចណាស់ 80% នៃពួកគេត្រូវតែទទួលបានពិន្ទយ៉ាងតិច 80 ក្នុងចំណោម 100 នៅលើការប្រលងក្រោយការប្រលង។ យ៉ាងហោចណាស់ 50% នៃសិក្ខាកាមទាំងអស់ ដែលពាក់កណ្ដាលងាស្ត្រី បានចូលរួមយ៉ាងពេញលេញក្នុងការអនុវត្តជីកំប៉ុស។ នេះអាចត្រូវបានកំណត់ដោយការសង្កេត និងបញ្ជីត្រួតពិនិត្យដោយគ្រូបណ្ដុះបណ្ដាល។

Deliverable 4.4 – Training Hubs Feasibility Studies

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ភាគរយនៃសិក្ខាកាមផ្លាស់ប្តូរូអាកប្បកិរិយារបស់ពួកគេក្នុងការគ្រប់គ្រងកាកសំណល់ក្រុង៖

សូចនាករនេះអាចត្រូវបានកំណត់ក្នុងដំណើរការជាបន្តបន្ទាប់។

មធ្យោបាយដ៍ល្អបំផុតដើម្បីពិនិត្យមើលនេះគឺត្រូវប្រើវេទិកាទំនាក់ទំនងដូចជា Telegram និង Facebook ដើម្បីចែករំលែកចំណេះឌីង និងធ្វើបច្ឆុប្បន្នភាពការវិវត្តន៍បន្ទាប់ពីវគ្គសិក្សា។ អ្នកចូលរួមត្រូវបានសួរជាបន្តបន្ទាប់នូវសំណួរដែលបានកំណត់ទុកជាមុនតាមអ៊ីនធឺណិតដើម្បីកំណត់ អត្តសញ្ញាណការផ្លាស់ប្តូរូអាកប្បកិរិយា។ ក្នុងករណីខ្លះ

ការសម្ភាសតាមទូរស័ព្ទក៍ត្រូវបានធ្វើឡើងផងដែរ ដើម្បីប្រមូលព័ត៌មាននេះ។ សម្រាប់ការបញ្ជាក់ អ្នកចូលរួមយ៉ាងហោចណាស់

នាក់ត្រូវបានទាក់ទងសម្រាប់ដំណើរទស្សនកិច្ចដើម្បីកំណត់ស្ថានភាពបច្ចប្បន្នរបស់ពួកគេរយ:ពេល ប្រាំមួយខែបន្ទាប់ពីការបណ្តុះបណ្តាល។ សូចនាករដ៍ល្អនៃភាពដោគជ័យគឺថាយ៉ាងហោចណាស់ 50% នៃអ្នកចូលរួមបានផ្លាស់ប្តូរូឥរិយាបថគ្រប់គ្រងកាកសំណល់របស់ពួកគេប្រាំមួយខែបន្ទាប់ពីការបណ្តុះ បណ្តាល។

ភាគរយនៃអ្នកចូលរួមបណ្ដុះបណ្ដាលអនុវត្តចំណេះឌីងរបស់ពួកគេឌើម្បីកែលម្អការអនុវត្តជីកំប៉ុសរប ស់ពួកគេះ

សូចនាករនេះក៍ត្រូវបានកំណត់ដោយការពិតដែលថាអ្នកចូលរួមប្រើប្រាស់វេទិកាទំនាក់ទំនងដើម្បីធ្វើ បច្ចុប្បន្នភាពសកម្មភាពឬអាជីវកម្មរបស់ពួកគេទាក់ទងនឹងការគ្រប់គ្រងកាកសំណល់ និងការផលិតជីកំប៉ុស។ យ៉ាងហោចណាស់មួយភាគបីនៃអ្នកចូលរួមក្នុងការបណ្តុះបណ្តាលនីមួយៗអនុវត្តចំណេះដឹងដើម្បីកែល

មួរអាជីវកម្មជីកំប៉ុសរបស់ពួកគេ។

ទំនោរនៃសិក្ខាកាមក្នុងការអនុវត្តចំណេះឌឹងនៅក្នុងអាជីវកម្មរបស់ពួកគេះ

សូចនាករនេះអាស្រ័យលើទិន្នន័យដែលបានប្រមូលកាលពីឆ្នាំមុន។ ដូច្នេះ គេអាចកំណត់បានក្នុងរយៈពេលពីរឆ្នាំដំបូងបំផុត បន្ទាប់ពីការអនុវត្តវគ្គបណ្ដុះបណ្ដាលដំបូង ដើម្បីតាមដានការវិវត្តន៍។ ការអនុវត្តគម្រោងគឺជាជោគជ័យ ប្រសិនបើនិន្នាការបង្ហាញពីនិន្នាការកើនឡើង ហើយសូចនាករសម្រាប់និន្នាការពីមួយឆ្នាំទៅមួយឆ្នាំកំពុងកើនឡើង។

ច្រាក់ចំណេញអាដីវកម្ម៖ សូចនាករនេះរួមបញ្ឈលទាំងសេណារីយ៉ូពីរង្សេងគ្នា៖ សម្រាប់អ្នកដែលមានអាដីវកម្មពាក់ព័ន្ធរួចហើយ និងសម្រាប់អ្នកដែលមិនធ្វើ។ នៅក្នុងសេណារីយ៉ូទី 1 វាមានន័យថាគម្រោងនេះបានរួមចំណែកដល់ការបង្កើតប្រាក់ចំណូលប្រសិនបើប្រាក់ចំណូលពីអាដីវ កម្មដែលត្រូវគ្នាបានកើនឡើងយ៉ាងហោចណាស់ 20% បន្ទាប់ពីបានចូលរួមក្នុងវគ្គបណ្ដុះបណ្ដាល។ ប្រសិនបើសិក្ខាកាមដែលមិនទាន់ធ្វើជីកំប៉ុសអាចចាប់ផ្ដើមអាដីវកម្មបាន នេះជាការបង្ហាញពីផលប៉ះពាល់នៃគម្រោង។ សម្រាប់អ្នកដែលនឹងធ្វើជីកំប៉ុសសម្រាប់ដំណាំរបស់ពួកគេ សូចនាករដ៍ល្អនៃភាពជោគជ័យគឺការកាត់បន្ថយការប្រើប្រាស់ជីគីមី 50% ។

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4៖

•A mixture of the participants,

•Percentage of successful trainees,

•Percentage of trainees changing their behaviour in municipal waste management,

•Percentage of training participants applying their knowledge to improve their composting practises,

•Tendency of trainees to apply the knowledge in their business

•Business Profit

រូបភាពទី

រ^{ូចកកាទ} សំណុំនៃសូចនាករដែលចាំបាច់សម្រាប់ការបង្ហាញពីភាពជោគជ័យនៃមជ្ឈមណ្ឌលបណ្ដុះបណ្ដាល

៨ ផែនការតាមដាន និងវាយតម្លៃ

ផែនការតាមដាន និងវាយតម្លៃ (M&E) មានសារៈសំខាន់សម្រាប់ការអនុវត្តគម្រោងដោយជោគជ័យ ព្រោះវាជួយកំណត់ អនុវត្ត តាមដាន និងកែលមួយុទ្ធសាស្ត្រ M&E ដើម្បីសម្រេចបានលទ្ធផលដែលចង់បាន និងសម្រេចបាននូវផលប៉ះពាល់ដែលត្រូវការ។ ប្រព័ន្ធ M&E ដែលដំណើរការបានល្អ គឺជាធាតុផ្សំដ៍សំខាន់នៃការគ្រប់គ្រងគម្រោង/កម្មវិធីល្អ និងគណនេយ្យភាព។

ដើម្បីធានាថាវគ្គបណ្ដុះបណ្ដាលទទួលបានដោគដ័យ សកម្មភាពក្រួតពិនិត្យ និងវាយតម្លៃត្រូវបានធ្វើឡើងក្នុងអំឡុងពេល និងក្រោយវគ្គបណ្ដុះបណ្ដាល។ ការកែលម្អចំណេះដឹងត្រូវបានត្រួតពិនិត្យតាមរយៈការធ្វើតេស្តមុន និងក្រោយវគ្គសិក្សា។ ដំណើរការ M&E ប្រកបដោយប្រសិទ្ធភាពមាន 6

ដំណានដែលនឹងត្រូវបានប្រើងាឧបករណ៍បណ្ដុះបណ្ដាលសម្រាប់វគ្គសិក្សានេះ។ ប្រព័ន្ធ M&E និងក្របខ័ណ្ឌនឹងគ្របដណ្ដប់លើចំណុចសំខាន់ៗចំនួនប្រាំមួយ។

វគ្គបណ្តុះបណ្តាលនេះមានគោលបំណងកាត់បន្ថយសំណល់រឹងក្រុងតាមរយៈការធ្វើជីកំប៉ុស និងបង្កើតឱកាសអាជីវកម្មសម្រាប់អ្នកពាក់ព័ន្ធទាំងអស់ក្នុងប្រទេស។ ប្រព័ន្ធ M&E លម្អិត និងក្របខ័ណ្ឌសម្រាប់ការងារនេះត្រូវបានផ្តល់ដូនខាងក្រោម៖

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បន្ទាប់ពីបញ្ចប់វគ្គសិក្សា

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UHST Training Hub

Waste management through segregation and recycling Feasibility Study

English version

Training Hubs feasibility studies

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UHST-Training Hub

Waste Management through Segregation and Recycling Feasibility Study

| Project Acronym | SWAP |
|----------------------------|---|
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| Deliverable | 4.4: Training Hubs Feasibility Studies |
| Deliverable Lead | UHST |
| Туре | Report |
| Dissemination Level | Confidential |
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| Author(s) | Mr. Pin Tara, Mr. Sok Pheak Ms. Uon Sophal, Ms. Meas Sreylen |









Versions

| Version | Date | Main Author | Summary of updates |
|---------|------------|-------------|--------------------|
| 1 | 16/11/2022 | Sok Pheak | - |
| | | | |

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ABSTRACT

This report is prepared for the feasibility study of the training hub intended to be organized at the Faculty of Agriculture, University of Heng Samrin Thbongkhmum (UHST). During the need analysis, it discussed regarding the challenges occurring in solid waste management. People in Cambodia's capital city of Phnom Penh produce about 3,000 metric tons of solid waste every day. Nearly 60 percent of municipal solid waste comes from households, followed by hotels and guesthouses (16.7%), restaurants (13.8%), markets (7.5%), to shops (5.4%) and offices (1.4%). As stated, the ambitious waste management programmes such as the National Environmental Strategy and Action Plan 2016-2023 and the Phnom Penh Waste Strategy 2018-2035, detailed a lot about improving governance, capacity and large scale investment on ensuring equally macro sustainable development goal.

Improper waste management becomes one of the most serious environmental and public health issues facing in many developing countries. In Cambodia, the municipal waste amount of 1.7 million tonnes is disposed at 106 landfills in 2018, steadily increased of 205,656 tonnes or equal to 13.68% compared in 2017 and increased of 56.9% if compared in 2014, while the methane gas generated from landfill sites across Cambodia (four cities - Phnom Penh, Siem Reap, Battambang, Kampong Cham) is estimated to be as high as 360,000 tonnes CO2 equivalent per year, contributing to global climate change.

KEYWORDS

Climate change, landfill, Matane gas, and Training Hub.

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1 Need Analysis

Solid waste management is an emerging concern for countries around the world, particularly developing nations with limited financial resources, lack of technologies, and an absence of policy framework. Waste management is the one of the biggest challenges in developing countries such as in Asia have serious environmental and public health problem. For the solid waste in Cambodia is classified into three categories; household waste, commercial waste, and industrial and hazardous waste (including medical waste). Cambodia has been among the fastest-growing economies in Southeast Asia, with an average annual GDP growth of 7% over the past five years. An increase in solid waste and associated challenges in solid waste management faced as a result of this rapid economic growth and subsequent rise in consumption. The amount of municipal solid waste increased sharply to over 4 million tons per year nationwide, with about 37% going to landfills, 12% recycled, and 51% illegally dumped or burned despite existing laws. The amount of waste disposed in landfills increased accordingly, from over 317,550 tons per year in 2004 to 1.5 million tons per year in 2017.

According to the Ministry of Environment, in Cambodia, the municipal waste amount of 1.7 million tonnes is disposed at 106 landfills in 2018, steadily increased of 205,656 tonnes or equal to 13.68% compared in 2017 and increased of 56.9% if compared in 2014 (MoE, 2018), while the methane gas generated from landfill sites across Cambodia (four cities - Phnom Penh, Siem Reap, Battambang, Kampong Cham) is estimated to be as high as 360,000 tonnes CO2 equivalent per year, contributing to global climate change (Thumbnails, 2011).

In 2018, Cambodia generated a 10 percent increase per year in waste, while in 2019 Phnom Penh alone generated up to 3,000 tonnes of waste daily, and for the whole country producing over 10,000 tonnes is equivalent to 3.6 million per year (Khmer Times News, 2020). Municipal solid waste combine waste from household and commercials, generated from households, markets, restaurants, shops, hotels, offices, street sweeping, and miscellaneous. Phnom Penh generates around 4.09 million tons/year of solid waste that from household waste make up around 55.3% of the total, followed by hotels/guesthouses (16.7%), restaurants (13.8%), markets (7.5%), shops (5.4%) and offices (1.4%). Looking at type of waste, around half (51.9%) is food and other organic waste, one-fifth (20.9%) plastic and one tenth (9.9%) paper. Municipal solid waste treatment in Cambodia has three ways; landfill, recycling, and incineration. Also, the University of Heng Samrin Thbongkhmum (UHST) located in TbongKhmum province, Cambodia was inaugurated on 11th Feb 2016 by the Prime Minister of Cambodia. UHST provides education to rural youth who would not otherwise have access to higher education. UHST has area of land covered 22 ha for University Building, Library, Meeting Hall Building, Relaxing Place, Canteen, Reserved Building, venue for other relevant workshop and training, TVET Building, Laboratory, Agricultural Farm, Lecturer's Dormitory, Students' Dormitory, Football space. The university currently has around 1,170 students, and 600 students and 40 lecturers stay in the dormitory. Solid waste segregation and recycle is an essential activity for UHST. Current situation is that both lecturers and students have not understood about the solid waste management, particularly how to segregate properly between solid and liquid waste. Improvement of this activity will help the UHST to become green university. Solid waste

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management based on segregation and Recycling will be able to boost students and lecturers to understand how to properly dispose of solid waste and encourage students to love and care for the environment. There is still a large knowledge gap on solid waste management. Therefore, our training hub on "Waste Management through Segregation and Recycling" will be needed.

2 Risk analysis

The risk analysis is important for set up business or run business. There are six points of the risk analysis such as

- **Occupation health and safety**: Participants fail to learn and teach in class and may suffer from waste pollution in the dirty places because they are required to collect solid waste at the landfill to identify the type of solid waste. Disseminate and set prior dates, find appropriate time, lecturers, students and college representatives
- **Technical**: Need a suitable place for field trip and equipment to use during the training. Collaboration with stakeholder for given place for trip and Trainees for bringing equipment to show during the training
- **Human resources**: The number of participants in the training is not available to all students and teachers who have studied and teach in UHST because due to limited room, time and covid-19 period. Select teachers, students, and students representing colleges and institutes to attend first.
- **Operational**: The business of the officers and the experience in setting up the training. Divide the team and prepare in advance for the place, materials and arrangements during the training.
- **Project and reputation**: Insufficient experience and network to promote solid waste management widely. Organize good human resources and allocate work responsibilities for project management. Establish a network for dissemination of comprehensive solid waste management
- **Financial**: lack of budget or non-availability of funding. So, the raise funds from stakeholders, promote the benefits of solid waste management implemented by the University for material assistance and financial support.

3 Goal

The goal of the training hub is to provide capacity building on solid waste management, including waste management technologies, building research partnership among relevant stakeholders.

The specific objectives are:

- 1. To provide training services for government institutions, NGOs, communities, private sectors, local people and informal workers on solid waste management;
- 2. To support curriculum development in waste managements, research and knowledgesharing platform.
- 3. To build collaboration on research partnership amongst development partners,

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4 Training and/or Services Offered

The university will begin offering a training course on "Waste Management through Segregation and Recycling". The training will be provided by qualified lecturers and experts from UHST and COMPOSTED, while the training facilities will be placed at UHST with enough space and equipment for the learning process and practices. Firstly, this training hub will only provide a short course given within a three-day period that involves theory, practice, and field visit.

The training consists of three components:

i. Classroom lectures, including day 1 to day 3 of the workshop covered the presentation of the national trainer of the Brief agenda of training course,

Lesson 1: The overview and solid waste management in Cambodia Lesson 2: How to segregate and prepare different types of solid waste Lesson 3: How to Recycling and prepare different types of solid waste Lesson 4: Conduct the needs and income generation for solid wastes utilizations and business opportunity.

- ii. field practice for 1 day, a field visit was planned to a UHST's campus.
 - Hands-on workshop: practice segregation, and preparation from the mixed solid wastes including cleaning
 - Hands-on workshop: practice for solid waste conversion, and recycling including solid waste extrusion and shaping it up to the different type of products
 - Hands-on workshop: Establish guidelines for proper solid waste management in UHST



Figure 1: Training/services offered in UHST-Training Hub and relevant partners

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iii. Workshop's reflections, the participants collected the information on waste information, and do it analysis on how the waste segregation. The students will be required to present the results of fieldwork. The participants include: include students, farmers, agricultural cooperatives, agricultural communities, NGOs, entrepreneurs, relevant stakeholders and development partners.

5 Structure of Training Hub

UHST Training Hub will be installed under the direct manage of Faculty of Agriculture of the University of Heng Samrin Thbongkhmum in Thbongkhmum Province. The UHST training hub's organization as below:



Figure 2: UHST Training Hub's Organizational Chart

6 Business Plan

6.1 Introduction

What is a business plan? A business plan is a document that summarizes the operational and financial goals of a business. It contains a detailed plan and budget showing how the goals are achieved and a roadmap for the success of your business to be implemented. In addition, business planning must also consider a number of components such as industry aspects, sales and marketing plans, competition, management plans, market analysis and operational plans for

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success. The business also focuses on cost-benefit analysis for better decision-making before starting up a compost business, such as amount of food waste from dormitory in University of Heng Samrin Thbongkhmum per day, labor force, the selling price of compost per kilogram and how much to investment costs on equipment or material to produce composing.

6.2 Objectives of the business

- To understand the waste segregation and recycling in the university
- To generate income source for supporting students to improve their studies
- To supply compost products to local communities, including local people and agricultural cooperatives producing products at the farm levels.

6.3 Action plan

| A | Description | | 2023 | | | 2024 | | | |
|--------------|--|----|------|----|----|------|----|----|----|
| Activities | Description | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| 1. Assess th | e institutional capacity and investment needs | | | | | | | | |
| 1.1 | Organize the meeting with management board and relevant staff from the faculty of the university | | | | | | | | |
| 1.2 | Conduct a comprehensive situation analysis and stakeholder mapping of solid waste management in Cambodia describing gaps in the policy framework | | | | | | | | |
| 1.3 | Conduct training on waste management through segration and recycling | | | | | | | | |
| 2. Compost | ing house at the unversity campus | | | | | | | | |
| 2.1 | Site Selection | | | | | | | | |
| 2.2 | Building and equipment set up | | | | | | | | |
| 2.3 | Train the technical staff, lecturers and students (2 times/year*20) | | | | | | | | |
| 2.4 | Compost products (30 bags*15\$*24 months | | | | | | | | |

6.4 Budget plan

| Activity | Description | Unit | Total Unit | Unit Cost | Total (USD) |
|--------------|--|---------------------|------------|--------------|----------------|
| TOTAL REVI | ENUE | | | | \$ 13,250.00 |
| 1. Assess th | e institutional capacity and investment needs | | | | \$ 1,350.00 |
| 1.1 | Organize the meeting with management board and relevant staff from the faculty of the university | Meetings | 1 | 100.00 | 100.00 |
| 1.2 | Conduct a comprehensive situation analysis and stakeholder mapping of solid waste management in Cambodia describing gaps in the policy framework | Report | 1 | 500.00 | 500.00 |
| 1.3 | Conduct training on waste management through segration and recycling | Person | 50 | 15.00 | 750.00 |
| 2. Compost | ing house at the unversity campus | | | | \$ 11,900.00 |
| 2.1 | Site Selection | field obsersavation | 0 | - | - |
| 2.2 | Building and equipment set up | Set | 1 | 500.00 | 500.00 |
| 2.3 | Train the technical staff, lecturers and students (2 times/year*20) | Person | 20 | 30.00 | 600.00 |
| 2.4 | Compost products (30 bags*15\$*24 months | Bag-month | 24 | 450.00 | 10,800.00 |
| TOTAL COS | г | | | | \$ 8,420.00 |
| 1 | Labour force | Person-Month | 24 | 200.00 | 4,800.00 |
| 2 | Trasportation to deliver the compost products | Lumsump | 1 | 500.00 | 500.00 |
| 3 | Office supplies | Month | 24 | 30.00 | 720.00 |
| 4 | Utilities | Month | 24 | 50.00 | 1,200.00 |
| 5 | Wifi connection | Month | 24 | 50.00 | 1,200.00 |
| | TOTAL NET INCOME | | | | \$ 4,830.00 |

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6.5 Source of funding

The practice of Income generation skill at University of Heng Samrin Thbong Khmum was established so that the school management, teachers and students can earn extra income on the practice to earn money University of Heng Samrin Thbong Khmum has established. Thus, the project needed funds for the production from solid waste, my team of experts made a project to request funding. The funds received are from.

- The project foundation
- The University foundation
- The teacher's foundation
- The student's foundation

6.6 Resources

Facility:

For UHST training hub, including training rooms, laboratory, computer, projector and IT system is located at laboratory of Faculty of Agriculture, UHST. All lab equipment and tools including the existing one and equipment from SWAP budgets will be used during the training.

Material:

Organic waste material can be collected from university areas by faculty, institute and students.

Human Resources:

Trainers are lecturers from Faculty of Agriculture, and COMPOSTED.

Financial resources:

Sponsors from own institution, government organisations, NGOs and private companies. Training fee from trainees.

7 Indicators of success

- Number of trainees
- Number of trainings provided during SWAP programme
- Number of research and collaboration activities
- Feedback of trainees after training
- A number of funding sources
- A number of curriculum developed for the improvement curriculum of the faculty

8 Monitoring and Evaluation Plan

- The operation of the training hub will be monthly monitored and evaluated every semester by UHST SWAP team members.
- The M&E reports will be available to UHST training hub management, SWAP committees, and funders.

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UHST Training Hub

Waste management through segregation and recycling Feasibility Study

Khmer version

Training Hubs feasibility studies

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សារសូងរាលខ្លាំងនេស៊ីងនស៊ីលពល់

းဆံနာအစစ်ချောလံဗာ စောစ မိန်ခ ဆျှစည့်

| ពាក្យកាត់គម្រោង | SWAP |
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| សមិទ្ធផល | 4.4: កាសិក្សាលទ្ធភាពបង្កើតមណ្ឌលបណ្ដុះបណ្ដាល |
| អ្នកដឹកនាំសមិទ្ធផល | UHST |
| ប្រភេទឯកសារ | របាយការណ៍ |
| កម្រិតផ្សព្វផ្សាយ | ផ្ទៃក្នុង |
| កាលបរិច្ឆេទដាក់សមិទ្ធផល | ខែទី២១ (១៥/០៩/២០២២) |
| កាលបរិប្លេទផ្ញើ | ขอ/๑๏/๒๐๒๒ |
| អ្នកនិពន្ធ | លោក ពិន តារា, លោក សុខ ភាក់ |
| | កញ្ញា អួន សុផល, កញ្ញា មាស ស្រីឡែន |



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ជំនាន់

| ជំនាន់ | កាលបរិច្ឆេទ | អ្នកនិពន្ធចម្បង | សេចក្តីសង្ខេបបច្ចុប្បន្ន |
|--------|-------------|-----------------|--------------------------|
| | | | ភាព |
| ୭ | 9៦/99/២0២២ | សុខ ភាក់ | - |
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Deliverable 4.4 – Training Hubs Feasibility Studies

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*ສ໌*හຮ<u></u>୍ ສະຍະອີຊ

របាយការណ៍នេះត្រូវបានរៀបចំសម្រាប់ការសិក្សាលទ្ធភាពនៃមណ្ឌលបណ្ដុះបណ្ដាល ដែលនឹងត្រូវបានរៀបចំ នៅមហាវិទ្យាល័យកសិកម្ម នៃសាកលវិទ្យាល័យ ហេង សំរិន ត្បូងឃ្មុំ (UHST)។ ក្នុងអំឡុងពេលនៃការវិភាគ តម្រូវការបង្កើតនេះ យើងបានពិភាក្សាអំពីបញ្ហាប្រឈមដែលកើតឡើងក្នុងការគ្រប់គ្រងសំណល់រឹង។ ប្រជាជន ក្នុងរាជធានីភ្នំពេញរបស់ប្រទេសកម្ពុជាផលិតកាកសំណល់រឹងប្រមាណ ៣.០០០តោនក្នុងមួយថ្ងៃ។ ប្រមាណជា 60% នៃសំណល់រឹងទីក្រុងបានមកពីគ្រួសារនីមួយៗ បន្ទាប់មកគឺសណ្ឋាគារ និងផ្ទះសំណាក់ (16.7%) ភោជនីយដ្ឋាន (13.8%) ទីផ្សារ (7.5%) ហាង (5.4%) និងការិយាល័យ (1.4%) ។ ដូចដែលបានបញ្ជាក់រួច មកហើយ កម្មវិធីគ្រប់គ្រងកាកសំណល់ប្រកបដោយដ៏ធំដូចជា៖ យុទ្ធសាស្ត្រ និងផែនការសកម្មភាពជាតិ បរិស្ថានឆ្នាំ ២០១៦-២០២៣ និងយុទ្ធសាស្ត្រកាកសំណល់រាជជានីភ្នំពេញឆ្នាំ ២០១៨-២០៣៥ បានរៀបរាប់ លម្អិតជាច្រើនអំពីការកែលម្អអភិបាលកិច្ច សមត្ថភាព និងការវិនិយោគខ្នាតធំលើការជានាឱ្យបានស្មើភាពគ្នានូវ គោលដៅអភិវឌ្ឍន៍ប្រកបដោយចីរភាពដ៏ខ្លាងខ្លា។

ការគ្រប់គ្រងកាកសំណល់មិនត្រឹមត្រូវក្លាយជាបញ្ហាបរិស្ថាន និងសុខភាពសាធារណៈធ្ងន់ធ្ងរបំផុតមួយដែល កំពុងប្រឈមមុខនៅក្នុងប្រទេសកំពុងអភិវឌ្ឍន៍ជាច្រើន។ នៅក្នុងនោះ កម្ពុជាផលិតកាកសំណល់ក្រុងចំនួន ១.៧លានតោន ត្រូវបានបោះចោលនៅទីលានចាក់សំរាមចំនួន ១០៦ ក្នុងឆ្នាំ ២០១៨ កើនឡើងជាលំដាប់ ២០៥.៦៥៦ តោន ឬស្មើនឹង ១៣.៦៨% បើធៀបនឹងឆ្នាំ ២០១៧ និងកើនឡើង ៥៦.៩% បើប្រៀបធៀបនឹង ឆ្នាំ ២០១៤ ខណៈកន្លែងចាក់សំរាមបង្កើតឧស្ម័នមេតាន។ នៅទូទាំងប្រទេសកម្ពុជា (ទីក្រុងចំនួនបួន - ភ្នំពេញ សៀមរាប បាត់ដំបង កំពង់ចាម) ត្រូវបានគេប៉ាន់ប្រមាណថាមានបរិមាណឧស្ម័នកាបូនិក ៣៦ ម៉ឺនតោនក្នុង មួយឆ្នាំ ដែលរួមចំណែកដល់ការប្រែប្រួលអាកាសធាតុពិភពលោក។

ເກສງສຄຼິ່:

ការប្រែប្រួលអាកាសធាតុ ទីលានចាក់សំរាម ឧស្ម័នមេតាន និងមណ្ឌលបណ្តុះបណ្តាល

នាអេះអាខ

ការគាំទ្ររបស់គណៈកម្មការអឺរ៉ុបសម្រាប់ការផលិតការបោះពុម្ពនេះមិនបានបង្កើតការយល់ព្រមលើខ្លឹម សារ ដែលឆ្លុះបញ្ចាំងពីទស្សនៈរបស់អ្នកនិពន្ធតែប៉ុណ្ណោះទេ ហើយគណៈកម្មការមិនអាចទទួលខុស ត្រូវចំពោះការប្រើប្រាស់ណាមួយដែលអាចត្រូវបានធ្វើឡើងពីព័ត៌មានដែលមាននៅក្នុងនោះ។

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ឯកសារនេះអាចមានសម្ភារៈ ដែលជាកម្មសិទ្ធិរបស់ភាគីអនុវត្តគម្រោង SWAP ហើយមិនអាចផលិត ឡើងវិញ ឬចម្លងដោយគ្មានការអនុញ្ញាតឡើយ។ គ្រប់ភាគីអនុវត្ត SWAP ទាំងអស់បានយល់ព្រមលើ ការបោះពុម្ពផ្សាយពេញលេញនៃឯកសារនេះ។ ការប្រើប្រាស់ពាណិជ្ជកម្មនៃព័ត៌មានណាមួយដែល មាននៅក្នុងឯកសារនេះទាមទារអាជ្ញាប័ណ្ណពីម្ចាស់ព័ត៌មាននោះ។

ទាំងភាគីអនុវត្តគម្រោង SWAP ទាំងអស់ ឬភាគីជាក់លាក់នៃអ្នកអនុវត្ត SWAP ត្រូវធានាថាព័ត៌មាន ដែលមាននៅក្នុងឯកសារនេះមិនអាចប្រើប្រាស់បាន ឬការប្រើប្រាស់ព័ត៌មាននោះមិនមានហានិភ័យ និងមិនទទួលខុសត្រូវចំពោះការបាត់បង់ ឬការខូចខាតណាមួយឡើយ ឬការទទួលរងទុក្ខដោយជន ណាម្នាក់ដោយប្រើព័ត៌មាននេះ។

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សេខភ្គីថ្លៃខងំណរគុណ

ឯកសារនេះគឺជាការផ្តល់ជូនរបស់គម្រោង SWAP។ គម្រោងនេះត្រូវបានសហការផ្តល់មូលនិធិដោយ កម្មវិធី Erasmus+ នៃសហភាពអឺរ៉ុប ក្រោមការប្រកាសសំណើគម្រោង EAC/A02/2019 និងអនុវត្ត គម្រោងលេខ 618723-EPP-1-2020-1-DE-EPPKA2-CBHE-JP។

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| ៥. ទេនាសម្ព័ន្ធគ្រម់គ្រទមណ្ឌលមណ្ណុះមណ្ដាល ៦ នៃនតារសេខីទតម្ ៦.១ សេចក្ដីផ្ដើម ៦.២ គោលបំណងនៃការបង្កើតអាជីវិកម្ម ៦.៣ ផែនការសកម្មភាព ៦.៥ ប្រភថវិកា ៦.៦ ធនធាន | |
| ៥. ខេនាសម្ព័ន្ធគ្រម់គ្រខមណ្ឌលមណ្ណុះមណ្ដាល ៦ នៃនតារសេខីទតម្ល ៦.១ សេចក្ដីផ្ដើម ៦.២ គោលបំណងនៃការបង្កើតអាជីវិកម្ម ៦.៣ ផែនការសកម្មភាព ៦.៥ ប្រកថវិកា ៦.៦ ធនធាន ៧. សូខនាគរខោគខ័យ | |
| ៥. ទេខាសម្ព័ន្ធគ្រម់គ្រេទមស្នាលមស្ពុះមស្ពាល ៦ ផែឧភារអាខីទកម្ម ៦.១ សេចក្តីផ្តើម ៦.២ គោលបំណងនៃការបង្កើតអាជីវកម្ម ៦.៣ ផែនការសកម្មភាព ៦.៥ ប្រភថវិកា ៦.៦ ធនធាន ៧. សូទទាកមខេម ៤. ផែនភារតាមដាន និទានាយតម្លៃ | |
| ៥. ទេនាសម្ព័ន្ធគ្រច់គ្រចទស្ឋាលទស្តុះទស្តាល ៦ នៃនគារអាស៊ីទកម្ម ៦.១ សេចក្តីផ្តើម ៦.២ គោលបំណងនៃការបង្កើតអាជីវកម្ម ៦.២ គោលបំណងនៃការបង្កើតអាជីវកម្ម ៦.៣ ផែនការសកម្មភាព ៦.៧ ប្រកបរិកា ៦.៦ ជនធាន | |

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9.ສາເອົສາສສາຮູອ

ការគ្រប់គ្រងសំណល់រឹងគឺជាកង្វល់ដែលកំពុងកើតមានសម្រាប់ប្រទេសជុំវិញពិភពលោក ជាពិសេស ប្រទេសកំពុងអភិវឌ្ឍន៍ដែលមានធនធានហិរញ្ញវត្ថុមានកម្រិត កង្វះបច្ចេកវិទ្យា និងអវត្តមាននៃ ក្របខ័ណ្ឌគោលនយោបាយ។ ការគ្រប់គ្រងកាកសំណល់គឺជាបញ្ហាប្រឈមដ៏ធំបំផុតមួយនៅក្នុង ប្រទេសកំពុងអភិវឌ្ឍន៍ ដូចជានៅអាស៊ីមានបញ្ហាបរិស្ថាន និងសុខភាពសាធារណៈធ្ងន់ធ្ងរ។ ចំពោះ សំណល់រឹងនៅកម្ពុជា ចែកចេញជាបីប្រភេទរួមមាន៖ កាកសំណល់ក្នុងគ្រួសារ កាកសំណល់ពាណិជ្ជ កម្ម និងកាកសំណល់ឧស្សាហកម្ម និងគ្រោះថ្នាក់ (រួមទាំងកាកសំណល់វេជ្ជសាស្ត្រ)។ ប្រទេសកម្ពុជា

បានស្ថិតក្នុងចំណោមប្រទេសដែលមានសេដ្ឋកិច្ចលូតលាស់លឿនបំផុតនៅក្នុងតំបន់អាស៊ីអាគ្នេយ៍ ជាមួយនឹងកំណើន GDP ប្រចាំឆ្នាំជាមធ្យម ៧% ក្នុងរយៈពេលប្រាំឆ្នាំចុងក្រោយនេះ។ ការកើនឡើង នៃសំណល់រឹង និងបញ្ហាប្រឈមនានាក្នុងការគ្រប់គ្រងសំណល់រឹងបានជួបប្រទះជាលទ្ធផលនៃ កំណើនសេដ្ឋកិច្ចយ៉ាងឆាប់រហ័សនេះ និងការកើនឡើងនៃការប្រើប្រាស់ជាបន្តបន្ទាប់។ បរិមាណ សំណល់រឹងរបស់ក្រុងបានកើនឡើងយ៉ាងខ្លាំងដល់ជាង ៤ លានតោនក្នុងមួយឆ្នាំទូទាំងប្រទេស ដោយ ប្រហែល ៣៧% មានទីលានចាក់សំរាម ១២% កែច្នៃឡើងវិញ និង ៥១% បោះចោលដោយខុសច្បាប់ ឬដុតចោល បើទោះជាមានច្បាប់ដែលមានស្រាប់ក៏ដោយ។ បរិមាណកាកសំណល់ដែលបោះចោលក្នុង ទីលានចាក់សំរាមបានកើនឡើងតាមនោះ ពីជាង ៣១៧,៥៥០ តោនក្នុងមួយឆ្នាំក្នុងឆ្នាំ ២០០៤ ដល់ ១,៥ លានតោនក្នុងមួយឆ្នាំក្នុងឆ្នាំ ២០១៧ ។

យោងតាមក្រសួងបរិស្ថាន នៅកម្ពុជា បរិមាណសំរាមទីក្រុងក្រុងចំនួន ១,៧លានតោន ត្រូវបានបោះ ចោលនៅទីលានចាក់សំរាមចំនួន ១០៦ ក្នុងឆ្នាំ ២០១៨ កើនឡើងជាលំដាប់ ២០៥,៦៥៦ តោន ឬ ស្មើនឹង ១៣,៦៨% បើប្រៀបធៀបនឹងឆ្នាំ ២០១៧ និងកើនឡើង ៥៦,៩% បើប្រៀបធៀបនឹងឆ្នាំ ២០១៤ (ក្រសួងបរិស្ថាន ២០១៨)។ ខណៈពេលដែលឧស្ម័នមេតានដែលបង្កើតចេញពីទីតាំងទី លានចាក់សំរាមនៅទូទាំងប្រទេសកម្ពុជា (ទីក្រុងចំនួនបួន - ភ្នំពេញ សៀមរាប បាត់ដំបង កំពង់ចាម) ត្រូវបានគេប៉ាន់ប្រមាណឋាមានកម្រិតខ្ពស់ដល់ទៅ ៣៦០,០០០ តោន ស្មើនឹងកម្រិតបញ្ចេញ CO2 ក្នុង មួយឆ្នាំ ដែលរួមចំណែកដល់ការប្រែប្រួលអាកាសជាតុពិភពលោក (Thumbnails, 2011) ។

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នៅឆ្នាំ ២០១៨ កម្ពុជាបង្កើតកាកសំណល់កើនឡើង ១០ ភាគរយក្នុងមួយឆ្នាំ ខណៈឆ្នាំ ២០១៩រាជ ធានីភ្នំពេញតែមួយបានបង្កើតកាកសំណល់រហូតដល់ ៣,០០០ តោនក្នុងមួយថ្ងៃ ហើយសម្រាប់ទូទាំង ប្រទេសផលិតបានជាង ១០.០០០ តោន ស្មើនឹង ៣,៦ លានតោនក្នុងមួយឆ្នាំ (Khmer Times News, ២០២០)។ សំណល់រឹងទីក្រុងរួមបញ្ចូលគ្នានូវកាកសំណល់ពីគ្រួសារ និងពាណិជ្ជកម្ម ដែលបង្កើត ចេញពីគ្រួសារ ផ្សារ កោជនីយដ្ឋាន ហាង សណ្ឋាគារ ការិយាល័យ ការរាយបាយតាមដងផ្លូវ និងផ្សេ ងៗ។ រាជធានីភ្នំពេញបង្កើតកាកសំណល់រឹងប្រមាណ ៤,០៩លានតោន/ឆ្នាំ ដែលពីកាកសំណល់តាម ផ្ទះមានប្រមាណ ៥៥,៣% នៃចំនួនសរុប បន្ទាប់មកគឺសណ្ឋាគារ/ផ្ទះសំណាក់ (១៦,៧%) ភោជនីយ ដ្ឋាន (១៣,៨%) ទីផ្សារ (៧,៥%) ហាង (៥,៤%) និងការិយាល័យ (១,៤%) ។ ក្រឡេកមើល ប្រភេទកាកសំណល់ ប្រហែលពាក់កណ្តាល (៥១,៩%) គឺជាអាហារ និងកាកសំណល់សរីរាង្គផ្សេង ទៀត មួយភាគប្រាំ (២០,៩%) ប្លាស្ទិក និងមួយភាគដប់ (៩,៩%) ក្រដាស។ ការធ្វើពិពិធកម្ម សំណល់រឹងក្នុងក្រុងក្នុងប្រទេសកម្ពុជាមានបីវិធី; ទីលានចាក់សំរាម ការកែឆ្នៃ និងការដុត។ គួរបញ្ជាក់ ផងដែរថា សាកលវិទ្យាល័យ ហេង សំរិន ត្បូងឃ្មុំ (UHST) ស្ថិតនៅក្នុងខេត្តត្បូងឃ្មុំ ប្រទេសកម្ពុជា ត្រូវបានសម្ពោធដាក់ឱ្យប្រើប្រាស់ជាផ្លូវការនៅថ្ងៃទី ១១ ខែកុម្ភៈ ឆ្នាំ ២០១៦ ដោយនាយករដ្ឋមន្ត្រីកម្ពុ ជា។ UHST ផ្តល់ការអប់រំដល់យុវជននៅតាមជនបទ ដែលមិនមានលទ្ធភាពទទួលបានការអប់រំខ្ពស់ ជាងនេះ។ UHST មានផ្ទៃដីទំហំ ២២ ហិចតា សម្រាប់អគារសាកលវិទ្យាល័យ បណ្ណាល័យ អគារសាល ប្រជុំ កន្លែងសម្រាកលំហែកាយ អាហារដ្ឋាន អគារបម្រុង កន្លែងរៀបចំសិក្ខាសាលា និងការបណ្តុះប ណ្តាលពាក់ព័ន្ធផ្សេងទៀត អគារ TVET មន្ទីរពិសោធន៍ កសិដ្ឋានកសិកម្ម អន្តេវាសិកដ្ឋានគ្រូ និងកន្លែងកីឡាបាល់ទាត់។ល។ សាកលវិទ្យាល័យបច្ចុប្បន្នមាននិស្សិត អន្តេវាសិកដ្ឋាននិស្សិត ប្រហែល ១,១៧០ នាក់ ហើយសិស្ស ៦០០ នាក់ និងសាស្ត្រាចារ្យ ៤០ នាក់ស្នាក់នៅក្នុងអន្តេវាសិក ដ្ឋាន។ ការបែងចែកសំណល់រឹង និងការកែច្នៃឡើងវិញ គឺជាសកម្មភាពសំខាន់មួយសម្រាប់ UHST ។ ស្ថានភាពបច្ចុប្បន្នគឺ ទាំងសាស្ត្រាចារ្យ និងនិស្សិតមិនទាន់បានយល់ដឹងអំពីការគ្រប់គ្រងសំណល់រឹង ជាពិសេសរបៀបបែងចែកឱ្យបានត្រឹមត្រូវរវាងសំណល់រឹង និងរាវ។ ការកែលម្អសកម្មភាពនេះនឹងជួយ UHST ឱ្យក្លាយជាសាកលវិទ្យាល័យមានភាពបៃតង។ ការគ្រប់គ្រងសំណល់រឹងដោយផ្អែកលើការបែង ចែក និងការកែច្នៃឡើងវិញ នឹងអាចជំរុញសិស្សានុសិស្ស និងសាស្ត្រចារ្យឱ្យយល់ពីរបៀបបោះចោល សំណល់រឹងឱ្យបានត្រឹមត្រូវ និងលើកទឹកចិត្តសិស្សឱ្យស្រឡាញ់ និងថែរក្សាបរិស្ថាន។ នៅមានគម្លាត

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ចំណេះដឹងច្រើនលើការគ្រប់គ្រងសំណល់រឹង។ ដូច្នេះ មណ្ឌលបណ្តុះបណ្តាលរបស់យើងស្តីពី "ការ គ្រប់គ្រងសំណល់តាមរយៈការបែងចែក និងកែច្នៃឡើងវិញ" នឹងត្រូវការជាចាំបាច់។

២. ສາເອົສາສອກຂີສ້ຍ

ការវិភាគហានិភ័យមានសារៈសំខាន់សម្រាប់ការបង្កើតអាជីវកម្ម ឬដំណើរការអាជីវកម្ម។ មានប្រាំ ចំណុចនៃការវិភាគហានិភ័យដូចជា៖

- សុខភាព និងសុវត្ថិភាពការងារ៖ អ្នកចូលរួមខកខានមិនបានរៀន និងបង្រៀនក្នុងថ្នាក់ ហើយអាច ទទួលរងការបំពុលកាកសំណល់នៅកន្លែងកខ្វក់ ដោយសារពួកគេតម្រូវឱ្យប្រមូលសំណល់រឹងនៅ កន្លែងចាក់សំរាមដើម្បីកំណត់ប្រភេទសំណល់រឹង។ ការផ្សព្វផ្សាយ និងកំណត់កាលបរិច្ឆេទមុន ស្វែងរក ពេលវេលាសមស្រប សាស្ត្រាចារ្យ និស្សិត និងតំណាងមហាវិទ្យាល័យ។

បច្ចេកទេស៖ ត្រូវការកន្លែងសមរម្យសម្រាប់ចុះទីវាល និងឧបករណ៍សម្រាប់ប្រើប្រាស់ក្នុងពេលហ្វឹក
 ហាត់។ កិច្ចសហប្រតិបត្តិការជាមួយភាគីពាក់ព័ន្ធសម្រាប់ទីកន្លែងដែលបានផ្តល់ឱ្យសម្រាប់ការធ្វើ
 ដំណើរ និងសិក្ខាកាមសម្រាប់ការនាំយកឧបករណ៍មកបង្ហាញក្នុងអំឡុងពេលបណ្តុះបណ្តាល។

- ធនធានមនុស្ស៖ ចំនួនអ្នកចូលរួមក្នុងវគ្គបណ្តុះបណ្តាលមិនមានសម្រាប់សិស្សានុសិស្ស និងគ្រូទាំង អស់ដែលបានសិក្សា និងបង្រៀននៅ UHST ទេ ដោយសារបន្ទប់ ពេលវេលា និងកូវីដ-១៩ មានកំណ ត់។ យើងជ្រើសរើសគ្រូបង្រៀន សិស្សានុសិស្ស និងនិស្សិតតំណាងឱ្យមហាវិទ្យាល័យ និងវិទ្យាស្ថាន ដើម្បីចូលរៀនមុនគេ។

- **ប្រតិបត្តិការ៖** អាជីវកម្មរបស់មន្ត្រី និងបទពិសោធន៍ក្នុងការរៀបចំវគ្គបណ្តុះបណ្តាល។ បែងចែកក្រុម និងរៀបចំជាមុនសម្រាប់ទីកន្លែង សម្ភារៈ និងការរៀបចំកំឡុងពេលបណ្តុះបណ្តាល។

- គម្រោង និងកេរ្តិ៍ឈ្មោះ៖ បទពិសោធន៍ និងបណ្តាញមិនគ្រប់គ្រាន់ ដើម្បីលើកកម្ពស់ផ្សព្វផ្សាយការ គ្រប់គ្រងសំណល់រឹងឱ្យបានទូលំទូលាយ។ រៀបចំជនជានមនុស្សល្អ និងបែងចែកទំនួលខុសត្រូវការងារ សម្រាប់ការគ្រប់គ្រងគម្រោង។ បង្កើតបណ្តាញផ្សព្វផ្សាយអំពីការគ្រប់គ្រងសំណល់រឹងយ៉ាងទូលំ ទូលាយ

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- ហិរញ្ញវត្ថុ៖ ខ្វះថវិកា ឬមិនមានថវិកា។ ដូច្នេះ ការរៃអង្គាសថវិកាពីភាគីពាក់ព័ន្ធ លើកកម្ពស់អត្ថ ប្រយោជន៍នៃការគ្រប់គ្រងសំណល់រឹង ដែលអនុវត្តដោយសាកលវិទ្យាល័យ សម្រាប់ជំនួយផ្នែកសម្ភារៈ និងជំនួយហិរញ្ញវត្ថុ។

ຓ.ເສານຮໍ້ໝອ

គោលដៅនៃមណ្ឌលបណ្តុះបណ្តាលគឺផ្តល់ការកសាងសមត្ថភាពលើការគ្រប់គ្រងសំណល់រឹង រួមទាំងប ច្ចេកវិទ្យាគ្រប់គ្រងកាកសំណល់ ការកសាងភាពជាដៃគូស្រាវជ្រាវក្នុងចំណោមភាគីពាក់ព័ន្ធ។ គោល បំណងជាក់លាក់គឺ៖

១. ផ្តល់សេវាបណ្តុះបណ្តាលដល់ស្ថាប័នរដ្ឋាភិបាល អង្គការក្រៅរដ្ឋាភិបាល សហគមន៍ វិស័យឯកជន ប្រជាពលរដ្ឋក្នុងមូលដ្ឋាន និងកម្មករក្រៅប្រព័ន្ធស្តីពីការគ្រប់គ្រងសំណល់រឹង។

២. ដើម្បីគាំទ្រដល់ការអភិវឌ្ឍន៍កម្មវិធីសិក្សាក្នុងការគ្រប់គ្រងកាកសំណល់ ការស្រាវជ្រាវ និងវេទិកា ចែករំលែកចំណេះដឹង។

៣. ដើម្បីកសាងកិច្ចសហប្រតិបត្តិការលើភាពជាដៃគូស្រាវជ្រាវក្នុងចំណោមដៃគូអភិវឌ្ឍន៍។

៤. ខង្គមឈ្នះមឈ្នាលឬសេខាអម្មដ្តលំខូន (នននាមនុស្ស មរិទេលា សម្ភារ: មរិទ្ធារ ពេលខេលា ។ល។)

សាកលវិទ្យាល័យនឹងផ្តល់វគ្គបណ្តុះបណ្តាលស្តីពី "ការគ្រប់គ្រងកាកសំណល់តាមរយៈការបែងចែក និងការកែច្នៃឡើងវិញ"។ វគ្គបណ្តុះបណ្តាលនេះនឹងត្រូវបានផ្តល់ដោយសាស្ត្រាចារ្យ និងអ្នកជំនាញ ដែលមានសមត្ថភាពមកពី UHST និង COMPOSTED ខណៈដែលកន្លែងបណ្តុះបណ្តាលនឹងត្រូវបាន ដាក់នៅ UHST ជាមួយនឹងកន្លែង និងឧបករណ៍គ្រប់គ្រាន់សម្រាប់ដំណើរការសិក្សា និងការអនុវត្ត។ ជា ដំបូង មណ្ឌលបណ្តុះបណ្តាលនេះនឹងផ្តល់តែវគ្គខ្លីៗដែលផ្តល់ឱ្យក្នុងរយៈពេលបីថ្ងៃប៉ុណ្ណោះ ដែលពាក់ ព័ន្ធនឹងទ្រឹស្តី ការអនុវត្ត និងដំណើរទស្សនកិច្ចសិក្សា។

ការបណ្តុះបណ្តាលមានបីផ្នែក៖

(i) ការបង្រៀនថ្នាក់រៀន រួមទាំងថ្ងៃទី ១ ដល់ថ្ងៃទី ៣ នៃសិក្ខាសាលាបានគ្របដណ្ដប់បទបង្ហាញ
 របស់គ្រូបង្គោលថ្នាក់ជាតិនៃរបៀបវារៈសង្ខេបនៃវគ្គបណ្ដុះបណ្ដាល។
 មេរៀនទី១៖ ទិដ្ឋភាពទូទៅ និងការគ្រប់គ្រងសំណល់រឹងនៅកម្ពុជា

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មេរៀនទី២៖ របៀបបែងចែក និងរៀបចំទៅតាមប្រភេទផ្សេងគ្នានៃសំណល់រឹង មេរៀនទី៣៖ របៀបកែច្នៃ និងរៀបចំកាកសំណល់រឹងប្រភេទផ្សេងៗ មេរៀនទី៤៖ អនុវត្តតម្រូវការ និងការបង្កើតប្រាក់ចំណូលសម្រាប់ការប្រើប្រាស់សំណល់រឹង និងឱកាសអាជីវកម្ម។

- (ii) ការអនុវត្តវាលសម្រាប់រយៈពេល 1 ថ្ងៃ ដំណើរទស្សនកិច្ចសិក្សាមួយត្រូវបានគ្រោងទុកទៅ កាន់បរិវេណសាលារបស់ UHST ។
 - សិក្ខាសាលាអនុវត្ត៖ អនុវត្តការបែងចែក និងការរៀបចំពីសំណល់រឹងចម្រុះ រួមទាំងការ
 សម្អាត
 - សិក្ខាសាលាអនុវត្ត៖ ការអនុវត្តសម្រាប់ការបំប្លែងសំណល់រឹង និងការកែច្នៃឡើងវិញ រួម
 ទាំងការបំប្លែងសំណល់រឹង និងការរៀបចំវាទៅតាមប្រភេទផលិតផលផ្សេងៗគ្នា។
 - សិក្ខាសាលាអនុវត្ត៖ បង្កើតគោលការណ៍ណែនាំសម្រាប់ការគ្រប់គ្រងសំណល់រឹងឱ្យបាន ត្រឹមត្រូវនៅក្នុង UHST
- (iii) ការឆ្លុះបញ្ចាំងពីសិក្ខាសាលា អ្នកចូលរួមបានប្រមូលព័ត៌មានអំពីព័ត៌មានសំណល់ និងធ្វើការ វិភាគអំពីរបៀបបែងចែកកាកសំណល់។ សិស្សនឹងតម្រូវឱ្យបង្ហាញលទ្ធផលនៃការសិក្សា។ អ្នកចូលរួមរួមមាន និស្សិត កសិករ សហករណ៍កសិកម្ម សហគមន៍កសិកម្ម អង្គការក្រៅរដ្ឋាភិ បាល សហគ្រិន អ្នកពាក់ព័ន្ធ និងដៃគូអភិវឌ្ឍន៍។

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Figure 1: Training/services offered in UHST-Training Hub and relevant partners

៥. ទេខាសន្ត័ន្ធគ្រប់គ្រួទមណ្ឌលបណ្តុះបណ្តាល

មណ្ឌលបណ្តុះបណ្តាល UHST នឹងត្រូវដំឡើងក្រោមការគ្រប់គ្រងផ្ទាល់របស់មហាវិទ្យាល័យកសិកម្មនៃ សាកលវិទ្យាល័យ ហេង សំរិន ត្បូងឃ្មុំ ក្នុងខេត្តត្បូងឃ្មុំ។ រចនាសម្ព័ន្ធគ្រប់គ្រងមណ្ឌលបណ្តុះបណ្តាល UHST ដូចខាងក្រោម៖

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Figure 2: UHST Training Hub's Organizational Chart

) සහභාභාවිෂයකි

៦.១ សេចក្តីផ្តើម

ដីកំប៉ុស គឺជាជីធម្មជាតិដែលបានមកពីសារធាតុសរីរាង្គដែលពុកផុយ ដែលជួយឱ្យរុក្ខជាតិលូតលាស់ បានល្អជាងការប្រើលាមកសត្វស្រស់ ឬសំណល់បន្លែស្រស់ ព្រោះវាផ្សំឡើងពីសារធាតុសរីរាង្គជាច្រើ ន។ កសិករអាចធ្វើជីកំប៉ុសក្នុងរយៈពេលខុសៗគ្នា រយៈពេលខ្លី រយៈពេលមធ្យម និងរយៈពេលវែង។ ជី កំប៉ុសអាចធ្វើរួចក្នុងរយៈពេលពី ១៤ ទៅ ១៤ ថ្ងៃ ហើយអាចប្រើប្រាស់បាន ប៉ុន្តែការទំុជាមធ្យមគឺ ៣-៤ ខែ ហើយរយៈពេលវែង វាអាចប្រើបានបន្ទាប់ពី ៥ ទៅ ៦ ខែ (CEDAC, 2015) ។ ជីកំប៉ុសធ្វើពី លាមកសត្វ (គោ ក្របី ជ្រូក មាន់ ទា) កាកសំណល់តាមផ្ទះ ស្លឹករុក្ខជាតិស្រស់ (ស្មៅឈើ ជីទឹក សា ឡាត់ បន្លែ ឬផ្លែឈើ) ជាដើម ជីកំប៉ុសនាំមកនូវអត្ថប្រយោជន៍សំខាន់ៗដូចជា៖ សារធាតុចិញ្ចឹមដល់រុក្ខ ជាតិ បើប្រៀបធៀបជាមួយលាមកសត្វស្រស់ ឬជីដែលមិនទាន់ដុត។ លើសពីនេះ ជីកំប៉ុស នាំមកនូវ អតិសុខុមប្រាណជាច្រើនដល់ដី ហើយសារពាង្គកាយទាំងនេះជួយដីមានជីជាតិ។ វាមិនមានគ្រាប់ពូជ រុក្ខជាតិ ឬស្មៅ មេរោគ ជំងឺលើដំណាំទេ ព្រោះភាគច្រើនត្រូវបានសម្លាប់ក្នុងពេលជីកំពុងរលួយ។ គោល

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បំណងសំខាន់នៃការបង្កើតជីកំប៉ុស គឺដើម្បីបង្កើនទិន្នផលស្រូវ និងទទួលបានទិន្នផលស្រូវដែលមាន សុខភាពល្អ (កាត់បន្ថយការប្រើប្រាស់ជីគីមី)។

តើផែនការអាជីវកម្មគឺជាអ្វី? ផែនការអាជីវកម្ម គឺជាឯកសារដែលសង្ខេបពីគោលដៅប្រតិបត្តិការ និង ហិរញ្ញវត្ថុនៃអាជីវកម្ម។ វាមានផែនការលម្អិត និងថវិកាដែលបង្ហាញពីរបៀបដែលគោលដៅត្រូវបាន សម្រេច និងផែនទីបង្ហាញផ្លូវសម្រាប់ភាពជោគជ័យនៃអាជីវកម្មរបស់អ្នកដែលត្រូវអនុវត្ត។ លើសពីនេះ ការធ្វើផែនការអាជីវកម្មក៏ត្រូវពិចារណាលើជាតុផ្សំមួយចំនួនដូចជា ទិដ្ឋភាពឧស្សាហកម្ម ផែនការលក់ និងទីផ្សារ ការប្រកួតប្រជែង ផែនការគ្រប់គ្រង ការវិភាគទីផ្សារ និងផែនការប្រតិបត្តិការដើម្បីជោគជ័ យ។ អាជីវកម្មក៏ផ្តោតលើការវិភាគតម្លៃ-អត្ថប្រយោជន៍សម្រាប់ការសម្រេចចិត្តឱ្យកាន់តែប្រសើរឡើង មុនពេលចាប់ផ្តើមអាជីវកម្មជីកំប៉ុស ដូចជាបរិមាណសំណល់អាហារពីអន្តេវាសិកដ្ឋានក្នុងសាកលវិទ្យា ល័យ ហេង សំរិន ត្បូងឃ្មុំ ក្នុងមួយថ្ងៃ កម្លាំងពលកម្ម តម្លៃលក់ជីកំប៉ុសក្នុងមួយគីឡូក្រាម និងរបៀប ច្រើនចំពោះការចំណាយលើការវិនិយោគលើឧបករណ៍ ឬសម្ភារៈសម្រាប់ផលិតសមាសភាព។

៦.២ គោលបំណងនៃការបង្កើតអាជីវិកម្ម

- 1. ដើម្បីស្វែងយល់ពីការបែងចែកកាកសំណល់ និងការកែច្នៃឡើងវិញនៅក្នុងសាកលវិទ្យាល័យ
- 2. បង្កើតប្រភពចំណូលសម្រាប់ជួយសិស្សក្នុងការពង្រឹងការសិក្សា
- ដើម្បីផ្គត់ផ្គង់ផលិតផលកំប៉ុសដល់សហគមន៍មូលដ្ឋាន រួមទាំងប្រជាជនក្នុងតំបន់ និងសហករ ណ៍កសិកម្មដែលផលិតផលិតផលនៅកម្រិតកសិដ្ឋាន។

៦.៣ ផែនការសកម្មភាព

| | Provide the second s | | 2023 | | | 20 | 24 | | |
|---|--|----|------|----|----|----|----|----|----|
| Activities | Description | Q1 | | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| 1. Assess the institutional capacity and investment needs | | | | | | | | | |
| 1.1 | Organize the meeting with management board and relevant staff from the faculty of the university | | | | | | | | |
| 1.2 | Conduct a comprehensive situation analysis and stakeholder mapping of solid waste management in Cambodia describing gaps in the policy framework | | | | | | | | |
| 1.3 | Conduct training on waste management through segration and recycling | | | | | | | | |
| 2. Composting house at the unversity campus | | | | | | | | | |
| 2.1 | Site Selection | | | | | | | | |
| 2.2 | Building and equipment set up | | | | | | | | |
| 2.3 | Train the technical staff, lecturers and students (2 times/year*20) | | | | | | | | |
| 2.4 | Compost products (30 bags*15\$*24 months | | | | | | | | |

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៦.៤ ផែនការថវិកា

| Activity | Description | Unit | Total Unit | Unit Cost | | Total (USD) |
|---|--|---------------------|------------|--------------|----|----------------|
| TOTAL REVI | ENUE | | | | \$ | 13,250.00 |
| 1. Assess th | e institutional capacity and investment needs | | | | \$ | 1,350.00 |
| 1.1 | Organize the meeting with management board and relevant staff from the faculty of the university | Meetings | 1 | 100.00 | | 100.00 |
| 1.2 | Conduct a comprehensive situation analysis and stakeholder mapping of solid waste management in Cambodia describing gaps in the policy framework | Report | 1 | 500.00 | | 500.00 |
| 1.3 | Conduct training on waste management through segration and recycling | Person | 50 | 15.00 | | 750.00 |
| 2. Composting house at the unversity campus | | | | | \$ | 11,900.00 |
| 2.1 | Site Selection | field obsersavation | 0 | - | | - |
| 2.2 | Building and equipment set up | Set | 1 | 500.00 | | 500.00 |
| 2.3 | Train the technical staff, lecturers and students (2 times/year*20) | Person | 20 | 30.00 | | 600.00 |
| 2.4 | Compost products (30 bags*15\$*24 months | Bag-month | 24 | 450.00 | | 10,800.00 |
| TOTAL COS | Г | | | | \$ | 8,420.00 |
| 1 | Labour force | Person-Month | 24 | 200.00 | | 4,800.00 |
| 2 | Trasportation to deliver the compost products | Lumsump | 1 | 500.00 | | 500.00 |
| 3 | Office supplies | Month | 24 | 30.00 | | 720.00 |
| 4 | Utilities | Month | 24 | 50.00 | | 1,200.00 |
| 5 | Wifi connection | Month | 24 | 50.00 | | 1,200.00 |
| TOTAL NET INCOME | | | | | | |

៦.៥ ប្រភថវិកា

ការអនុវត្តជំនាញបង្កើតប្រាក់ចំណូលនៅសាកលវិទ្យាល័យ ហេង សំរិន ត្បូងឃ្មុំ ត្រូវបានបង្កើតឡើង ដើម្បីឲ្យគណៈគ្រប់គ្រងសាលា លោកគ្រូ អ្នកគ្រូ និងសិស្សានុសិស្សអាចរកប្រាក់ចំណូលបន្ថែមលើការ អនុវត្ត ដើម្បីរកប្រាក់ ដែលសាកលវិទ្យាល័យ ហេង សំរិន ត្បូងឃ្មុំ បានបង្កើត។ ដូច្នេះហើយ គម្រោង នេះត្រូវការថវិកាសម្រាប់ការផលិតពីសំណល់រឹង ក្រុមអ្នកជំនាញរបស់ខ្ញុំបានធ្វើគម្រោងមួយដើម្បីស្នើ សុំថវិកា។ ថវិកាដែលទទួលបានគឺមកពី៖

- មូលនិធិគម្រោង - មូលនិធិសាកលវិទ្យាល័យ - មូលនិធិគ្រូ - និងមូលនិធិសិស្ស

៦.៦ ធនជាន

គ្រឿងបរិក្ខារ៖ សម្រាប់មណ្ឌលបណ្តុះបណ្តាល UHST រួមមាន បន្ទប់បណ្តុះបណ្តាល បន្ទប់ពិសោធន៍ កុំ ព្យូទ័រ ម៉ាស៊ីនបញ្ចាំង និងប្រព័ន្ធ IT មានទីតាំងនៅមន្ទីរពិសោធន៍នៃមហាវិទ្យាល័យកសិកម្ម UHST ។ ឧបករណ៍ និងឧបករណ៍មន្ទីរពិសោធន៍ទាំងអស់ រួមទាំងឧបករណ៍ដែលមានស្រាប់ និងឧបករណ៍ពី ថវិកា SWAP នឹងត្រូវបានប្រើក្នុងអំឡុងពេលបណ្តុះបណ្តាល។

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សម្ភារៈ សម្ភារៈសំណល់សរីរាង្គអាចត្រូវបានប្រមូលពីតំបន់សាកលវិទ្យាល័យដោយមហាវិទ្យាល័យ វិទ្យាស្ថាន និងនិស្សិត។

ធនធានមនុស្សៈ សិក្ខាកាមគឺជាសាស្ត្រាចារ្យមកពីមហាវិទ្យាល័យកសិកម្ម និងអង្គការCOMPOSTED។ **ធនធានហិរញ្ញវត្ថុ៖** អ្នកឧបត្ថម្ភពីស្ថាប័នផ្ទាល់ខ្លួន អង្គការរដ្ឋាភិបាល អង្គការក្រៅរដ្ឋាភិបាល និងក្រុម ហ៊ុនឯកជន។ ថ្លៃបង់វគ្គបណ្តុះបណ្តាលពីសិក្ខាកាមចូលរួម។

៧. សຸຍຄາສາເອາສອັບ

- ចំនួនសិក្ខាកាម
- ចំនួននៃការបណ្តុះបណ្តាលដែលបានផ្តល់ក្នុងអំឡុងពេលកម្មវិធី SWAP
- ចំនួននៃសកម្មភាពស្រាវជ្រាវ និងកិច្ចសហការ
- មតិរបស់សិក្ខាកាមបន្ទាប់ពីការបណ្តុះបណ្តាល
- ចំនួនប្រភពថវិកា
- កម្មវិធីសិក្សាមួយចំនួនដែលត្រូវបានបង្កើតឡើងសម្រាប់កម្មវិធីសិក្សាធ្វើឱ្យប្រសើរឡើងនៃ
 មហាវិទ្យាល័យ

໔. ເສຂຸກາສາຮສາຂ ຂີ້ອອາເຮສໄຮູ

- ប្រតិបត្តិការនៃមណ្ឌលបណ្តុះបណ្តាលនឹងត្រូវបានត្រួតពិនិត្យប្រចាំខែ និងវាយតម្លៃរៀងរាល់ ឆមាសដោយសមាជិកក្រុម UHST SWAP ។
- របាយការណ៍ M&E នឹងមានសម្រាប់ការគ្រប់គ្រងមណ្ឌលបណ្តុះបណ្តាល UHST គណៈកម្មា ធិការ SWAP និងអ្នកផ្តល់មូលនិធិ។

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Deliverable 4.4 – Training Hubs Feasibility Studies





ឯកសារយោង៖

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CMU Training Hub Plastic waste segregation and circular-based utilization Feasibility Study

English version

Training Hubs feasibility studies



CMU Training Hub

Plastic waste segregation and circular-based utilization

Feasibility Study

| Project Acronym | SWAP |
|----------------------------|--|
| Work Package | 4 |
| Deliverable | D4.4: Training Hubs Feasibility studies |
| Deliverable Lead | СМИ |
| Туре | Report |
| Dissemination Level | Confidential |
| Contractual delivery date | FILL IN - M21 (15/09/2022) |
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| | HAMPUDO |









Versions

| Version | Date | Main Author | Summary of updates |
|---------|-----------|-------------|--------------------|
| 1 | 9/09/2022 | Napat | - |
| | | | |

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ABSTRACT

This report is prepared from the feasibility study of the training hub intended to be organized at the Department of Environmental Engineering, Chiang Mai University (CMU), Thailand. The need analysis indicates that plastic waste recycle is an essential activity for Thailand. Improvement of this activity will help the country to fulfil the Bio-Circular-Green (BCG) Economy Model, which is an integral part towards sustainable development. The training on "Plastic waste segregation and circular-based utilization" is, therefore, proposed with the main goals to instil the trainee with plastic waste segregation and utilization skill. Business opportunity from plastic waste utilization will also be elucidated. Risk analysis reveals that both risk severity and likelihood are restricted at the low and medium levels. Almost all required equipment, purchased using SWAP's equipment budget, is already available at the Department of Environmental Engineering and the main trainers are the staff of CMU SWAP and experts from the partner private company. To be able to maintain the training hub activity, budget is planned to be provided from the sponsorship of both government organizations and private companies. Moreover, CMU financial support under the CMU BCG platform can also be expected along with some training fee from the trainee. The method used to monitor and evaluate the training hub is also explained.

KEYWORDS

CMU Training Hub; Plastic waste segregation, Plastic waste utilization

DISCLAIMER

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1 Needs analysis

Plastics are an integral and important part of the global and Thai economies. Since the 1950s the use of plastic products has expanded twenty-fold owing to their low cost, various functional properties, durability and wide range of applications. In 2018, global plastics production reached 360 million tonnes. Plastics are commonly used in a wide range of industries including packaging, consumer goods, electronics, automotive and aviation manufacturing, textiles and agriculture. Thailand's petrochemical sector is the largest in the Southeast Asian region and the 16th largest in the world. In 2018, Thailand produced 11.8 million tonnes of downstream petrochemical products, including plastic resins. Thailand's plastics industry contributed 1,100 billion baht (USD 36.9 billion) to the national economy in 2018, representing 6.71% of Thailand's GDP (World Bank Group, 2021).

Mismanaged plastic waste from land-based sources, especially in the form of packaging, generates significant economic costs globally and in Thailand by reducing the productivity of vital natural systems and clogging urban infrastructure. 8 to 12 million tonnes of plastics leak into the world's oceans each year. Asia is responsible for over 80% of marine leakage and 8 of the top 10 contributing countries are from this region, with Thailand ranking number 6. Globally, the cost of such after-use externalities for plastic packaging, plus the cost associated with greenhouse gas emissions from its production, is conservatively estimated at USD 40 billion annually exceeding the plastic packaging industry's profit pool. USD 80-120 billion worth of plastic packaging is lost from the global economy each year due to lack of recycling or suboptimal value creation where recycling does exist. All this has led to increased global awareness towards plastic waste management, elevating the topic of plastic pollution into the mainstream consumer consciousness in Thailand (World Bank Group, 2021).

The situation is exacerbated by inefficient collection schemes and disposal methods: low household waste separation, overstretched waste collection services and low economic incentives for waste separation and recycling. These issues have resulted in improper disposal of 27% of municipal solid waste (Akenji et al., 2019; PCD, 2019). Plastic waste generation in particular has increased more rapidly than any other waste stream, negating recent improvements in the proper disposal of plastic waste. Plastic waste has increased at an average rate of 12% per year, to between 2 and 2.5 million tonnes of plastic waste per year, making Thailand among the largest plastic consumers in Asia (Ocean Conservancy, 2017; PCD, 2019). Thailand's plastic packaging waste is dominated by just two products: plastic bags and bottles. Together, they account for some 60% of all plastic packaging waste. While the mass of plastic bag waste (including mono-layers and shopping bags) is almost double that of plastic bottle waste, very few bags are collected for recycling – they are lightweight and often too contaminated for recycling. However, household waste separation can significantly increase the efficacy of recycling even for bags (WWF THAILAND, 2020).

From a commercial standpoint, plastic and packaging industries currently work with linear (take, make, dispose), single-use product design. Multiple layers, dyes, lightweighting, single serving products and other design choices reduce the feasibility of both collection and recycling. This accelerates plastic waste and limits opportunities to reintroduce plastic back into production processes where it can be reused to make new products. In addition, current forms of recycling are actually forms of downcycling (where materials are downgraded to a lower value or a lower level of functionality). Furthermore, low prices for certain types of plastic and increasing plastic

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waste imports have impacted Thai recycling companies without a large end-market for their recycled materials, reducing investment in recycling businesses (Johnson and Trang, 2019; WWF THAILAND, 2020).

Utilization of plastic waste based on the circular economy principle (i.e. upcycling to the higher value products) can increase the value of plastic waste and boost the incentive of plastic waste collection and circular utilization. As a result, it can reduce waste to landfill and mismanaged plastic waste that causes plastic leakage into the ocean and helps the Thai government to meet the target in plastic waste management. However, this issue is quite new to Thailand and there is still a large knowledge gap and there are very few training centres on this issue. Therefore, our training hub on "Plastic waste segregation and circular-based utilization" will be really appropriate. This hub will be in the attention of the Thai government and private sectors concerning their EPR to support this activity or support the trainee to set up community enterprises all around Thailand to create jobs and income for the community and reduce mismanage plastic waste at the same time.

2 Risk analysis

| RISK TOPIC | RISK DESCRIPTION | SEVERITY | LIKELIHOOD | Mitigation Measures |
|---------------------------------|---|----------|------------|---|
| Occupation health and safety | The trainee may get injured and have chemical toxicity, heat, along with eye injury. | Low | Low | Personal protective equipment; ergonomics plan; evaluation and improvement of working conditions; physical examinations. |
| Technical | Advances in technology, or from technical failure. | Medium | Low | Collaboration with equipment suppliers for good technical support |
| Human resources | The number of workshops might prove insufficient for proper academic staff training | Medium | Low | Constant communication among the partnership so any problems or obstacles are spotted and resolved on time so as to avoid delays |
| Operational | Disruption to supplies and operations, loss of access to essential assets, or failures in distribution. | Low | Low | Well prepare in advance for source of material supply and duty arrangement. |
| Project and reputation | Taking too long on key tasks, or experiencing issues with product or service quality. Loss of customer or employee confidence, or damage to market reputation. | Medium | Low | Well prepare in advance for project management. Create the network in advance for accepting the interested party to be the customer. |
| Financial | Going over budget, Business failure, or non-availability of funding. | Medium | Low | Asking for sponsorship from other sources and collect some training fees, use student assistant for training |

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Likelihood of Occurrence

| ESTIMATION | DESCRIPTION | INDICATORS |
|------------|--|---|
| High | Likely to occur each year or more than | Potential of it occurring several times |
| (Probable) | 50 per cent chance of occurrence. | within the lifetime of the project |
| | | -Could occur but not likely more than |
| Medium | Likely to occur by less than 25 per cent | once within the lifetime of the project |
| (Possible) | chance. | -Could be difficult to control due to |
| | | some external influences. |
| Low | Not likely to occur | -Has not occurred. |
| (Remote) | NOT INCLY TO OCCUT. | -Unlikely to occur. |

Likely Impact and Severity

| ESTIMATION | DESCRIPTION |
|------------|---|
| | -Significant impact on the project's achievement or operational |
| High | activities. |
| | -Significant stakeholder concern. |
| | -Significant financial impact. |
| | Moderate impact on the Project's achievement or operational |
| Medium | activities. |
| | Moderate stakeholder concern. |
| | -Moderate financial impact. |
| Low | -Low impact on the Project's achievement or operational activities. |
| LOW | -Low stakeholder concern. |
| | -Low financial impact. |
| | |

3 Goals

Goal #1—Trainees can do plastic waste segregation correctly and can convert waste into valuable product

Objective 1.1: Improve knowledge in understanding types of plastic waste and importance of plastic waste segregation and how to segregate waste correctly

Objective 1.2: Improve knowledge in identify quality of plastic that suit for upcycling and how to do plastic waste pre-treatment/ preparation for upcycling

Objective 1.3: Provide hands-on experience on plastic waste conversion into valuable products

Goal #2—Trainees have a good mindset about turning waste to useful products and have some views on business opportunity for developing product from waste

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4 Training and/or services offered

Training Topic: "Plastic waste segregation and circular-based utilization".

Duration: 2 days.

Location: Main lab hall at Department of Environmental Engineering, CMU.

Target Group: School teachers and students, small to medium size communities that are interested in gaining some revenue from solid waste.

Content:

- Lecture, The overview and situation of plastic wastes in Thailand.
- Lecture, How to segregate and prepare different types of plastic for utilization?
- **Lecture**, Alternatives for sorted plastic wastes utilizations with income analysis and ecobusiness opportunity.
- **Hands-on workshop,** practice segregation, and preparation from the mixed plastic wastes including cleaning and shredding using plastic shredder.
- **Hands-on workshop,** practice for plastic conversion, and upcycling including plastic extrusion and shaping it up to the different type of products, such as plastic pots or plastic filament, using an extruder.
- Hands-on workshop, practice on using plastic filament with 3D printer.

5 Scope of the hub

Activities: we will accomplish aforementioned objectives by carrying out the following activities:

- Training Conducting 1-2 training programs per year for School teachers and students, small to medium size communities that are interested in gaining some revenue from solid waste
- 2) Counselling providing following counselling or advisory services to help school teachers and students or communities to develop their own plastic waste segregation and circular-based utilization center for reducing their waste and setting up their business

6 Structure, role and responsibilities in governance bodies and functioning procedures

Main responsible organization: Department of Environmental Engineering, Faculty of Engineering, Chiang Mai University.

Management representative: Assistant Professor Dr. PATIROOP PHOLCHAN (Head of the Department)

Trainer: Assoc. Prof. Dr. NAPAT JAKRAWATANA (Lead trainer) Dr. SARUNNOUD PHUPHISITH (Trainer) Asst. Prof. Dr. SULAK SUMITSAWAN (Trainer) Asst. Prof. Dr. Aunnop Wongrueng (Trainer) Asst. Prof. Dr. Pharkphum Rakruam (Trainer)

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Asst. Prof. Dr. Patiroop Pholchan (Trainer) Experts from Zero Waste YOLO Co., Ltd. (Trainer) 1 PhD and 2 Master students (Assistant trainers)

Partner: Experts from the company (Zero Waste YOLO Co., Ltd.) will be the technical support for machine operation and recycled plastic business models.

Location: The CMU-SWAP training room and main lab hall at Department of Environmental Engineering, CMU.

Facility: a training room, computer and screen (belong to Dept. of Environmental Engineering). The plastic shredder, extruder and 3D printer obtained using the equipment budget of SWAP will be used during the training.

7 Resources required

Equipment: The plastic shredder, extruder, filament maker and 3D printer obtained using the equipment budget of SWAP will be used during the training.

Material: Plastic waste material can be collected from university bin by faculty of engineering porter or collecting by student from their own source.

Facilities: a training room, computer and screen (belong to Dept. of Environmental Engineering).

Human resource: Trainers are lecturers from Dept. of Environmental Engineering and graduate students.

Financial support: Sponsors from both government organisations and private companies. Training fee from trainees.

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8 Business plan

Business Model Canvas

| Key Partners | Key Activities | Value Propositions | Customer Relationships | Customer Segments |
|--|---|---|---|--|
| - Chiang Mai University -Zero Waste YOLO Co., Ltd. -Partner universities from SWAP Project | Lecture and Hands-on practicing on Plastic waste segregation and circular-based utilization training Key Resources Equipment: The plastic shredder, extruder, filament maker and 3D printer Material: Plastic waste material Facilities: a training room, computer, and screen Trainers and graduate students | Innovation, fun, and engaging educational method Add to people 's knowledge, skill and attitude | Person-to-person contact (i.e. visitor to the center) Video conf. Email Social VR APP Channels - Social media - Word of mouth - Presentation | High school students and teachers Higher education Member of community group Community enterprise |
| Cost Structure | | Revenue Streams | | |
| Maintenance and replacement of equipment Labor cost for student assistance Electricity and water | | Government organisations and/or Training fees Chiang Mai University (under the "I Faculty of Engineering, CMU. | private companies BCG model strategy") | |

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9 Indicators of success

The CMU training hub will focus on the plastic waste segregation and utilization. The trainees will be given the lecture about the overview and situation of plastic wastes in Thailand, segregation methods and preparation of different types of plastic for utilization. Income analysis for plastic waste utilizations will also be explained. Afterward, trainees will practice segregation and preparation from the mixed plastic wastes. The suitable type of plastic will then be used to produce both products, such as plastic pots and plastic filament.

As per the success of the training hub, the following indicators are proposed to determine the performance of the training hub:

- 1. Percentage of improvement in plastic waste segregation correctness.
- 2. Test score of trainees' pre- and post-trainings.
- 3. Number of trainees complete a 2-day training.
- 4. Number of trainings provided during SWAP programme.

The details of each indicator including data collection and evaluation are discussed in the Monitoring and Evaluation Plan.

10 Monitoring and evaluation plan

Monitoring is a process that routinely collects meaningful information to track the progress of a project by comparing collected data to pre-defined plans. CMU training hub is a physical location in Chiang Mai, Thailand, to provide training on the topic of "Plastic waste segregation and circular-based utilization" under the SWAP program.

The overall goal of the training is to improve the correctness of plastic waste segregation and to introduce options for plastic waste utilization. Various types of plastic that are often found in solid waste, methods to identify the plastic type, and the utilization of recycled plastic will be introduced during the training through explanation and hands-on workshops.

To ensure that the overall goal is reached, monitoring and evaluation (M&E) will be used as a tool to steer the training hub management. This process will help identify project direction, adapt implementation plans, and support decision-making in project management. The process of M&E will be conducted regularly along with the operation of the training hub by CMU SWAP team members. The M&E reports will be available to CMU training hub management, SWAP committees, CMU executives, and funders.





Logical Framework

The overall goal, outcome, output and activities of CMU training hub is shown in the logical framework. The indicator, methods of verification and the risks/assumptions of the training are identified.

| | PROJECT SUMMARY | INDICATORS | MEANS OF VERIFICATION | RISKS / ASSUMPTIONS |
|------------|--|--|--|--|
| Goal | Improve the correctness of plastic waste segregation and introduce options for plastic waste utilization | Percentage of improvement in plastic waste segregation correctness | Comparison of pre-training and post-training tests | N/A |
| Outcome | Higher test and practice scores on the topic of "Plastic waste segregation and circular-based utilization" | Test score | Pre-training and post-training test scores | Trainees attend at least 90% of the training programme and take pre-training and post-training tests |
| Output | Trainees from communities or schools complete a 2-day training on "Plastic waste segregation and circular-based utilization" | Number of trainees complete a 2-day training | Training hub attendance records | Trainees apply for the training |
| Activities | Provide at least 1 training course during the SWAP programme Equipment demonstration in plastic waste utilization | Number of trainings provided during SWAP programme | Training hub records | Trainees are interested and willing to attend the training course on "Plastic waste segregation and circular- based utilization" |

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The details of monitoring indicators are defined as followed.

| Indicator | Percentage of improvement in plastic waste segregation correctness |
|-----------------|--|
| Definition | Difference between post-training and pre-training divided by pre-training score multiplied by 100 |
| Purpose | To assess that trainee, improve their understanding of plastic waste segregation and utilization |
| Data Collection | The instructor will evaluate each trainee individually by the pre-training and post- training test questions. The testing score will be used in the evaluation of improvement that is developed during the training. |
| Frequency | Every training held |
| Responsible | CMU SWAP members |
| Reporting | A test score of all trainees will be included in statistical analysis e.g., average score, and standard deviation. The report will be available to CMU training hub management and SWAP programme. |

| Indicator | Test score |
|-----------------|---|
| Definition | The score of each trainee obtained from the pre- and post-training tests |
| Purpose | To assess the knowledge and skill of trainee before and after the training |
| Data Collection | The student will be given a set of questions related to plastic waste segregation and utilization before the training and after completion of training |
| Frequency | Every training held |
| Responsible | CMU SWAP members, instructors |
| Reporting | Test score will be used as a trainee performance indicator. The test score will be available to individual trainee, CMU training hub management and SWAP programme. |

| Indicator | Number of trainees who complete a 2-day training |
|------------|---|
| Definition | Amount of trainee who attend the "Plastic Waste Segregation and Utilization" held by CMU training hub. The trainee needs to attend all lectures and workshops during 2-day workshop to complete the training. |
| Purpose | To determine capacity and community connection of the CMU training hub |

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| Data Collection | Numbers of trainee will be collected from the sign-in sheet of the training. |
|-----------------|---|
| Frequency | Every training held |
| Responsible | CMU SWAP members |
| Reporting | Number of trainees who complete a 2-day training will be available to CMU training hub management and SWAP programme. |

| Indicator | Number of trainings provided during SWAP programme |
|-----------------|--|
| Definition | Numbers of training that CMU training hub provide on the topic of "Plastic waste segregation and circular-based utilization" during the effective SWAP programme |
| Purpose | To determine capacity and community connection of the CMU training hub |
| Data Collection | CMU training hub operational plan |
| Frequency | Every training held |
| Responsible | CMU SWAP members |
| Reporting | Number of trainings will be available to CMU training hub management and SWAP programme. |

In addition to the previously mention indicators, the evaluation forms will be provided to the trainees and partner instructors to ask their opinions of the training. The choices of answer have different scores to indicate the level of agreement for each question. The questions will be related to

- training facility
- training duration
- training subjects
- training materials
- equipment demonstration
- suggestions

The evaluation form for trainees and instructors will be provided to all trainees at the end of the training and will be evaluated for the suitability of the training. The results of the evaluation form will be available to CMU training hub management and SWAP programme.

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CMU Training Hub Plastic waste segregation and circular-based utilization Feasibility Study

Thai version

Training Hubs feasibility studies





| อักษรย่อโครงการ | SWAP |
|---------------------|--|
| หมายเลขแพคเกจ | 4 |
| ผลงานที่ส่งมอบ | D 4.4: การศึกษาความเป็นไปได้ของศูนย์ฝึกอบรม CMU |
| ผู้รับผิดชอบ | มหาวิทยาลัยเชียงใหม่ |
| ประเภทผลงาน | รายงาน |
| ระดับการเผยแพร่ | ລັບ |
| วันทีส่งมอบตามสัญญา | กรอกข้อมูล – M 21 (15/09/2022) |
| วันทีส่งมอบผลงาน | 12 กันยายน 2565 |
| ผู้เขียน | รองศาสตราจารย์ ดร.ณภัทร จักรวัฒนา |
| | ผู้ช่วยศาสตราจารย์ ดร.สุลักษณ์ สุมิตสวรรค์ |
| | ผู้ช่วยศาสตราจารย์ ดร.ปฏิรูป ผลจันทร์ |
| | ดร.สรัลนุช ภู่พิสิฐ |



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เวอร์ชั่น

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|----------|-----------------------|--------------|-----------------|
| 1 | 9 กันยายน 2565 | ณภัทร | - |





บทคัดย่อ

รายงานฉบับนี้จัดทำขึ้นจากผลการศึกษาความเป็นไปได้ของศูนย์ฝึกอบรม CMU ณ ภาควิชาวิศวกรรมสิ่งแวดล้อม มหาวิทยาลัยเชียงใหม่ ประเทศไทย ผลการวิเคราะห์ความต้องการชี้ให้ว่าการรีไซเคิลขยะพลาสติกและการนำขยะพลา สติกกลับมาใช้ประโยชน์เป็นแนวทางที่สำคัญและจำเป็นอย่างยิ่งสำหรับการแก้ปัญ าขยะพลาสติกของประเทศไทย ห การดำเนินกิจกรรมดังกล่าวจะช่วยให้ประเทศสามารถบรรลูวัตถุประสงค์ของการมุ่ งสู่เศรษฐกิจชีวภาพ หรือ Bio-Circular-Green economy ้ซึ่งเป็นหนึ่งในองค์ประกอบสำคัญของการขับเคลื่อนสู่การพัฒนาอย่างยั่งยืน เพื่อสนับสนุนการดำเนินการดังกล่าว จึงมีการจัดตั้งศูนย์ฝึกอบรมเรื่อง "การแยกขยะพลาสติกและการใช้ประโยชน์จากขยะพลาสติก LL น า คิ น วี ۶١ น บ น ด LL ۱۱ บ ห ม ้โดยมีวัตถุประสงค์หลักเพื่อปลูกฝังให้ผู้เข้ารับการฝึกอบรมมีทักษะการแยกขยะพล ำสติก และแนวทางการนำขยะพลาสติกกลับมาใช้ประโยชน์ รวมไปถึงการเรียนรู้เพื่อสร้างโอกาสทางธุรกิจของการใช้ประโยชน์จากขยะพลาส ติก ผลการวิเคราะห์ความเสี่ยง พบว่า กิจกรรมต่างๆ ที่เกี่ยวข้องมีความโอกาสและความรุนแรงของความเสี่ยงอยู่ในระดับต่ำถึงปานกลา ้ง อุปกรณ์ต่าง ๆ ที่จำเป็นต้องใช้ในการดำเนินงานของศูนย์อบรมมีพร้อมใช้แล้ว ณ ภาควิชาวิศวกรรมสิ่งแวดล้อม ซึ่งจัดซื้อโดยใช้งบประมาณอุปกรณ์ของโครงการ SWAP ผู้ฝึกสอนหลักของศูนย์ฝึกอบรมเป็นคณาจารย์ในคณะทำงานโครงการ CMU SWAP และผู้เชี่ยวชาญจากบริษัทพันธมิตร ในส่วนงบประมาณการดำเนินงาน ้ศูนย์ฝึกอบรมได้การวางแผนขอรับการสนับสนุนจากทั้งองค์กรภาครัฐและบริษัทเอ กชน และขอรับสนับสนุนจากมหาวิทยาลัยเชียงใหม่ ภายใต้แพลตฟอร์ม CMU BCG ร่วมกับการเก็บค่าธรรมเนียมการฝึกอบรมบางส่วนจากผู้เข้าฝึกอบรม เพื่อให้มั่นใดได้ว่าศูนย์ฝึกอบรมจะสามารถดำเนินงานได้อย่างต่อเนื่อง ในส่วนสุดท้ายของรายงานได้อธิบายถึงรายละเอียดของแผนการติดตามและการป ระเมินผลการดำเนินงานของศูนย์ฝึกอบรม





คำสำคัญ

ศูนย์ฝึกอบรม CMU; การแยกขยะพลาสติก, การใช้ประโยชน์จากขยะพลาสติก ข้อจำกัดความรับผิดชอบ

รายงานฉบับนี้ได้รับการสนับสนุนจากคณะกรรมาธิการยุโรปสำหรับการผลิตสิ่งพิม พ์ นี้ เ ท่ า นั้ น ทั้งนี้คณะกรรมาธิการยุโรปไม่มีส่วนในการรับรองเนื้อหาซึ่งสะท้อนจากมุมมองของ ผู้เขียนเท่านั้น และคณะกรรมาธิการยุโรปไม่รับผิดชอบต่อการใช้งานใด ๆ อันเนื่องมาจากข้อมูลที่มีเผยแพร่ในรายงานฉบับนี้

รายงานฉบับนี้อาจมีเนื้อหาซึ่งเป็นลิขสิทธิ์ของโครงการ SWAP การทำซ้าหรือคัดลอกเนื้อหาในรายงานฉบับนี้ต้องได้รับการขออนุญาตก่อน คณะทำงางานโครงงการ SWAP ทั้งหมดได้ตกลงที่จะเผยแพร่เอกสารนี้อย่างเต็มรูปแบบการใช้ข้อมูลใดๆ ที่มีอยู่ในเอกสารนี้ในเชิงพาณิชย์จำเป็นต้องได้รับอนุญาตจากเจ้าของข้อมูลนั้น

คณะทำงานทั้งหมดของโครงการ SWAP หรือฝ่ายใดฝ่ายหนึ่งของโครงการ

SWAP ไม่รับประกันว่าข้อมูลที่มีอยู่ในเอกสารนี้สามารถใช้งานได้ หรือการใช้ข้อมูลที่มีอยู่ในเอกสารนี้ปราศจากความเสี่ยง และไม่ยอมรับความรับผิดใด ๆ ต่อความสูญเสียหรือความเสียหายที่บุคคลใด ๆ ได้รับความเดือดร้อนจากการใช้ข้อมูลในเอกสารนี้

กิตติกรรมประกาศ

เอกสารนี้เป็นผลงานส่งมอบของโครงการ SWAP และได้รับทุนสนับสนุนจากโครงการ Erasmus+ ของสหภาพยุโรปภายใต้ข้อเสนอ EAC/A02/2019





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การวิเคราะห์ความต้องการ

พลาสติกนับว่ามีความสำคัญอย่างยิ่งต่อเศรษฐกิจของประเทศไทยและเศรษ โ กิ งใ ຈ ๆ อ ຈ ิล ก อุตสาหกรรมปิโตรเคมีของประเทศไทยนั้นมีขนาดใหญ่ที่สุดในภูมิภาคเอเชียต ะวันออกเฉียงใต้และใหญ่เป็นอันดับที่ 16 ของโลก ในปี พ.ศ. 2561 ประเทศไทยผลิตผลิตภัณฑ์ปิโตรเคมีปลายน้าจำนวน 11.8 ล้านตัน ซึ่งนับรวมถึงผลิตภัณฑ์เม็ดพลาสติก อุตสาหกรรมพลาสติกของไทยมีส่วนช่วยเศรษฐกิจของประเทศ 1,100 พันล้านบาท หรือประมาณ 36.9 พันล้านเหรียญสหรัฐ คิดเป็น ร้อยละ 6.71 ของ GDP ของไทย (World Bank Group, 2021)

ต้ นั ป ۹١ Ш ต่ 2 493 ศ พ การใช้ผลิตภัณฑ์พลาสติกขยายตัวเพิ่มมากถึงยี่สิบเท่า ในปี พ.ศ. 2561 การผลิตพลาสติกทั่วโลกมีมากถึง 360 ล้านตัน การเพิ่มขึ้นของการใช้ผลิตภัณฑ์พลาสติกนั้นเนื่องมาจากพลาสติกมีราคาถูก และมีคุณสมบัติมากมาย มีความทนทาน และสามารถนำไปใช้งานได้หลากหลาย จึงมักพบการใช้พลาสติกในหลากหลายอุตสาหกรรมตั้งแต่ อุตสาหกรรมการผลิตบรรจุภัณฑ์ สินค้าอุปโภคบริโภค อุปกรณ์อิเล็กทรอนิกส์ การผลิตยานยนต์ การผลิตสิ่งทอ รวมไปถึงในภาคการเกษตร ้ปัญหาการจัดการขยะพลาสติกบนบกที่ไม่เหมาะสม โดยเฉพาะอย่างยิ่งขยะบรรจุภัณฑ์พลาสติก ้สร้างความเสียหายต่อต้นทุนทางเศรษฐกิจไปทั่วโลก รวมถึงในประเทศไทย ส่ ศ ึ่งใ ฝ ະ บ ต่ ۱۱ นิ C ิล ก ร ท ۹١ อ ร ະ และทำให้เกิดปัญหาการอุดตันในโครงสร้างพื้นฐานของเมือง ในแต่ละปีมีขยะพลาสติกบนบกรั่วไหลออกสู่มหาสมุทรประมาณ 8 ถึง 12 ล้านตัน โดยร้อยละ 80 พบว่าเกิดจากประเทศในภูมิภาคเอเชีย



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โดยมีประเทศไทยอยู่ในอันดับที่ จาก 6 10 อันดับสูงสุดของประเทศที่มีการรั่วไหลของขยะพลาสติกบนบกลงสู่มหาสมุทร ารป 5 ະ มินเบื้อ ৩ ต้ น พ L ۱۱ ว่า ผลกระทบภายนอกหลังจากการใช้งานบรรจภัณฑ์พลาสติก รวมกับต้นทุนที่เกี่ยวข้องกับการปล่อยก๊าซเรือนกระจกจากกระบวนการผลิตบร รจุภัณฑ์พลาสติก นั้นมีมูลค่าประมาณ พันล้านเหรียญสหรัฐต่อปีซึ่งมากกว่ากำไรของกลุ่มอุตสาหกรรมบรรจุภัณฑ์พล ทั้ ส ติ า ึ่ง ก ห ม ้นอกจากนี้ยังพบว่าทั่วโลกสูญเสียมูลค่าทางเศรษฐกิจอันเนื่องมาจากการไม่ได้ นำบรรจุภัณฑ์พลาสติกกลับมารีไซเคิล หรือนำกลับมาใช้ประโชน์ใหม่ มากถึง ถึง 120 พันล้านเหรียญสหรัฐต่อปี 8 0 ทั้งหมดนี้นำไปสู่การเพิ่มความตระหนักต่อปัญหาการจัดการขยะพลาสติกไปทั่ และส่งผลให้ปัญหามลพิษจากพลาสติกถูกยกระดับให้เป็นหนึ่งในกระแสหลักข ้องการสร้างจิตสำนึกผู้บริโภคในประเทศไทย (World Bank Group, 2021) รไ ผ่ ງ น ห ที น ิล า ٤١ าเ ้ปริมาณขยะพลาสติกในประเทศไทยนั้นเพิ่มขึ้นอย่างรวดเร็วเมื่อเทียบกับขยะป ระเภทอื่น ขยะพลาสติกเพิ่มขึ้นในอัตราเฉลี่ย 12% ต่อปี หรือประมาณ 2 ถึง ล้ ตั ต่ รไ 2 5 ۹١ น ิก ทำให้ประเทศไทยกลายเป็นหนึ่งในผู้บริโภคพลาสติกรายใหญ่ที่สุดในเอเชีย ซึ่งสวนทางกับสถานการณ์การแก้ปัญหาและจัดการขยะพลาสติกที่ถูกต้องเหม าะสม (Ocean Conservancy, 2017; PCD, 2019) การขาดแผนการเก็บขนและวิธีการกำจัดอย่างประสิทธิภาพ ขาดการคัดแยกขยะในระดับครัวเรือน และขาดแรงจูงใจทางเศรษฐกิจสำหรับการแยกขยะและการรีไซเคิล ้ปัญหาเหล่านี้ส่งผลให้ขยะมูลฝอยชุมชนในประเทศไทยถูกจัดการอย่างไม่เหม าะสมถึง 27% ของปริมาณขยะมูลฝอยชุมชนทั้งหมด (Akenji et al., 2019; Ρ С 2 D 0 9 1)



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ขยะบรรจุภัณฑ์พลาสติกทั้งหมดของประเทศไทยประกอบด้วยผลิตภัณฑ์หลักส องชนิด ได้แก่ ถุงพลาสติก และขวดพลาสติก คิดเป็น 60% ของขยะบรรจุภัณฑ์ พลาสติกทั้งหมด โดยพบว่า ขยะถุงพลาสติก(คิดทั้งถุงประเภท ชั้นเดียว monolayer และถุงช้อปปิ้ง) มีปริมาณโดยน้ำหนักมากกว่าขยะขวดพลาสติกถึงสองเท่า แต่ถุงพลาสติกกลับถูกเก็บรวบรวมเข้าสู่กระบวนรีไซเคิลน้อยกว่ามาก อันเนื่องมาจากถุงพลาสติกนั้นมีน้ำหนักเบาหลุดรอดสู่สิ่งแวดล้อมได้ง่าย ถุงพลาสติกกลับถูกเป็นรวบรวมเข้าสู่กระบวนรีไซเคิลน้อยกว่ามาก อันเนื่องมาจากถุงพลาสติกนั้นมีน้ำหนักเบาหลุดรอดสู่สิ่งแวดล้อมได้ง่าย ถุงพลาสติก ยังถูกปนเปื้อนได้ง่ายจากการใช้งาน ทำให้ไม่เหมาะสมกับการนำกลับไปรีไซเคิล อย่างไรก็ตาม การเริ่มต้นจากการคัดแยกขยะในระดับครัวเรือนนั้นสามารถเพิ่มประสิทธิภาพ ของการนำขยะพลาสติก รวมถึงขยะประเภทถุงพลาสติก ให้กลับเข้าสู่วงจรการรีไซเคิลได้ (WWF THAILAND, 2020)

อุตสาหกรรมพลาสติกและบรรจุภัณฑ์ที่ผ่านมากมักมุ่งเน้นการผลิตบนแนวคิ

ด เศรษฐกิจ แบบเส้นตรง นั่นคือ ผลิต-ใช้-ทิ้ง หรือเน้นการออกแบบเพื่อใช้ครั้งเดียว การออกแบบผลิตภัณฑ์หลายๆ วิธี ที่ผ่านมายังไม่เอื้อต่อกระบวนการเก็บรวมรวมและกระบวนการรีไซเคิล เช่น

การใช้พลาสติกหลายชั้น (multilayer) การผสมสีย้อม การออกแบบให้ผลิตภัณฑ์สามารถใช้ได้แค่ครั้งเดียว เป็นต้น นอกจากนี้รูปแบบการรีไซเคิลในปัจจุบันเป็นรูปแบบของการดาวน์ไซคลิ่ง วัสดุจะถูกลดคุณภาพและมูลค่าต่ำลงทุกครั้งที่รีไซเคิล ทำให้จำกัดโอกาสในการสร้างมูลค่าของการนำพลาสติกกลับมาใช้ใหม่ ปัญหาราคาพลาสติกตกต่ำในบางประเภท และการนำเข้าขยะพลาสติกที่เพิ่มขึ้น ยังส่งผลกระทบต่อบริษัทรีไซเคิลของไทยที่ยังไม่มีตลาดขนาดใหญ่สำหรับวัส ดุรีไซเคิล ที่จะช่วยลดการลงทุนในธุรกิจรีไซเคิล (Johnson and Trang, 2019; WWF ประเทศไทย, 2563)

การนำขยะพลาสติกกลับมาใช้ประโยชน์ตามหลักการเศรษฐกิจหมุนเวียน อันได้แก่ การอัพไซเคิลผลิตภัณฑ์ที่มีมูลค่าสูงขึ้น





สามารถเพิ่มมูลค่าขยะพลาสติก เพิ่มแรงจูงใจในการรวบรวมขยะพลาสติก ร ว ม ถึ ง ก่ อ ใ ห้ เ กิ ด น ำ ไ ป ใ ช้ ป ร ะ โ ย ช น์ แ บ บ ห มุ น เ วี ย น ม า ก ขึ้ น ส่งผลให้สามารถลดปริมาณขยะไปยังหลุมฝังกลบและขยะพลาสติกที่จัดการอย่

٦ ม่ ٦ ര് ึ่ง ต้ ิล ึ่ง า ຄ ก ิก ึ่ง และส่งผลให้ปริมาณขยะพลาสติกที่รั่วไหลออกสู่มหาสมุทรลดลงลงตามมา การส่งเสริมการนำขยะพลาสติกกลับมาใช้ประโยชน์ตามหลักการเศรษฐกิจหมุ ้นเวียนยังช่วยให้รัฐบาลไทยสามารถบรรลุเป้าหมายในการจัดการขยะพลาสติ ตั้ ก ที่ งใ ٦ ว้ ไ ด้ ก็ ร อ ۶İ า ไ ต า ม การนำขยะพลาสติกกลับมาใช้ประโยชน์ตามหลักการเศรษฐกิจหมุนเวียนยังเป็ นแนวปฏิบัติที่ค่อนข้างใหม่สำหรับประเทศไทย ้องค์ความรู้ที่เกี่ยวข้องกับประเด็นดังกล่าวยังไม่เป็นที่รู้จักกันอย่างแพร่พลาย รวมถึงจำนวนศูนย์ฝึกอบรมในหัวข้อดังกล่าวยังมีน้อยมาก ทางภาควิชาวิศวกรรมสิ่งแวดล้อม คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่ภายใต้โครงการ SWAP จึงจัดตั้งศูนย์ฝึกอบรมในเรื่อง "การแยกขยะพลาสติกและการใช้ประโยชน์จากขยะพลาสติก น บ น ш น ງ คิ ด แ บ บ ห ม น L วี 21 ้เพื่อเผยแพร่องค์ความรู้ทางวิชาการและแนวปฏิบัติที่เกี่ยวข้องในเรื่องดังกล่าว ศูนย์ฝึกอบรมนี้จะเป็นประโยชน์อย่างยิ่งแก่ผู้ที่สนใจทั้งจากภาครัฐและภาคเอก ୩ น

ร่วมถึงประชาชนและกลุ่มวิสาหกิจชุมชนทั่วไปที่ต้องการเรียนรู้เพื่อโอกาสในก ารสร้างงานและรายได้จากการจัดการขยะพลาสติกในกับชุมชนของตน





การวิเคราะห์ความเสี่ยง

| หัวข้อคว | คำอธิบายความเสียง | คว | ໂ | มาตรการบรรเทาผลกระทบ |
|----------|------------------------------|-----|------|-------------------------------|
| ามเสี่ยง | | าม | อ | |
| | | รุน | ก | |
| | | แร | า | |
| | | ৩ | ส | |
| อาชีวอน | ผู้เข้ารับการฝึกอบรมอาจได้รั | ต่า | ର୍ଡ଼ | การใช้อุปกรณ์ป้องกันส่วนบุ |
| ามัยและ | บบาดเจ็บจากการใช้สารเคมี | | า | ନ ନ ର |
| ความปล | การสัมผัสความร้อน | | | แผนงานด้านการยศาสตร์ |
| อดภัย | และเกิดอันตรายต่อดวงตาได้ | | | การประเมินและปรับปรุงสภ |
| | | | | าพแสดล้อมในพื้นที่ทำงาน |
| | | | | และการตรวจร่างกาย |
| ทางเทค | ความล้มเหลวทางเทคนิค | ปา | ର୍ଡ଼ | สร้างความร่วมมือกับซัพพล |
| นิค | หรืออันตรายจากเทคโลยีที่ | นก | า | ายเออร์อุปกรณ์ที่ให้การสนั |
| | นำมาใช้ | ล า | | บสนุนทางเทคนิคที่มีคุณภา |
| | | ৩ | | W |
| ทรัพยาก | | ปา | ର୍ଡ଼ | กำหนดให้มีการสือสารอย่าง |
| รบุคคล | จำนวนการประชุมเชิงปฏิบัติ | นก | า | ต่อเนื่องระหว่างกลุ่มเครือข่า |
| | การอาจไม่เพียงพอสำหรับก | ลา | | ยเพื่อให้รับทราบถึงปัญหาห |
| | ารฝึกอบรมบุคลากรทางการ | ง | | รืออุปสรรคใด ๆ |
| | ศึกษาที่เหมาะสม | | | ที่เกิดขึ้นและสามารถแก้ไขไ |
| | | | | ด้ตรงเวลา |
| การดำเ | การขาดแคลดทรัพยากรและ | ต่า | ต่ | วางแผนล่วงหน้าสำหรับการ |
| นินงาน | วัสดุที่ต้องใช้ในการดำเนินง | | า | จัดหาแหล่งจัดหาวัสดุ |
| | านเนื่องจาก | | | และการแบ่งภาระหน้าที่ |
| | ปัญหาด้านการจัดส่งและการ | | | |
| | ขาดแคลนสินค้าของผู้จำหน่ | | | |
| | าย | | | |





| หัวข้อคว | คำอธิบายความเสียง | คว | ໂ | มาตรการบรรเทาผลกระทบ |
|----------|------------------------------|-----|----|-------------------------------|
| ามเสี่ยง | | าม | อ | |
| | | รุน | ก | |
| | | แร | า | |
| | | ৩ | ส | |
| โครงกา | ใช้เวลานานเกินไปในการทำ | ปา | ต่ | การวางแผนและเตรียมการ |
| รและชื่อ | งาน ที่สำ คัญ | นก | า | ล่วงหน้า |
| เสียง | หรือประสบปัญหาเกี่ยวกับคุ | ล า | | การสร้างเครือข่ายกับกลุ่มผู้ |
| | ุณภาพของผลิตภัณฑ์หรือบริ | ৩ | | มีส่วนได้เสีย |
| | การ | | | และกลุ่มผู้เกี่ยวข้องล่วงหน้า |
| | การสูญเสียความเชื่อมั่นของ | | | |
| | ลูกค้าหรือพนักงาน | | | |
| | หรือความเสียหายต่อชื่อเสียง | | | |
| | ของโครงการ | | | |
| การเงิน | ใช้จ่ายเกินงบประมาณ | ปา | ต่ | ขอรับการสนับสนุนจากแหล่ |
| | ธุรกิจล้มเหลวหรือการไม่มีเงิ | นก | า | ง อื่น ๆ |
| | นทุนในการดำเนินธุรกิจ | ล า | | เก็บค่าธรรมเนียมการเข้าฝึก |
| | | ৩ | | อ บ ร ม |
| | | | | ใช้นักศึกษาเป็นผู้ช่วยในกา |
| | | | | รจัดฝึกอบรม |





Likelihood of Occurrence

| ESTIMATION | DESCRIPTION | INDICATORS |
|------------|--|---|
| High | Likely to occur each year or more than | Potential of it occurring several times |
| (Probable) | 50 per cent chance of occurrence. | within the lifetime of the project |
| | | -Could occur but not likely more than |
| Medium | Likely to occur by less than 25 per cent | once within the lifetime of the project |
| (Possible) | chance. | -Could be difficult to control due to |
| | | some external influences. |
| Low | Not likely to occur | -Has not occurred. |
| (Remote) | NOT INCLY TO OCCUT. | -Unlikely to occur. |

Likely Impact and Severity

| ESTIMATION | DESCRIPTION |
|------------|--|
| | Significant impact on the project's achievement or operational |
| High | activities. |
| | -Significant stakeholder concern. |
| | -Significant financial impact. |
| | Moderate impact on the Project's achievement or operational |
| Medium | activities. |
| | Moderate stakeholder concern. |
| | Moderate financial impact. |
| Low | -Low impact on the Project's achievement or operational activities. |
| LOW | -Low stakeholder concern. |
| | -Low financial impact. |





เป้าหมาย

เป้าหมายที่ 1 ผู้เข้ารับการฝึกอบรมสามารถแยกขยะพลาสติกได้อย่างถูกต้อง และสามารถแปลงขยะพลาสติกให้เป็นสินค้าที่มีมูลค่าได้

ถ ป วั ต ร ะ ส ค์ ง 1 1 เสริมสร้างความรู้ความเข้าใจในเรื่องประเภทของขยะพลาสติก ้ความสำคัญของการแยกขยะ และวิธีการแยกขยะอย่างถูกต้อง วั ป งใ ค์ ต ຄ ร ŝ ส 1 2 ้เสริมสร้างความรู้ความเข้าใจในเรื่องการคุณภาพของพลาสติกที่เหมาะสมกับก 5 ລັ ٦ ണ คิ า พ L ิล และวิธีจัดการขยะพลาสติกขั้นต้นก่อนนำไปใช้สำหรับการอัพไซเคิล าั ป ร ค์ 1 ଡ ຄ ş ส งใ 3 เสริมสร้างประสบการณ์ในการลงมือทำจริงของการแปลงขยะพลาสติกให้เป็น ผลิตภัณฑ์ที่มีมูลค่า

เปัาหมายที่2ผู้เข้ารับการฝึกอบรมมีมุมมองเชิงบวกต่อการเปลี่ยนขยะให้เป็นผลิตภัณฑ์ที่มีมูลค่า และมองเห็นโอกาสทางธุรกิจในการพัฒนาผลิตภัณฑ์จากของเสีย

การฝึกอบรมและ/หรือบริการที่นำเสนอ

หัวข้อการฝึกอบรม: "การแยกขยะและการใช้ประโยชน์จากขยะพลาสติก บนแนวคิดแบบหมุนเวียน"

ระยะเวลา: 2 วัน

สถานที่: ห้องโถงปฏิบัติการ ภาควิชาวิศวกรรมสิ่งแวดล้อม คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่

กลุ่มเป้าหมาย: คุณครูและนักเรียน ชุมชนขนาดเล็กถึงขนาดกลางที่สนใจสร้างรายได้จากขยะมูลฝอย **เนื้อหา:**





- ก า ร บ ร ร ย า ย ∶ หั ว ข้ อ สถานการณ์ภาพรวมของปัญหาขยะพลาสติกในประเทศไทย
- การบรรยาย: หัวข้อ วิธีการคัดแยกและเตรียมพลาสติกชนิดต่าง ๆ
 เพื่อใช้ประโยชน์
- การบรรยาย: หัวข้อ
 ทางเลือกในการใช้ประโยชน์จากขยะพลาสติกที่คัดแยกแล้ว
 การวิเคราะห์รายได้และโอกาสของธุรกิจที่เป็นมิตรต่อสิ่งแวดล้อม
- การฝึกปฏิบัติ: การคัดแยกขยะจากขยะพลาสติกรวม และการเตรียมขยะขั้นต้น ได้แก่ การทำความสะอาด และการหั่นย่อยโดยใช้เครื่องบดพลาสติก
- การฝึกปฏิบัติ: การอัพไซคลิ่งขยะพลาสติก ได้แก่ การอัดรีด และการขึ้นรูปพลาสติกเป็นผลิตภัณฑ์ประเภทต่างๆเช่น หม้อพลาสติก หรือเส้นใยพลาสติก
- การฝึกปฏิบัติ: การใช้เส้นใยพลาสติกกับเครื่องพิมพ์ 3 มิติ

ขอบเขตของศูนย์ฝึกอบรม

กิจกรรม: เราจะบรรลุวัตถุประสงค์ดังกล่าวโดยการดำเนินกิจกรรมต่อไปนี้: 1) การฝึกอบรม – ดำเนินโครงการฝึกอบรม 1-2 โครงการต่อปี สำหรับ ԼԼ ູ นั ก รี 81 ณ ค ร ิล L น ค และกลุ่มชุมชนขนาดเล็กถึงขนาดกลางที่สนใจสร้างรายได้จากขยะมูลฝอย 2) การให้คำปรึกษา – ให้คำปรึกษา แนะแนว แก่คุณครูและนักเรียน และกลุ่มชุมชนที่สนใจ ในการพัฒนาจัดตั้งศูนย์แยกขยะพลาสติก และศูนย์การใช้ประโยชน์แบบหมุนเวียนจากขยะของตนเอง

โครงสร้าง บทบาท และความรับผิดชอบของหน่วยงาน และขั้นตอนการปฏิบัติงาน





องค์กรที่รับผิดชอบหลัก: ภาควิชาวิศวกรรมสิ่งแวดล้อม คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่

ตัวแทนฝ่ายบริหาร: ผู้ช่วยศาสตราจารย์ ดร. ปฏิรูป ผลจันทร์ (หัวหน้าภาควิชา)

ผู้ฝึกสอน: รองศาสตราจารย์ ดร.ณภัทร จักรวัฒนา (หัวหน้าผู้ฝึกสอน) ดร. สรัลนุช ภู่พิสิฐ (ผู้ฝึกสอน)

ผู้ช่วยศาสตราจารย์ ดร.สุลักษณ์ สุมิตสวรรค์ (ผู้ฝึกสอน)

รองศาสตราจารย์ ดร.อรรณพ วงศ์เรือง (ผู้ฝึกสอน)

ผู้ช่วยศาสตราจารย์ ดร. ภาคภูมิ รักร่วม (ผู้ฝึกสอน)

ผู้ช่วยศาสตราจารย์ ดร. ปฏิรูป ผลจันทร์ (ผู้ฝึกสอน)

ผู้เชี่ยวชาญจาก บริษัท Zero Waste YOLO จำกัด (ผู้ฝึกสอน)

นักศึกษาปริญญาเอก 1 คน และ นักศึกษาปริญญาโท 2 คน (ผู้ช่วยผู้ฝึกสอน)

พันธมิตร: ผู้เชี่ยวชาญจาก บริษัท Zero Waste **YOLO** จำกัด ให้การสนับสนุนทางเทคนิคสำหรับเครื่องจักรในการดำเนินโครงการ และเป็นต้นแบบในการเรียนรู้รูปแบบธุรกิจของพลาสติกรีไซเคิล

สถานที่: ห้องฝึกอบรม CMU-SWAP และห้องโถงปฏิบัติการ ภาควิชาวิศวกรรมสิ่งแวดล้อม คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่ **สิ่งอำนวยความสะดวก:** ห้องฝึกอบรม อุปกรณ์คอมพิวเตอร์ และจอโปรเจคเตอร์ (เป็นของภาควิชาวิศวกรรมสิ่งแวดล้อม) เครื่องบดย่อยพลาสติก เครื่องอัดรีด และเครื่องพิมพ์ 3 มิติ (จากงบประมาณสนับสนุน หมวดอุปกรณ์ของโครงการ SWAP)

ทรัพยากรที่จำเป็น





อุปกรณ์: เครื่องบดย่อยพลาสติก เครื่องอัดรีด เครื่องทำเส้นใย และเครื่องพิมพ์

3 มิติ (จากงบประมาณสนับสนุน หมวดอุปกรณ์ของโครงการ SWAP) **วัสดุ:** ขยะพลาสติก รวบรวมจากถังขยะของมหาวิทยาลัยเชียงใหม่ โดยพนักงานเก็บขนของคณะวิศวกรรมศาสตร์ หรือขยะที่รวบรวมจากสถานที่อื่นของผู้เข้ารับการฝึกอบรม

สิ่งอำนวยความสะดวก: ห้องฝึกอบรม อุปกรณ์คอมพิวเตอร์ และจอโปรเจคเตอร์ (เป็นของภาควิชาวิศวกรรมสิ่งแวดล้อม)

ทรัพยากรบุคคล: ผู้ฝึกสอนเป็นอาจารย์จากภาควิชาวิศวกรรมสิ่งแวดล้อม และผู้ช่วยผู้ฝึกสอนเป็นนักศึกษาระดับบัณฑิตศึกษา

การสนับสนุนทางการเงิน: ผู้สนับสนุนจากองค์กรภาครัฐและบริษัทเอกชน ค่าธรรมเนียมการฝึกอบรมจากผู้เข้ารับการฝึกอบรม



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แผนธุรกิจ

ผ้าใบรูปแบบธุรกิจ

| พันธมิตรหลัก - มหาวิทยาลัยเชียงใ หม่ - บริษัท Zero Waste YOLO จำกัด - มหาวิทยาลัยพันธมิต ร จ า ก โ ค ร ง ก า ร รพAP | กิจกรรมหลัก - การบรรยายและการฝึกปฏิบัติจริง - การฝึกอบรมการแยกขยะพลาสติกและการใช้ประโยชน์จาก ขยะพลาสติกบนแนวคิดแบบหมุนเวียน | คุณค่า - นวัตกรรม | ความสัมพันธ์กับลูกค่ - การติดต่อระหว่างบุ คคลกับบุคคล (เช่น ผู้เยี่ยมชมศูนย์) - วิดีโอคอนเฟอเรนซ์ - อีเมล์ - โซเชียลมีเดีย | ศ กลุ่มลูกค้า - นักเรียนและครูในระดับ ชั้น มัธยมศึกษา และอุดมศึกษา - สมาชิกของกลุ่มชุมชน - - |
|--|--|---|---|--|
| ໂດຣາດຮັດງທັນງານ | ทรัพยากรหลัก อุปกรณ์: เครืองบดย่อย เครืองอัดรีด เครืองทำเส้นใย และเครื่องพิมพ์ 3 มิติ วัสดุ: พยะพลาสติก สิ่งอำนวยความสะดวก: ห้องฝึกอบรม คอมพิวเตอร์ และโปรเจคเตอร์ ผู้ฝึกสอนและนักศึกษาระดับบัณฑิตศึกษา | การเพิ่มความ รู้ ทักษะ-และ สร้างทัศนคติ รี | ช่องทาง - สื่ อ สั ง ค ม โซเชียลมีเดีย - การบอกต่อ - การนำเสนอ | |
| เพาะพุณ การบำรุงรักษาและการเปลี่ยนอุปกรณ์ เมื่อนอุปกรณ์ | | เทสงวาย เต องค์กรภาครัฐและ | /หรือบริษัทเอกชน | |

D 4.4: การศึกษาความเป็นไปได้ของศูนย์ฝึกอบรม CMU



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- ค่าตอบแทนนักศึกษาช่วยงาน
- ค่าสาธารณูปโภค เช่น ค่าไฟฟ้า และค่าน้าประปา

- ค่าธรรมเนียมการฝึกอบรม
- มหาวิทยาลัยเชียงใหม่ (ภายใต้ "กลยุทธ์โมเดล BCG")
- คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่





ตัวชี้วัดความสำเร็จ

ศูนย์ฝึกอบรม CMU จะมุ่งเน้นไปที่การแยกและการใช้ประโยชน์จากขยะพลาสติก ผู้เข้ารับการฝึกอบรมจะได้รับการบรรยายเกี่ยวกับภาพรวมและสถานการณ์ของขย ะพลาสติกในประเทศไทย วิธีการคัดแยกและเตรียมพลาสติกชนิดต่าง ๆ เพื่อใช้ประโยชน์ ทางเลือกในการใช้ประโยชน์จากขยะพลาสติกที่คัดแยกแล้ว การวิเคราะห์รายได้และโอกาสของธุรกิจที่เป็นมิตรต่อสิ่งแวดล้อม หลังจากนั้นผู้เข้ารับการฝึกอบรมจะได้ฝึกปฏิบัติในกิจกรรมการคัดแยกขยะจากขย ะพลาสติกรวม และการเตรียมขยะขั้นต้น และได้ฝึกปฏิบัติในขั้นตอนการอัดรีด และการขึ้นรูปพลาสติกเป็นผลิตภัณฑ์ประเภทต่างๆเช่น หม้อพลาสติก หรือเส้นใยพลาสติก ตามความเหมาะสมของขยะพลาสติก รายการตัวชี้วัดเพื่อประเมินผลสัมฤทธิ์ของการจัดตั้งศูนย์ฝึกอบรม ประกอบด้วย

- 1. ร้อยละของการปรับปรุงการแยกขยะพลาสติกได้อย่างถูกต้อง
- 2. ผลคะแนนสอบก่อนและหลังการฝึกอบรม
- จำนวนผู้ที่เข้ารับการฝึกอบรมครบทั้ง 2 วัน

จำนวนครั้งการจัดฝึกอบรมในช่วงการดำเนินงานของโครงการ SWAP
 รายละเอียดของแต่ละตัวชี้วัด
 ขั้นตอนการรวบรวมและประเมินผลจะกล่าวถึงในหัวข้อ 10
 แผนการติดตามและประเมินผล

แผนการติดตามและประเมินผล

การตรวจสอบเป็นกระบวนการที่รวบรวมข้อมูลสำคัญอย่างสม่ำเสมอเพื่อติดตา น้ คื ۱۱ ห า ม ค ว ม ବା ค ิด ร ึ่ง ก า ร ้โดยทำการเปรียบเทียบข้อมูลที่รวบรวมได้กับแผนที่ได้กำหนดไว้

ศูนย์ฝึกอบรม CMU ตั้งอยู่ในจังหวัดเชียงใหม่ ประเทศไทย จัดตั้ง เพื่อ ให้ การฝึกอบรมในหัวข้อ "การแยกขยะและการใช้ประโยชน์จากขยะพลาสติกบนแนวคิดแบบหมุนเวียน" ภายใต้โครงการ SWAP เป้าหมายโดยรวมของการฝึกอบรมคือ เพื่อสร้างความรู้ความเข้าใจในการคัดแยกขยะพลาสติกอย่างถูกต้อง





และเพื่อแสดงให้เห็นถึงทางเลือกในใช้ประโยชน์จากขยะพลาสติก ผู้เข้าอบรมจะได้เรียนรู้ถึง ชนิดของพลาสติกที่มักพบในขยะมูลฝอย วิธีการระบุประเภทพลาสติก และการใช้ประโยชน์จากพลาสติกรีไซเคิล

ทั้งในภาคทฤษฎีจากการบรรยายและภาคปฏิบัติผ่านการลงมือปฏิบัติจริง กระบวนการติดตามและประเมินผลจะถูกใช้เป็นเครื่องมือในการควบคุมการจัด การศูนย์ฝึกอบรม เพื่อให้การจัดตั้งศูนย์ฝึกอบรมบรรลุเป้าหมายที่กำหนดไว้ กระบวนการติดตามและประเมินผลนี้จะช่วยกำหนดทิศทางโครงการ รั ٩l ۱۱ นิ հ น ร ດໍ า L น ผ ก ึ่ง า น และเป็นเครื่องมือสนับสนุนการตัดสินใจการจัดการโครงการ กระบวนการติดตามและประเมินผลจะดำเนินการอย่างสม่าเสมอโดยสมาชิกในทีมโ มหาวิทยาลัยเชียงใหม่ SWAP ครงการ ควบคู่ไปพร้อมกับการดำเนินงานของศูนย์ฝึกอบรม และจะจัดทำรายงานการผลการติดตามและประเมินผล ให้แก่ คณะทำงาน คณะกรรมการโครงการ SWAP ผู้บริหารมหาวิทยาลัยเชียงใหม่ และผู้ให้ทุน





กรอบเหตุผลสัมพันธ์

กรอบเหตุผลสัมพันธ์แสดง เป้าหมาย ผลลัพธ์ ผลผลิต และกิจกรรมโดยรวมของศูนย์ฝึกอบรม CMU ร่วมกับตัวชี้วัด วิธีการตรวจสอบ และความเสี่ยง / สมมติฐานของการฝึกอบรม ในตารางด้างล่าง

ตารางที่ 1. กรอบเหตุผลสัมพันธ์ของศูนย์ฝึกอบรม CMU

| | สรุปโครงการ | ตัวชีวัด | วิธีการตรวจสอบ | ความเสียง / สมมติฐาน |
|-----------|-------------------------------------|----------------------------------|----------------------|------------------------------|
| เป้ | ปรับปรุงความถูกต้องของการแยกขยะพ | ร้อยละของการปรับปรุ | การเปรียบเทียบผลคะแ | ไม่ระบุ |
| าห | ลาสตกและแนะนาทางเลอกสาหรบการไ | งการแยกขยะพลาสติก | นนสอบระหวางกอนแล | |
| มา | ช้ประโยชน์จากขยะพลาสติก | ได้อย่างถูกต้อง | ะหลังการฝึกอบรม | |
| ย | | | | |
| ผล | ผลคะแนนจาการทดสอบและการปฏิบัติ | คะแนนสอบ | การเปรียบเทียบผลคะแ | ผู้เข้ารับการฝึกอบรมเข้าร่วม |
| ລັ | สูงขึ้นในหัวข้อ | | นนสอบระหว่างก่อนแล | ้อย่างน้อย 90% |
| ธ์ | "การแยกขยะและการใช้ประโยชน์จาก | | ะหลังการฝึกอบรม | ของโปรแกรมการฝึกอบรม |
| | ขยะพลาสติก บนแนวคิดแบบหมุนเวียน" | | | และทำการทดสอบก่อนและ |
| | | | | หลังการฝึกอบรม |
| ผล | ผู้เข้ารับการฝึกอบรมจากชุมชนหรือโรง | จำนวนผู้ที่เข้ารับการฝึ | บันทึกการเข้าฝึกอบรม | ผู้เข้ารับการฝึกอบรมสมัครเ |
| ผ ลิ | เรียนเข้ารับการอบรมครบ 2 วัน | กอบรมค [้] รบทั้ง 2 วัน | | ข้ารับการฝึกอบรม |
| ต | | | | |





| กิ จ | - | จำนวนครังการจัดฝึกอ | บันทึกการเข้าฝึกอบรม | ผู้เข้ารับการฝึกอบรมมีความ |
|-----------|---|---|----------------------|--|
| ก ร รม | จัดให้มีหลักสูตรการฝึกอบรมอย่างน้อย 1 หลักสูตรในช่วงการดำเนินงานของโคร งการ SWAP | บรมในช่วงการดำเนิน งานของโครงการ SWAP | | สนใจและเต็มใจที่จะเข้าร่วม หลักสูตรการฝึกอบรม |
| | - การสาธิตอุปกรณ์ที่ใช้สำหรับการใช้ปร ะโยชน์จากขยะพลาสติก | | | |





รายละเอียดของตัวชี้วัดสำหรับการติดตามตรวจสอบ ถูกกำหนดไว้ดังนี้

| ตัวชีวัด | ร้อยละของการปรับปรุงการแยกขยะพลาสติกได้อย่างถูกต้อง | |
|---------------|--|--|
| นิยาม | ความแตกต่างระหว่างหลังการฝึกอบรม และก่อนการฝึกอบรม | |
| | หารด้วยคะแนนก่อนการฝึกอบรมคูณด้วย 100 | |
| วัตถุประสงค์ | เพื่อประเมินการพัฒนาความรู้ความเข้าใจเกี่ยวกับการแยกและการใช้ประโยชน์ขยะพลาสติ | |
| | กของผู้เข้ารับการอบรม | |
| การเก็บรวบรวม | ผู้สอนจะประเมินผู้เข้ารับการอบรมแต่ละคนเป็นรายบุคคล โดยใช้แบบทดสอบก่อน | |
| ข้อมูล | และแบบทดสอบหลังการฝึกอบรม | |
| | ผลคะแนนจากการทดสอบจะใช้ในการประเมินการพัฒนาที่เกิดขึ้นในระหว่างการเข้าฝึกอบ | |
| | รม | |
| ความถี | ทุกการฝึกอบรมที่จัดขึ้น | |
| ผู้รับผิดชอบ | สมาชิก CMU SWAP | |
| การรายงานผล | คะแนนการทดสอบของผู้เข้ารับการฝึกอบรมทังหมดจะนำไปใช้วิเคราะห์ทางสถิติ เช่น | |
| | คะแนนเฉลี่ย และส่วนเบี่ยงเบนมาตรฐาน และจัดทำรายงานให้แก่ ศูนย์ฝึกอบรม CMU | |
| | และโครงการ SWAP | |

| ตัวชีวัด | คะแนนสอบ |
|--------------------|--|
| นิยาม | คะแนนของผู้เข้ารับการฝึกอบรมแต่ละคนที่ได้รับจากการทดสอบก่อนและหลังการฝึกอบ |
| | รม |
| วัตถุประสงค์ | เพื่อประเมินความรู้และทักษะของผู้เข้ารับการฝึกอบรม ในช่วงก่อนและหลังการฝึกอบรม |
| การเก็บรวบรวมข้อมู | ผู้เข้ารับการฝึกอบรม จะได้รับชุดคำถามที่เกี่ยวข้องกับการแยกขยะพลาสติกและ |
| ล | การใช้ประโยชน์ ก่อนการฝึกอบรมและหลังจากเสร็จสิ้นการฝึกอบรม |
| ความถี | ทุกการฝึกอบรมที่จัดขึ้น |
| ผู้รับผิดชอบ | สมาชิก CMU SWAP และอาจารย์ผู้สอน |
| การรายงานผล | คะแนนการทดสอบจะถูกใช้เป็นดัชนีชี้วัดความสำเร็จของผู้เข้ารับการฝึกอบรม |
| | ผลคะแนนการทดสอบจะรวบรวมและรายงานให้แก่ผู้เข้ารับการฝึกอบรม ศูนย์ฝึกอบรม |
| | CMU และโครงการ SWAP |

| ตัวชีวัด | จำนวนผู้เข้ารับการฝึกอบรมทีสำเร็จการฝึกอบรม 2 วัน |
|---------------|---|
| นิยาม | จำนวนผู้เข้ารับการฝึกอบรมในหัวข้อ |
| | การแยกขยะพลาสติกและการใช้ประโยชน์จากขยะพลาสติกบนแนวคิดแบบหมุนเวียน ณ |
| | ศูนย์ ฝึกอบรม CMU |
| | โดยผู้เข้ารับการฝึกอบรมต้องเข้าร่วมการบรรยายและการประชุมเชิงปฏิบัติการทั้งหมดตลอด |
| | ระยะเวลาจัดการฝึกอบรม 2 วัน |
| วัตถุประสงค์ | เพื่อสร้างขีดความสามารถและการสร้างสัมพันธ์ระหว่างกลุ่มผู้ฝึกอบรม ณ ศูนย์ฝึกอบรม |
| | CMU |
| การเก็บรวบรวม | จำนวนผู้เข้ารับการฝึกอบรมจะถูกรวบรวมจากเอกสารลงลายมือชื่อเข้ารับการฝึกอบรม |
| ข้อมูล | |
| ความถึ่ | ทุกการฝึกอบรมที่จัดขึ้น |



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| ผู้รับผิดชอบ | สมาชิก CMU SWAP |
|--------------|--|
| การรายงานผล | ตัวเลขจำนวนผู้เข้ารับการฝึกอบรมทีสำเร็จการฝึกอบรม 2 วัน จะรายงานผลให้แก่ |
| | ศูนย์ฝึกอบรม CMU และโครงการ SWAP |

| ตัวชีวัด | จำนวนครั้งการจัดฝึกอบรมในช่วงการดำเนินงานของโครงการ SWAP |
|---------------------|---|
| นิยาม | การจัดฝึกอบรมทีศูนย์ฝึกอบรม CMU ในหัวข้อ |
| | "การแยกขยะพลาสติกและการใช้ประโยชน์จากขยะพลาสติก |
| | บนแนวคิดแบบหมุนเวียน" ในช่วงการดำเนินงานของโครงการ SWAP |
| วัตถุประสงค์ | เพื่อสร้างขีดความสามารถและการสร้างสัมพันธ์ระหว่างกลุ่มผู้ฝึกอบรม ณ |
| | ศูนย์ฝึกอบรม CMU |
| การเก็บรวบรวมข้อมูล | แผนการดำเนินงานศูนย์ฝึกอบรม CMU |
| ความถี | ทุกการฝึกอบรมที่จัดขึ้น |
| ผู้รับผิดชอบ | สมาชิก CMU SWAP |
| การรายงานผล | ตัวเลขจำนวนครังของการจัดฝึกอบรมจะรายงานผลให้แก่ ศูนย์ฝึกอบรม CMU และโครงการ SWAP |

นอกเหนือจากตัวชี้วัดข้างต้น

โครงการจะทำการประเมินผลการดำเนินการฝึกอบรมโดยใช้แบบสอบถาม ทำการสอบถามระดับความคิดเห็นจากผู้เข้ารับการฝึกอบรม และพันธมิตรผู้สอน เกี่ยวกับความเหมาะสมของการจัดฝึกอบรมในหัวข้อดังต่อไปนี้

- สถานที่ฝึกอบรม
- ระยะเวลาการฝึกอบรม
- วิชาการฝึกอบรม
- สื่อที่ใช้ในการการฝึกอบรม
- การสาธิตอุปกรณ์
- การให้คำปรึกษาแนะนำ

การประเมินด้วยแบบสอบถามข้างต้นจะดำเนินการเมื่อสิ้นสุดการฝึกอบรม และจะสรุปผลการประเมินให้แก่ คณะทำงานของศูนย์ฝึกอบรม CMU และโครงการ SWAP





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MJU Training Hub Agricultural waste utilization Feasibility Study

English version

Training Hubs feasibility studies

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Versions

| Version | Date | Main Author | Summary of updates |
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ABSTRACT

This report is prepared from the feasibility study of the training hub intended to be organized at the Faculty of Sciences, Maejo University (MJU), Thailand, and the neighboring communities. The need analysis indicates that agricultural waste utilization is essential for Thailand, especially in the local community. Improvement of this activity will help the country to fulfill the Bio-Circular-Green (BCG) Economy Model toward the Sustainable Development Goals (SDGs). Therefore, training on "Agricultural waste utilization" is proposed with the primary goal of training the trainees to design and develop value-added products from agricultural waste such as compost, biochar, food and supplements, and health and wellness products with an economical and environmentally friendly approach. Risk analysis reveals that both risk severity and likelihood are restricted at the low and medium levels. Both recent equipment and some purchases using SWAP's budget are already available at the Faculty of Science. The main trainers are the staff of MJU SWAP. To maintain the training hub activity, we planned the budget from the sponsorship of government organizations, private companies, MJU research grants, and training fees from the trainees. The success of the training hub is evaluated at the end of the training.

KEYWORDS

MJU Training hub, agricultural waste utilization, value added products

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1 Needs analysis

The Thai agricultural sector involves a population of nearly 24 million people, representing 149.24 million hectares of agricultural land, or nearly half of the country's agricultural production. According to the global market's climate and supply and the fluctuation of raw materials and products, Thai farmers have relatively low average incomes. In addition, after harvesting, a large amount of agricultural waste will be left unutilized. This number is expected to rise due to increased demand for farm products. These wastes are often discarded without any recovery treatment causing environmental problems, health, and the economy. Typically, only high heating value biomass could be used as biomass energy for the industrial sector. Nowadays, converting agricultural wastes into value-added products has gained considerable interest due to rising demand for products with natural additives and stricter environmental regulations. Furthermore, the valorization of agricultural waste can improve the livelihood of the local communities through more extra income.

Due to the promising applicability of agro-residues in various industries such as chemical, agricultural, food processing, and pharmaceuticals, the bio-products and their substances have been intensively explored in recent years. However, value-added products from agricultural wastes are already in commercial practice in the agro-processing industry, not for local communities or small and mid-size enterprises (SMEs). There is still a big gap between both sectors. The development concept and practical guidelines for Thai farmers to transform BCG into high-value industrial agriculture are required to drive Thailand's economy toward sustainable development goals (SDGs). However, achieving a circular economy remains far from agricultural communities. Nowadays, the trends of green growth (environmentally friendly products), health and wellness, preparing for an aging society, and food security have become clear. Our training hub can fulfill those needs with a training program series. The valorization of agricultural wastes offers tons of exploitable opportunity in economic, environmental, and social aspects.

Nevertheless, social acceptance, especially among local stakeholders, is essential to successfully implementing waste utilization. Therefore, this training hub will involve related parties in the decision-making process to select a series of training hubs to prevent conflict issues, promote mutual agreement among stakeholders, and increase the training and implementation success rate. In this way, the local farmers and SMEs can thrive with the additional utilization and product development from agricultural waste.

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2 Risk analysis

This initial risk assessment was conducted using the guidelines outlined in Table 2 to .

Risk was determined based on a threat event, the likelihood of that threat event occurring, mitigating factors, and consequences/impact to mission. The risk assessment result showed in Table 1.

| Risk Topic | Risk Description | Severity | Likelihood | Mitigation factors |
|------------------------------------|---|----------|------------|--|
| Occupation health and safety | 1. The trainee may get injured or accidents occur during the training | Low | Low | Personal protective equipment Emergency and safety plan |
| | 2. Epidermic situation | Moderate | Moderate | 3. Online training |
| Technical | 1.Tools, equipment and technology advances | Low | Low | 1. Collaboration with equipment suppliers for |
| | 2.Tools, equipment and technical failure. | Low | Low | good technical support |
| Operational | 1. Disruption to supplies and operations | Low | Low | 1. Preparation of materials and supply |
| | Human error Trainee trust | Low | Low | source 2. Duty arrangement and plan. 3. Market plan |
| Financial | 1. Going over budget | Moderate | Low | 1. Supporting funding |
| | 2. Business failure 3. No funding | Moderate | Low Low | and sponsorship2. Training fees3. Financial plan |

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The following table is provided as a list of assessment scales for likelihood, impact, and risk value.

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Table 2: Assessment Scale – Likelihood of Threat

| Qualitative Values | Semi-Qu Val | antitative lues | Description |
|-----------------------|----------------|--------------------|---|
| Very High | 96-100 | 10 | Adversary is almost certain to initiate the threat event. |
| High | 80-95 | 8 | Adversary is highly likely to initiate the threat event. |
| Moderate | 21-79 | 5 | Adversary is somewhat likely to initiate the threat event. |
| Low | 5-20 | 2 | Adversary is unlikely to initiate the threat event. |
| Very Low | 0-4 | 0 | Adversary is highly unlikely to initiate the threat event |

Table 3: Assessment Scale – Likelihood of Threat

| Qualitative Values | Semi-Qu Va | antitative lues | Description |
|-----------------------|---------------|--------------------|---|
| Very High | 96-100 | 10 | Error, accident, or act of nature is almost certain to occur; or occurs more than 100 times per year . |
| High | 80-95 | 8 | Error, accident, or act of nature is highly likely to occur; or occurs between 10-100 times per year. |
| Moderate | 21-79 | 5 | Error, accident, or act of nature is somewhat likely to occur; or occurs between 1-10 times per year . |
| Low | 5-20 | 2 | Error, accident, or act of nature is unlikely to occur; or occurs less than once a year, but more than once every 10 years. |
| Very Low | 0-4 | 0 | Error, accident, or act of nature is highly unlikely to occur; or occurs less than once every 10 years . |

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Table 4: Assessment Scale – Impact of Threat

| Qualitative Values | Semi-Quantitative Values | | Description |
|-----------------------|-----------------------------|----|--|
| Very High | 96-100 | 10 | The threat event could be expected to have multiple severe or catastrophic adverse effects on training hub activities |
| High | 80-95 | 8 | The threat event could be expected to have a severe or catastrophic adverse effect on training hub activities |
| Moderate | 21-79 | 5 | The threat event could be expected to have a serious adverse effect on training hub activities |
| Low | 5-20 | 2 | The threat event could be expected to have a limited adverse effect on training hub activities. |
| Very Low | 0-4 | 0 | The threat event could be expected to have a negligible adverse effect on training hub activities |

Table 5: Assessment Scale – Level of Risk

| Qualitative Values | Semi-Quantitative Values | | Description |
|-----------------------|-----------------------------|----|--|
| Very High | 96-100 | 10 | Threat event could be expected to have multiple severe or catastrophic adverse effects on training hub activities |
| High | 80-95 | 8 | Threat event could be expected to have a severe or catastrophic adverse effect on training hub activities |
| Moderate | 21-79 | 5 | Threat event could be expected to have a serious adverse effect on training hub activities |
| Low | 5-20 | 2 | Threat event could be expected to have a limited adverse effect on training hub activities |
| Very Low | 0-4 | 0 | Threat event could be expected to have a negligible adverse effect on training hub activities |

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3 Goals

- 3.1 To convert agricultural waste into value added products
- 3.2 To transfer knowledge and technology innovation combines local wisdom to develop high standards of agricultural products
- 3.3 To develop community enterprise and entrepreneurship

4 Training and/or services offered

The details of MJU training hub are described below;

Training Topic: "Agricultural waste utilization ".

Duration: 1 days/each program.

5 Location: Environmental technology laboratory, Faculty of Science, Maejo university

Biotechnology laboratory, Faculty of Science, Maejo university

Local community

Target Group: Farmers, SMEs entrepreneurs, communities, municipalities

Training program series:

Series I

- Hands-on workshop, Agricultural waste for soil amendment products : composting
 - : biofertilizers
 - : biochar production

Series 2

- Hands-on workshop, Agricultural waste for functional food products Series 3

- Hands-on workshop, Agricultural waste for health and wellness products Series 4

- Hands-on workshop, Agricultural waste for bio-packaging Series 5

- Hands-on workshop, Agricultural waste for animal food

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6 Scope of the hub

Activities: we will accomplish aforementioned objectives by carrying out the following activities:

1) Training – Conducting 1-2 training programs per year for farmers, SMEs entrepreneurs, communities, municipalities

2) Counselling – Providing following counselling or advisory services to help farmers, SMEs entrepreneurs, communities, municipalities to set up their entrepreneurship

7 Structure, role and responsibilities in governance bodies and functioning procedures

Main responsible organization:

Program in Environmental technology, Faculty of Science, Maejo University

Program in Biotechnology, Faculty of Science, Maejo University

Management representative: (Asst.Prof.Dr.Mujalin Pholchan) (Head of Program)

Trainer:

Series I

- Hands-on workshop, Agricultural waste for soil amendment products

: composting

Trainer: Asst.Prof.Dr. Tapana Cheunbarn

: biofertilizers

Trainer: Asst.Prof.Dr. Tapana Cheunbarn

: biochar production

Trainer: Asst.Prof.Dr. Mujalin Pholchan

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Series 2

- Hands-on workshop, Agricultural waste for functional food products Trainer: Dr. Tippapha Pisithkul
 - : Asst.Prof.Dr. Piyanuch Niamsup
 - : Asst.Prof.Dr. Pairote Wongputtisin

Series 3

- Hands-on workshop, Agricultural waste for health and wellness products Trainer: Asst.Prof Dr. Mathurot Chaiharn

Series 4

- Hands-on workshop, Agricultural waste for bio-packaging Trainer: Asst.Prof.Dr. Mujalin Pholchan Asst.Prof.Dr.Rawadi Wongmaneerung Asst.Prof.Dr.Supattra Wongsanmai

Series 5

- Hands-on workshop, Agricultural waste for animal food Trainer: Asst.Prof.Dr. Mujalin Pholchan Dr. Wongphan Promwong

Location: The MJU-SWAP training room and main lab hall at Faculty of Science, MJU and local communities.

8 Facility:

For MJU training hub, training rooms, laboratory, computer, projector and IT system is located at Chulaporn building, Faculty of Science. All lab equipment and tools including the existing one and the one from SWAP budgets such as notebook, incinerator, incubator shakers, soil pH meter, Plastic shredder and Infrared thermometer will be used during the training.



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9 **Resources required**

Equipment: Incinerator, Incubator shakers, soil pH meter, Infrared thermometer from SWAP budgets and existing Lab equipment from the faculty of Science.

Material: Agricultural waste are collected from local communities

Chemicals and Innoculum are from the faculty of science and research project **Facilities:** a training room, laboratory, computer, and projectors and etc. are from the faculty of science, Maejo university

Human resource: Trainers are lecturers from program in Environmental technology, Material science, Biotechnology and graduate students.

Financial support: Sponsors from university, government organisations and private companies. Training fee from trainees.



10 Business plan

The business plan of MJU training hub is explained below;

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THE BUSINESS MODEL CANVAS



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11 Indicators of success

MJU training hub focus on agricultural waste utilization. For the success of MJU the training hub, the following indicators are proposed to determine the performance of the training hub;

- 1. Training attendance in 1-day training/ each series.
- 2. Number of training course provided during SWAP programme.
- 3. Trainers and trainees' satisfaction
- 4. Completion rate
- 5. Transfer of training knowledge for waste utilization
- 6. Number of products and entrepreneurship
- 7. Financial and investment

The details of each indicator including data collection and evaluation are discussed in the Monitoring and Evaluation Plan.

12 Monitoring and evaluation plan.

Monitoring is a process that routinely collects meaningful information to track the progress of a project by comparing collected data to pre-defined plans. MJU training hub on the topic of Agricultural waste utilization is organized in ChiangMai. The overall goal of the training is to transfer knowledge and hands-on technology of agricultural waste utilization to valorization of the value added products. To ensure that the success of the training hub goal, monitoring and evaluation process will be used as a tool. This process will help identify project direction, adapt implementation plans, and support decision-making in project management. The process of monitoring and evaluation process will be conducted regularly along with the operation of the training hub by MJU SWAP team members. The monitoring and evaluation results is reported to MJU SWAP management team, SWAP committees as well as MJU executives, and funders.

Several types of questionnaire including Expectations questionnaires, Participants' satisfaction questionnaire and Trainers' satisfaction questionnaire is used to identified the training need, to monitor the results of the training program and to collect data on participants perception of the training and to collect data on the training course from the expert

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perspective. Also the preliminary financial sheet is used for identify the foreseen resources and costs needed for the training and the financial form is used to enable the proper financial monitoring during the training program. Moreover, in order to propose and justify modification and communicate the achieved objectives and results of the training programmes, monitoring report and final evaluation report are developed. The details of monitoring indicators are defined as followed;

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| Set of indicators | Indicators |
|-----------------------------------|---|
| 1. Financial resources | 1.1 Costs for the training hub implementation |
| | 1.2 Costs for training fees |
| | 1.3 Costs for travel of the trainees |
| 2. Competence of supporting staff | 2.1 Staff preparation |
| | 2.2 Staff experiences on professional |
| | trainings |
| 3. Competence of trainers | 3.1 Trainers knowledge |
| | 3.2 Trainer teaching skills and techniques |
| | 3.3 Trainer experiences in delivering |
| | professional training |
| 4. Infrastructure and equipment | 4.1 Training room and laboratory |
| | 4.2 Accessibility |
| | 4.3 Security and safety |
| | 4.4 Availability of computer, equipment and |
| | internet network |
| 5. Trainers satisfaction | 5.1 Satisfaction about outcome |
| | 5.2 Satisfaction about training activities |
| | 5.3 Satisfaction about content |
| | 5.4 Satisfaction about applicability of the |
| | output / products |
| 6. Trainers learning | 6.1 level of knowledge /learning |
| | 6.2 level of experience on the topic |
| 7. Trainers motivation | 7.1 Interest about content |
| | 7.2 Interest in participation |
| | 7.3 Interest in develop community enterprise |
| | or entrepreneurship |
| 8. Time management | 8.1 Timetable for the training |
| | 8.2 Compliance with the foreseen deadlines |

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CMU Training Hub Agricultural waste utilization Feasibility Study

Thai version

Training Hubs feasibility studies





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บทคัดย่อ

รายงานฉบับนี้จัดทำขึ้นจากผลการศึกษาความเป็นไปได้ของศูนย์ฝึกอบรม CMU ณ ภาควิชาวิศวกรรมสิ่งแวดล้อม มหาวิทยาลัยเชียงใหม่ ประเทศไทย ผลการวิเคราะห์ความต้องการชี้ให้ว่าการรีไซเคิลขยะพลาสติกและการนำขยะพลา สติกกลับมาใช้ประโยชน์เป็นแนวทางที่สำคัญและจำเป็นอย่างยิ่งสำหรับการแก้ปัญ าขยะพลาสติกของประเทศไทย ห การดำเนินกิจกรรมดังกล่าวจะช่วยให้ประเทศสามารถบรรลูวัตถุประสงค์ของการมุ่ งสู่เศรษฐกิจชีวภาพ หรือ Bio-Circular-Green economy ้ซึ่งเป็นหนึ่งในองค์ประกอบสำคัญของการขับเคลื่อนสู่การพัฒนาอย่างยั่งยืน เพื่อสนับสนุนการดำเนินการดังกล่าว จึงมีการจัดตั้งศูนย์ฝึกอบรมเรื่อง "การแยกขยะพลาสติกและการใช้ประโยชน์จากขยะพลาสติก LL น า คิ น วี ۶١ น บ น ด LL ۱۱ บ ห ม ้โดยมีวัตถุประสงค์หลักเพื่อปลูกฝังให้ผู้เข้ารับการฝึกอบรมมีทักษะการแยกขยะพล ำสติก และแนวทางการนำขยะพลาสติกกลับมาใช้ประโยชน์ รวมไปถึงการเรียนรู้เพื่อสร้างโอกาสทางธุรกิจของการใช้ประโยชน์จากขยะพลาส ติก ผลการวิเคราะห์ความเสี่ยง พบว่า กิจกรรมต่างๆ ที่เกี่ยวข้องมีความโอกาสและความรุนแรงของความเสี่ยงอยู่ในระดับต่ำถึงปานกลา ้ง อุปกรณ์ต่าง ๆ ที่จำเป็นต้องใช้ในการดำเนินงานของศูนย์อบรมมีพร้อมใช้แล้ว ณ ภาควิชาวิศวกรรมสิ่งแวดล้อม ซึ่งจัดซื้อโดยใช้งบประมาณอุปกรณ์ของโครงการ SWAP ผู้ฝึกสอนหลักของศูนย์ฝึกอบรมเป็นคณาจารย์ในคณะทำงานโครงการ CMU SWAP และผู้เชี่ยวชาญจากบริษัทพันธมิตร ในส่วนงบประมาณการดำเนินงาน ้ศูนย์ฝึกอบรมได้การวางแผนขอรับการสนับสนุนจากทั้งองค์กรภาครัฐและบริษัทเอ กชน และขอรับสนับสนุนจากมหาวิทยาลัยเชียงใหม่ ภายใต้แพลตฟอร์ม CMU BCG ร่วมกับการเก็บค่าธรรมเนียมการฝึกอบรมบางส่วนจากผู้เข้าฝึกอบรม เพื่อให้มั่นใดได้ว่าศูนย์ฝึกอบรมจะสามารถดำเนินงานได้อย่างต่อเนื่อง ในส่วนสุดท้ายของรายงานได้อธิบายถึงรายละเอียดของแผนการติดตามและการป ระเมินผลการดำเนินงานของศูนย์ฝึกอบรม





คำสำคัญ

ศูนย์ฝึกอบรม CMU; การแยกขยะพลาสติก, การใช้ประโยชน์จากขยะพลาสติก ข้อจำกัดความรับผิดชอบ

รายงานฉบับนี้ได้รับการสนับสนุนจากคณะกรรมาธิการยุโรปสำหรับการผลิตสิ่งพิม พ์ นี้ เ ท่ า นั้ น ทั้งนี้คณะกรรมาธิการยุโรปไม่มีส่วนในการรับรองเนื้อหาซึ่งสะท้อนจากมุมมองของ ผู้เขียนเท่านั้น และคณะกรรมาธิการยุโรปไม่รับผิดชอบต่อการใช้งานใด ๆ อันเนื่องมาจากข้อมูลที่มีเผยแพร่ในรายงานฉบับนี้

รายงานฉบับนี้อาจมีเนื้อหาซึ่งเป็นลิขสิทธิ์ของโครงการ SWAP การทำซ้าหรือคัดลอกเนื้อหาในรายงานฉบับนี้ต้องได้รับการขออนุญาตก่อน คณะทำงางานโครงงการ SWAP ทั้งหมดได้ตกลงที่จะเผยแพร่เอกสารนี้อย่างเต็มรูปแบบการใช้ข้อมูลใดๆ ที่มีอยู่ในเอกสารนี้ในเชิงพาณิชย์จำเป็นต้องได้รับอนุญาตจากเจ้าของข้อมูลนั้น

คณะทำงานทั้งหมดของโครงการ SWAP หรือฝ่ายใดฝ่ายหนึ่งของโครงการ

SWAP ไม่รับประกันว่าข้อมูลที่มีอยู่ในเอกสารนี้สามารถใช้งานได้ หรือการใช้ข้อมูลที่มีอยู่ในเอกสารนี้ปราศจากความเสี่ยง และไม่ยอมรับความรับผิดใด ๆ ต่อความสูญเสียหรือความเสียหายที่บุคคลใด ๆ ได้รับความเดือดร้อนจากการใช้ข้อมูลในเอกสารนี้

กิตติกรรมประกาศ

เอกสารนี้เป็นผลงานส่งมอบของโครงการ SWAP และได้รับทุนสนับสนุนจากโครงการ Erasmus+ ของสหภาพยุโรปภายใต้ข้อเสนอ EAC/A02/2019





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การวิเคราะห์ความต้องการ

พลาสติกนับว่ามีความสำคัญอย่างยิ่งต่อเศรษฐกิจของประเทศไทยและเศรษ โ กิ งใ ຈ ๆ อ ຈ ิล ก อุตสาหกรรมปิโตรเคมีของประเทศไทยนั้นมีขนาดใหญ่ที่สุดในภูมิภาคเอเชียต ะวันออกเฉียงใต้และใหญ่เป็นอันดับที่ 16 ของโลก ในปี พ.ศ. 2561 ประเทศไทยผลิตผลิตภัณฑ์ปิโตรเคมีปลายน้ำจำนวน 11.8 ล้านตัน ซึ่งนับรวมถึงผลิตภัณฑ์เม็ดพลาสติก อุตสาหกรรมพลาสติกของไทยมีส่วนช่วยเศรษฐกิจของประเทศ 1,100 พันล้านบาท หรือประมาณ 36.9 พันล้านเหรียญสหรัฐ คิดเป็น ร้อยละ 6.71 ของ GDP ของไทย (World Bank Group, 2021)

ต้ นั ป ۹١ Ш ต่ 2 493 ศ พ การใช้ผลิตภัณฑ์พลาสติกขยายตัวเพิ่มมากถึงยี่สิบเท่า ในปี พ.ศ. 2561 การผลิตพลาสติกทั่วโลกมีมากถึง 360 ล้านตัน การเพิ่มขึ้นของการใช้ผลิตภัณฑ์พลาสติกนั้นเนื่องมาจากพลาสติกมีราคาถูก และมีคุณสมบัติมากมาย มีความทนทาน และสามารถนำไปใช้งานได้หลากหลาย จึงมักพบการใช้พลาสติกในหลากหลายอุตสาหกรรมตั้งแต่ อุตสาหกรรมการผลิตบรรจุภัณฑ์ สินค้าอุปโภคบริโภค อุปกรณ์อิเล็กทรอนิกส์ การผลิตยานยนต์ การผลิตสิ่งทอ รวมไปถึงในภาคการเกษตร ้ปัญหาการจัดการขยะพลาสติกบนบกที่ไม่เหมาะสม โดยเฉพาะอย่างยิ่งขยะบรรจุภัณฑ์พลาสติก ้สร้างความเสียหายต่อต้นทุนทางเศรษฐกิจไปทั่วโลก รวมถึงในประเทศไทย ส่ ศ ึ่งใ ฝ ະ บ ต่ ۱۱ นิ C ิล ก ร ท ۹١ อ ร ະ และทำให้เกิดปัญหาการอุดตันในโครงสร้างพื้นฐานของเมือง ในแต่ละปีมีขยะพลาสติกบนบกรั่วไหลออกสู่มหาสมุทรประมาณ 8 ถึง 12 ล้านตัน โดยร้อยละ 80 พบว่าเกิดจากประเทศในภูมิภาคเอเชีย





โดยมีประเทศไทยอยู่ในอันดับที่ จาก 6 10 อันดับสูงสุดของประเทศที่มีการรั่วไหลของขยะพลาสติกบนบกลงสู่มหาสมุทร ารป 5 ະ มินเบื้อ ৩ ต้ น พ L ۱۱ ว่า ผลกระทบภายนอกหลังจากการใช้งานบรรจภัณฑ์พลาสติก รวมกับต้นทุนที่เกี่ยวข้องกับการปล่อยก๊าซเรือนกระจกจากกระบวนการผลิตบร รจุภัณฑ์พลาสติก นั้นมีมูลค่าประมาณ พันล้านเหรียญสหรัฐต่อปีซึ่งมากกว่ากำไรของกลุ่มอุตสาหกรรมบรรจุภัณฑ์พล ทั้ ส ติ า ึ่ง ก ห ม ้นอกจากนี้ยังพบว่าทั่วโลกสูญเสียมูลค่าทางเศรษฐกิจอันเนื่องมาจากการไม่ได้ นำบรรจุภัณฑ์พลาสติกกลับมารีไซเคิล หรือนำกลับมาใช้ประโชน์ใหม่ มากถึง ถึง 120 พันล้านเหรียญสหรัฐต่อปี 8 0 ทั้งหมดนี้นำไปสู่การเพิ่มความตระหนักต่อปัญหาการจัดการขยะพลาสติกไปทั่ และส่งผลให้ปัญหามลพิษจากพลาสติกถูกยกระดับให้เป็นหนึ่งในกระแสหลักข ้องการสร้างจิตสำนึกผู้บริโภคในประเทศไทย (World Bank Group, 2021) รไ ผ่ ງ น ห ที น ิล า ٤١ าเ ้ปริมาณขยะพลาสติกในประเทศไทยนั้นเพิ่มขึ้นอย่างรวดเร็วเมื่อเทียบกับขยะป ระเภทอื่น ขยะพลาสติกเพิ่มขึ้นในอัตราเฉลี่ย 12% ต่อปี หรือประมาณ 2 ถึง ล้ ตั ต่ รไ 2 5 ۹١ น ิก ทำให้ประเทศไทยกลายเป็นหนึ่งในผู้บริโภคพลาสติกรายใหญ่ที่สุดในเอเชีย ซึ่งสวนทางกับสถานการณ์การแก้ปัญหาและจัดการขยะพลาสติกที่ถูกต้องเหม าะสม (Ocean Conservancy, 2017; PCD, 2019) การขาดแผนการเก็บขนและวิธีการกำจัดอย่างประสิทธิภาพ ขาดการคัดแยกขยะในระดับครัวเรือน และขาดแรงจูงใจทางเศรษฐกิจสำหรับการแยกขยะและการรีไซเคิล ้ปัญหาเหล่านี้ส่งผลให้ขยะมูลฝอยชุมชนในประเทศไทยถูกจัดการอย่างไม่เหม าะสมถึง 27% ของปริมาณขยะมูลฝอยชุมชนทั้งหมด (Akenji et al., 2019; Ρ С 2 D 0 9 1)



**** C * * E **** 0

ขยะบรรจุภัณฑ์พลาสติกทั้งหมดของประเทศไทยประกอบด้วยผลิตภัณฑ์หลักส องชนิด ได้แก่ ถุงพลาสติก และขวดพลาสติก คิดเป็น 60% ของขยะบรรจุภัณฑ์ พลาสติกทั้งหมด โดยพบว่า ขยะถุงพลาสติก(คิดทั้งถุงประเภท ชั้นเดียว monolayer และถุงช้อปปิ้ง) มีปริมาณโดยน้ำหนักมากกว่าขยะขวดพลาสติกถึงสองเท่า แต่ถุงพลาสติกกลับถูกเก็บรวบรวมเข้าสู่กระบวนรีไซเคิลน้อยกว่ามาก อันเนื่องมาจากถุงพลาสติกนั้นมีน้ำหนักเบาหลุดรอดสู่สิ่งแวดล้อมได้ง่าย ถุงพลาสติกกลับถูกเป็นรวบรวมเข้าสู่กระบวนรีไซเคิลน้อยกว่ามาก อันเนื่องมาจากถุงพลาสติกนั้นมีน้ำหนักเบาหลุดรอดสู่สิ่งแวดล้อมได้ง่าย ถุงพลาสติก ยังถูกปนเปื้อนได้ง่ายจากการใช้งาน ทำให้ไม่เหมาะสมกับการนำกลับไปรีไซเคิล อย่างไรก็ตาม การเริ่มต้นจากการคัดแยกขยะในระดับครัวเรือนนั้นสามารถเพิ่มประสิทธิภาพ ของการนำขยะพลาสติก รวมถึงขยะประเภทถุงพลาสติก ให้กลับเข้าสู่วงจรการรีไซเคิลได้ (WWF THAILAND, 2020)

อุตสาหกรรมพลาสติกและบรรจุภัณฑ์ที่ผ่านมากมักมุ่งเน้นการผลิตบนแนวคิ

ด เศรษฐกิจ แบบเส้นตรง นั่นคือ ผลิต-ใช้-ทิ้ง หรือเน้นการออกแบบเพื่อใช้ครั้งเดียว การออกแบบผลิตภัณฑ์หลายๆ วิธี ที่ผ่านมายังไม่เอื้อต่อกระบวนการเก็บรวมรวมและกระบวนการรีไซเคิล เช่น

การใช้พลาสติกหลายชั้น (multilayer) การผสมสีย้อม การออกแบบให้ผลิตภัณฑ์สามารถใช้ได้แค่ครั้งเดียว เป็นต้น นอกจากนี้รูปแบบการรีไซเคิลในปัจจุบันเป็นรูปแบบของการดาวน์ไซคลิ่ง วัสดุจะถูกลดคุณภาพและมูลค่าต่ำลงทุกครั้งที่รีไซเคิล ทำให้จำกัดโอกาสในการสร้างมูลค่าของการนำพลาสติกกลับมาใช้ใหม่ ปัญหาราคาพลาสติกตกต่ำในบางประเภท และการนำเข้าขยะพลาสติกที่เพิ่มขึ้น ยังส่งผลกระทบต่อบริษัทรีไซเคิลของไทยที่ยังไม่มีตลาดขนาดใหญ่สำหรับวัส ดุรีไซเคิล ที่จะช่วยลดการลงทุนในธุรกิจรีไซเคิล (Johnson and Trang, 2019; WWF ประเทศไทย, 2563)

การนำขยะพลาสติกกลับมาใช้ประโยชน์ตามหลักการเศรษฐกิจหมุนเวียน อันได้แก่ การอัพไซเคิลผลิตภัณฑ์ที่มีมูลค่าสูงขึ้น





สามารถเพิ่มมูลค่าขยะพลาสติก เพิ่มแรงจูงใจในการรวบรวมขยะพลาสติก ร ว ม ถึ ง ก่ อ ใ ห้ เ กิ ด น ำ ไ ป ใ ช้ ป ร ะ โ ย ช น์ แ บ บ ห มุ น เ วี ย น ม า ก ขึ้ น ส่งผลให้สามารถลดปริมาณขยะไปยังหลุมฝังกลบและขยะพลาสติกที่จัดการอย่

٦ ม่ ٦ ര് ึ่ง ต้ ิล ึ่ง า ຄ ก ิก ึ่ง และส่งผลให้ปริมาณขยะพลาสติกที่รั่วไหลออกสู่มหาสมุทรลดลงลงตามมา การส่งเสริมการนำขยะพลาสติกกลับมาใช้ประโยชน์ตามหลักการเศรษฐกิจหมุ ้นเวียนยังช่วยให้รัฐบาลไทยสามารถบรรลุเป้าหมายในการจัดการขยะพลาสติ ตั้ ก ที่ งใ ٦ ว้ ไ ด้ ก็ ร อ ۶İ า ไ ต า ม การนำขยะพลาสติกกลับมาใช้ประโยชน์ตามหลักการเศรษฐกิจหมุนเวียนยังเป็ นแนวปฏิบัติที่ค่อนข้างใหม่สำหรับประเทศไทย ้องค์ความรู้ที่เกี่ยวข้องกับประเด็นดังกล่าวยังไม่เป็นที่รู้จักกันอย่างแพร่พลาย รวมถึงจำนวนศูนย์ฝึกอบรมในหัวข้อดังกล่าวยังมีน้อยมาก ทางภาควิชาวิศวกรรมสิ่งแวดล้อม คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่ภายใต้โครงการ SWAP จึงจัดตั้งศูนย์ฝึกอบรมในเรื่อง "การแยกขยะพลาสติกและการใช้ประโยชน์จากขยะพลาสติก น บ น ш น ງ คิ ด แ บ บ ห ม น L วี 21 ้เพื่อเผยแพร่องค์ความรู้ทางวิชาการและแนวปฏิบัติที่เกี่ยวข้องในเรื่องดังกล่าว ศูนย์ฝึกอบรมนี้จะเป็นประโยชน์อย่างยิ่งแก่ผู้ที่สนใจทั้งจากภาครัฐและภาคเอก ୩ น

ร่วมถึงประชาชนและกลุ่มวิสาหกิจชุมชนทั่วไปที่ต้องการเรียนรู้เพื่อโอกาสในก ารสร้างงานและรายได้จากการจัดการขยะพลาสติกในกับชุมชนของตน





การวิเคราะห์ความเสี่ยง

| หัวข้อคว | คำอธิบายความเสียง | คว | ໂ | มาตรการบรรเทาผลกระทบ |
|----------|------------------------------|-----|------|-------------------------------|
| ามเสี่ยง | | าม | อ | |
| | | รุน | ก | |
| | | แร | า | |
| | | ৩ | ส | |
| อาชีวอน | ผู้เข้ารับการฝึกอบรมอาจได้รั | ต่า | ର୍ଡ଼ | การใช้อุปกรณ์ป้องกันส่วนบุ |
| ามัยและ | บบาดเจ็บจากการใช้สารเคมี | | า | ନ ନ ର |
| ความปล | การสัมผัสความร้อน | | | แผนงานด้านการยศาสตร์ |
| อดภัย | และเกิดอันตรายต่อดวงตาได้ | | | การประเมินและปรับปรุงสภ |
| | | | | าพแสดล้อมในพื้นที่ทำงาน |
| | | | | และการตรวจร่างกาย |
| ทางเทค | ความล้มเหลวทางเทคนิค | ปา | ର୍ଡ଼ | สร้างความร่วมมือกับซัพพล |
| นิค | หรืออันตรายจากเทคโลยีที่ | นก | า | ายเออร์อุปกรณ์ที่ให้การสนั |
| | นำมาใช้ | ล า | | บสนุนทางเทคนิคที่มีคุณภา |
| | | ৩ | | W |
| ทรัพยาก | | ปา | ର୍ଡ଼ | กำหนดให้มีการสือสารอย่าง |
| รบุคคล | จำนวนการประชุมเชิงปฏิบัติ | นก | า | ต่อเนื่องระหว่างกลุ่มเครือข่า |
| | การอาจไม่เพียงพอสำหรับก | ลา | | ยเพื่อให้รับทราบถึงปัญหาห |
| | ารฝึกอบรมบุคลากรทางการ | ง | | รืออุปสรรคใด ๆ |
| | ศึกษาที่เหมาะสม | | | ที่เกิดขึ้นและสามารถแก้ไขไ |
| | | | | ด้ตรงเวลา |
| การดำเ | การขาดแคลดทรัพยากรและ | ต่า | ต่ | วางแผนล่วงหน้าสำหรับการ |
| นินงาน | วัสดุที่ต้องใช้ในการดำเนินง | | า | จัดหาแหล่งจัดหาวัสดุ |
| | านเนื่องจาก | | | และการแบ่งภาระหน้าที่ |
| | ปัญหาด้านการจัดส่งและการ | | | |
| | ขาดแคลนสินค้าของผู้จำหน่ | | | |
| | าย | | | |





| หัวข้อคว | คำอธิบายความเสียง | คว | ໂ | มาตรการบรรเทาผลกระทบ |
|----------|------------------------------|-----|----|-------------------------------|
| ามเสี่ยง | | าม | อ | |
| | | รุน | ก | |
| | | แร | า | |
| | | ৩ | ส | |
| โครงกา | ใช้เวลานานเกินไปในการทำ | ปา | ต่ | การวางแผนและเตรียมการ |
| รและชื่อ | งาน ที่สำ คัญ | นก | า | ล่วงหน้า |
| เสียง | หรือประสบปัญหาเกี่ยวกับคุ | ล า | | การสร้างเครือข่ายกับกลุ่มผู้ |
| | ุณภาพของผลิตภัณฑ์หรือบริ | ৩ | | มีส่วนได้เสีย |
| | การ | | | และกลุ่มผู้เกี่ยวข้องล่วงหน้า |
| | การสูญเสียความเชื่อมั่นของ | | | |
| | ลูกค้าหรือพนักงาน | | | |
| | หรือความเสียหายต่อชื่อเสียง | | | |
| | ของโครงการ | | | |
| การเงิน | ใช้จ่ายเกินงบประมาณ | ปา | ต่ | ขอรับการสนับสนุนจากแหล่ |
| | ธุรกิจล้มเหลวหรือการไม่มีเงิ | นก | า | ง อื่น ๆ |
| | นทุนในการดำเนินธุรกิจ | ล า | | เก็บค่าธรรมเนียมการเข้าฝึก |
| | | ৩ | | อ บ ร ม |
| | | | | ใช้นักศึกษาเป็นผู้ช่วยในกา |
| | | | | รจัดฝึกอบรม |





Likelihood of Occurrence

| ESTIMATION DESCRIPTION | | INDICATORS |
|------------------------|--|---|
| High | Likely to occur each year or more than | Potential of it occurring several times |
| (Probable) | 50 per cent chance of occurrence. | within the lifetime of the project |
| | | -Could occur but not likely more than |
| Medium | Likely to occur by less than 25 per cent | once within the lifetime of the project |
| (Possible) | chance. | -Could be difficult to control due to |
| | | some external influences. |
| Low | Not likely to occur | -Has not occurred. |
| (Remote) | NOT INCLY TO OCCUT. | -Unlikely to occur. |

Likely Impact and Severity

| ESTIMATION | DESCRIPTION |
|------------|--|
| | Significant impact on the project's achievement or operational |
| High | activities. |
| | -Significant stakeholder concern. |
| | -Significant financial impact. |
| | Moderate impact on the Project's achievement or operational |
| Medium | activities. |
| | Moderate stakeholder concern. |
| | Moderate financial impact. |
| Low | -Low impact on the Project's achievement or operational activities. |
| LOW | -Low stakeholder concern. |
| | -Low financial impact. |





เป้าหมาย

เป้าหมายที่ 1 ผู้เข้ารับการฝึกอบรมสามารถแยกขยะพลาสติกได้อย่างถูกต้อง และสามารถแปลงขยะพลาสติกให้เป็นสินค้าที่มีมูลค่าได้

ถ ป วั ต ร ะ ส ค์ ง 1 1 เสริมสร้างความรู้ความเข้าใจในเรื่องประเภทของขยะพลาสติก ้ความสำคัญของการแยกขยะ และวิธีการแยกขยะอย่างถูกต้อง วั ป งใ ค์ ต ຄ ร ŝ ส 1 2 ้เสริมสร้างความรู้ความเข้าใจในเรื่องการคุณภาพของพลาสติกที่เหมาะสมกับก 5 ລັ ٦ ണ คิ า พ L ิล และวิธีจัดการขยะพลาสติกขั้นต้นก่อนนำไปใช้สำหรับการอัพไซเคิล าั ป ร ค์ 1 ଡ ຄ ş ส งใ 3 เสริมสร้างประสบการณ์ในการลงมือทำจริงของการแปลงขยะพลาสติกให้เป็น ผลิตภัณฑ์ที่มีมูลค่า

เปัาหมายที่2ผู้เข้ารับการฝึกอบรมมีมุมมองเชิงบวกต่อการเปลี่ยนขยะให้เป็นผลิตภัณฑ์ที่มีมูลค่า และมองเห็นโอกาสทางธุรกิจในการพัฒนาผลิตภัณฑ์จากของเสีย

การฝึกอบรมและ/หรือบริการที่นำเสนอ

หัวข้อการฝึกอบรม: "การแยกขยะและการใช้ประโยชน์จากขยะพลาสติก บนแนวคิดแบบหมุนเวียน"

ระยะเวลา: 2 วัน

สถานที่: ห้องโถงปฏิบัติการ ภาควิชาวิศวกรรมสิ่งแวดล้อม คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่

กลุ่มเป้าหมาย: คุณครูและนักเรียน ชุมชนขนาดเล็กถึงขนาดกลางที่สนใจสร้างรายได้จากขยะมูลฝอย **เนื้อหา:**





- ก า ร บ ร ร ย า ย ∶ หั ว ข้ อ สถานการณ์ภาพรวมของปัญหาขยะพลาสติกในประเทศไทย
- การบรรยาย: หัวข้อ วิธีการคัดแยกและเตรียมพลาสติกชนิดต่าง ๆ
 เพื่อใช้ประโยชน์
- การบรรยาย: หัวข้อ
 ทางเลือกในการใช้ประโยชน์จากขยะพลาสติกที่คัดแยกแล้ว
 การวิเคราะห์รายได้และโอกาสของธุรกิจที่เป็นมิตรต่อสิ่งแวดล้อม
- การฝึกปฏิบัติ: การคัดแยกขยะจากขยะพลาสติกรวม และการเตรียมขยะขั้นต้น ได้แก่ การทำความสะอาด และการหั่นย่อยโดยใช้เครื่องบดพลาสติก
- การฝึกปฏิบัติ: การอัพไซคลิ่งขยะพลาสติก ได้แก่ การอัดรีด และการขึ้นรูปพลาสติกเป็นผลิตภัณฑ์ประเภทต่างๆเช่น หม้อพลาสติก หรือเส้นใยพลาสติก
- การฝึกปฏิบัติ: การใช้เส้นใยพลาสติกกับเครื่องพิมพ์ 3 มิติ

ขอบเขตของศูนย์ฝึกอบรม

กิจกรรม: เราจะบรรลุวัตถุประสงค์ดังกล่าวโดยการดำเนินกิจกรรมต่อไปนี้: 1) การฝึกอบรม – ดำเนินโครงการฝึกอบรม 1-2 โครงการต่อปี สำหรับ ԼԼ ູ นั ก รี 81 ณ ค ร ิล L น ค และกลุ่มชุมชนขนาดเล็กถึงขนาดกลางที่สนใจสร้างรายได้จากขยะมูลฝอย 2) การให้คำปรึกษา – ให้คำปรึกษา แนะแนว แก่คุณครูและนักเรียน และกลุ่มชุมชนที่สนใจ ในการพัฒนาจัดตั้งศูนย์แยกขยะพลาสติก และศูนย์การใช้ประโยชน์แบบหมุนเวียนจากขยะของตนเอง

โครงสร้าง บทบาท และความรับผิดชอบของหน่วยงาน และขั้นตอนการปฏิบัติงาน





องค์กรที่รับผิดชอบหลัก: ภาควิชาวิศวกรรมสิ่งแวดล้อม คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่

ตัวแทนฝ่ายบริหาร: ผู้ช่วยศาสตราจารย์ ดร. ปฏิรูป ผลจันทร์ (หัวหน้าภาควิชา)

ผู้ฝึกสอน: รองศาสตราจารย์ ดร.ณภัทร จักรวัฒนา (หัวหน้าผู้ฝึกสอน) ดร. สรัลนุช ภู่พิสิฐ (ผู้ฝึกสอน)

ผู้ช่วยศาสตราจารย์ ดร.สุลักษณ์ สุมิตสวรรค์ (ผู้ฝึกสอน)

รองศาสตราจารย์ ดร.อรรณพ วงศ์เรือง (ผู้ฝึกสอน)

ผู้ช่วยศาสตราจารย์ ดร. ภาคภูมิ รักร่วม (ผู้ฝึกสอน)

ผู้ช่วยศาสตราจารย์ ดร. ปฏิรูป ผลจันทร์ (ผู้ฝึกสอน)

ผู้เชี่ยวชาญจาก บริษัท Zero Waste YOLO จำกัด (ผู้ฝึกสอน)

นักศึกษาปริญญาเอก 1 คน และ นักศึกษาปริญญาโท 2 คน (ผู้ช่วยผู้ฝึกสอน)

พันธมิตร: ผู้เชี่ยวชาญจาก บริษัท Zero Waste **YOLO** จำกัด ให้การสนับสนุนทางเทคนิคสำหรับเครื่องจักรในการดำเนินโครงการ และเป็นต้นแบบในการเรียนรู้รูปแบบธุรกิจของพลาสติกรีไซเคิล

สถานที่: ห้องฝึกอบรม CMU-SWAP และห้องโถงปฏิบัติการ ภาควิชาวิศวกรรมสิ่งแวดล้อม คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่ **สิ่งอำนวยความสะดวก:** ห้องฝึกอบรม อุปกรณ์คอมพิวเตอร์ และจอโปรเจคเตอร์ (เป็นของภาควิชาวิศวกรรมสิ่งแวดล้อม) เครื่องบดย่อยพลาสติก เครื่องอัดรีด และเครื่องพิมพ์ 3 มิติ (จากงบประมาณสนับสนุน หมวดอุปกรณ์ของโครงการ SWAP)

ทรัพยากรที่จำเป็น





อุปกรณ์: เครื่องบดย่อยพลาสติก เครื่องอัดรีด เครื่องทำเส้นใย และเครื่องพิมพ์

3 มิติ (จากงบประมาณสนับสนุน หมวดอุปกรณ์ของโครงการ SWAP) **วัสดุ:** ขยะพลาสติก รวบรวมจากถังขยะของมหาวิทยาลัยเชียงใหม่ โดยพนักงานเก็บขนของคณะวิศวกรรมศาสตร์ หรือขยะที่รวบรวมจากสถานที่อื่นของผู้เข้ารับการฝึกอบรม

สิ่งอำนวยความสะดวก: ห้องฝึกอบรม อุปกรณ์คอมพิวเตอร์ และจอโปรเจคเตอร์ (เป็นของภาควิชาวิศวกรรมสิ่งแวดล้อม)

ทรัพยากรบุคคล: ผู้ฝึกสอนเป็นอาจารย์จากภาควิชาวิศวกรรมสิ่งแวดล้อม และผู้ช่วยผู้ฝึกสอนเป็นนักศึกษาระดับบัณฑิตศึกษา

การสนับสนุนทางการเงิน: ผู้สนับสนุนจากองค์กรภาครัฐและบริษัทเอกชน ค่าธรรมเนียมการฝึกอบรมจากผู้เข้ารับการฝึกอบรม





แผนธุรกิจ

ผ้าใบรูปแบบธุรกิจ

| พันธมิตรหลัก - มหาวิทยาลัยเชียงใ หม่ - บริษัท Zero Waste YOLO จำกัด - มหาวิทยาลัยพันธมิต ร จ า ก โ ค ร ง ก า ร รพAP | กิจกรรมหลัก - การบรรยายและการฝึกปฏิบัติจริง - การฝึกอบรมการแยกขยะพลาสติกและการใช้ประโยชน์จาก ขยะพลาสติกบนแนวคิดแบบหมุนเวียน | คุณค่า - นวัตกรรม | ความสัมพันธ์กับลูกค่ - การติดต่อระหว่างบุ คคลกับบุคคล (เช่น ผู้เยี่ยมชมศูนย์) - วิดีโอคอนเฟอเรนซ์ - อีเมล์ - โซเชียลมีเดีย | กลุ่มลูกค้า - นักเรียนและครูในระดับ ชั้ น มั ธ ย ม ศึ ก ษ า และอุดมศึกษา - สมาชิกของกลุ่มชุมชน - องค์กรชุมชน |
|---|--|---|---|---|
| ໂດຣາດຮັດງທັນງານ | ทรัพยากรหลัก อุปกรณ์: เครืองบดย่อย เครืองอัดรีด เครืองทำเส้นใย และเครื่องพิมพ์ 3 มิติ วัสดุ: พยะพลาสติก สิ่งอำนวยความสะดวก: ห้องฝึกอบรม คอมพิวเตอร์ และโปรเจคเตอร์ ผู้ฝึกสอนและนักศึกษาระดับบัณฑิตศึกษา | การเพิ่มความ รู้ ทักษะ-และ สร้างทัศนคติ รี | ช่องทาง - สื่ อ สั ง ค ม โซเชียลมีเดีย - การบอกต่อ - การนำเสนอ | |
| - การบำรุงรักษาและการเปลี่ยนอุปกรณ์ - ส | | เทสงวาย เต องค์กรภาครัฐและ | /หรือบริษัทเอกชน | |

D 4.4: การศึกษาความเป็นไปได้ของศูนย์ฝึกอบรม CMU





- ค่าตอบแทนนักศึกษาช่วยงาน
- ค่าสาธารณูปโภค เช่น ค่าไฟฟ้า และค่าน้าประปา

- ค่าธรรมเนียมการฝึกอบรม
- มหาวิทยาลัยเชียงใหม่ (ภายใต้ "กลยุทธ์โมเดล BCG")
- คณะวิศวกรรมศาสตร์ มหาวิทยาลัยเชียงใหม่





ตัวชี้วัดความสำเร็จ

ศูนย์ฝึกอบรม CMU จะมุ่งเน้นไปที่การแยกและการใช้ประโยชน์จากขยะพลาสติก ผู้เข้ารับการฝึกอบรมจะได้รับการบรรยายเกี่ยวกับภาพรวมและสถานการณ์ของขย ะพลาสติกในประเทศไทย วิธีการคัดแยกและเตรียมพลาสติกชนิดต่าง ๆ เพื่อใช้ประโยชน์ ทางเลือกในการใช้ประโยชน์จากขยะพลาสติกที่คัดแยกแล้ว การวิเคราะห์รายได้และโอกาสของธุรกิจที่เป็นมิตรต่อสิ่งแวดล้อม หลังจากนั้นผู้เข้ารับการฝึกอบรมจะได้ฝึกปฏิบัติในกิจกรรมการคัดแยกขยะจากขย ะพลาสติกรวม และการเตรียมขยะขั้นต้น และได้ฝึกปฏิบัติในขั้นตอนการอัดรีด และการขึ้นรูปพลาสติกเป็นผลิตภัณฑ์ประเภทต่างๆเช่น หม้อพลาสติก หรือเส้นใยพลาสติก ตามความเหมาะสมของขยะพลาสติก รายการตัวชี้วัดเพื่อประเมินผลสัมฤทธิ์ของการจัดตั้งศูนย์ฝึกอบรม ประกอบด้วย

- 1. ร้อยละของการปรับปรุงการแยกขยะพลาสติกได้อย่างถูกต้อง
- 2. ผลคะแนนสอบก่อนและหลังการฝึกอบรม
- จำนวนผู้ที่เข้ารับการฝึกอบรมครบทั้ง 2 วัน

จำนวนครั้งการจัดฝึกอบรมในช่วงการดำเนินงานของโครงการ SWAP
 รายละเอียดของแต่ละตัวชี้วัด
 ขั้นตอนการรวบรวมและประเมินผลจะกล่าวถึงในหัวข้อ 10
 แผนการติดตามและประเมินผล

แผนการติดตามและประเมินผล

การตรวจสอบเป็นกระบวนการที่รวบรวมข้อมูลสำคัญอย่างสม่ำเสมอเพื่อติดตา น้ คื ۱۱ ห า ม ค ว ม ବା ค ଜ ร ึ่ง ก า ร ้โดยทำการเปรียบเทียบข้อมูลที่รวบรวมได้กับแผนที่ได้กำหนดไว้

ศูนย์ฝึกอบรม CMU ตั้งอยู่ในจังหวัดเชียงใหม่ ประเทศไทย จัดตั้ง เพื่อ ให้ การฝึกอบรมในหัวข้อ "การแยกขยะและการใช้ประโยชน์จากขยะพลาสติกบนแนวคิดแบบหมุนเวียน" ภายใต้โครงการ SWAP เป้าหมายโดยรวมของการฝึกอบรมคือ เพื่อสร้างความรู้ความเข้าใจในการคัดแยกขยะพลาสติกอย่างถูกต้อง





และเพื่อแสดงให้เห็นถึงทางเลือกในใช้ประโยชน์จากขยะพลาสติก ผู้เข้าอบรมจะได้เรียนรู้ถึง ชนิดของพลาสติกที่มักพบในขยะมูลฝอย วิธีการระบุประเภทพลาสติก และการใช้ประโยชน์จากพลาสติกรีไซเคิล

ทั้งในภาคทฤษฎีจากการบรรยายและภาคปฏิบัติผ่านการลงมือปฏิบัติจริง กระบวนการติดตามและประเมินผลจะถูกใช้เป็นเครื่องมือในการควบคุมการจัด การศูนย์ฝึกอบรม เพื่อให้การจัดตั้งศูนย์ฝึกอบรมบรรลุเป้าหมายที่กำหนดไว้ กระบวนการติดตามและประเมินผลนี้จะช่วยกำหนดทิศทางโครงการ รั ٩l ۱۱ นิ հ น ร ດໍ า L น ผ ก ึ่ง า น และเป็นเครื่องมือสนับสนุนการตัดสินใจการจัดการโครงการ กระบวนการติดตามและประเมินผลจะดำเนินการอย่างสม่าเสมอโดยสมาชิกในทีมโ มหาวิทยาลัยเชียงใหม่ SWAP ครงการ ควบคู่ไปพร้อมกับการดำเนินงานของศูนย์ฝึกอบรม และจะจัดทำรายงานการผลการติดตามและประเมินผล ให้แก่ คณะทำงาน คณะกรรมการโครงการ SWAP ผู้บริหารมหาวิทยาลัยเชียงใหม่ และผู้ให้ทุน





กรอบเหตุผลสัมพันธ์

กรอบเหตุผลสัมพันธ์แสดง เป้าหมาย ผลลัพธ์ ผลผลิต และกิจกรรมโดยรวมของศูนย์ฝึกอบรม CMU ร่วมกับตัวชี้วัด วิธีการตรวจสอบ และความเสี่ยง / สมมติฐานของการฝึกอบรม ในตารางด้างล่าง

ตารางที่ 1. กรอบเหตุผลสัมพันธ์ของศูนย์ฝึกอบรม CMU

| | สรุปโครงการ | ตัวชีวัด | วิธีการตรวจสอบ | ความเสียง / สมมติฐาน |
|-----------|-------------------------------------|----------------------------------|----------------------|------------------------------|
| เป้ | ปรับปรุงความถูกต้องของการแยกขยะพ | ร้อยละของการปรับปรุ | การเปรียบเทียบผลคะแ | ไม่ระบุ |
| าห | ลาสตกและแนะนาทางเลอกสาหรบการไ | งการแยกขยะพลาสติก | นนสอบระหวางกอนแล | |
| มา | ช้ประโยชน์จากขยะพลาสติก | ได้อย่างถูกต้อง | ะหลังการฝึกอบรม | |
| ย | | | | |
| ผล | ผลคะแนนจาการทดสอบและการปฏิบัติ | คะแนนสอบ | การเปรียบเทียบผลคะแ | ผู้เข้ารับการฝึกอบรมเข้าร่วม |
| ລັ | สูงขึ้นในหัวข้อ | | นนสอบระหว่างก่อนแล | ้อย่างน้อย 90% |
| ธ์ | "การแยกขยะและการใช้ประโยชน์จาก | | ะหลังการฝึกอบรม | ของโปรแกรมการฝึกอบรม |
| | ขยะพลาสติก บนแนวคิดแบบหมุนเวียน" | | | และทำการทดสอบก่อนและ |
| | | | | หลังการฝึกอบรม |
| ผล | ผู้เข้ารับการฝึกอบรมจากชุมชนหรือโรง | จำนวนผู้ที่เข้ารับการฝึ | บันทึกการเข้าฝึกอบรม | ผู้เข้ารับการฝึกอบรมสมัครเ |
| ผ ลิ | เรียนเข้ารับการอบรมครบ 2 วัน | กอบรมค [้] รบทั้ง 2 วัน | | ข้ารับการฝึกอบรม |
| ต | | | | |





| กิ จ | - | จำนวนครังการจัดฝึกอ | บันทึกการเข้าฝึกอบรม | ผู้เข้ารับการฝึกอบรมมีความ |
|-----------|---|---|----------------------|--|
| ก ร รม | จัดให้มีหลักสูตรการฝึกอบรมอย่างน้อย 1 หลักสูตรในช่วงการดำเนินงานของโคร งการ SWAP | บรมในช่วงการดำเนิน งานของโครงการ SWAP | | สนใจและเต็มใจที่จะเข้าร่วม หลักสูตรการฝึกอบรม |
| | - การสาธิตอุปกรณ์ที่ใช้สำหรับการใช้ปร ะโยชน์จากขยะพลาสติก | | | |





รายละเอียดของตัวชี้วัดสำหรับการติดตามตรวจสอบ ถูกกำหนดไว้ดังนี้

| ตัวชีวัด | ร้อยละของการปรับปรุงการแยกขยะพลาสติกได้อย่างถูกต้อง | |
|---------------|--|--|
| นิยาม | ความแตกต่างระหว่างหลังการฝึกอบรม และก่อนการฝึกอบรม | |
| | หารด้วยคะแนนก่อนการฝึกอบรมคูณด้วย 100 | |
| วัตถุประสงค์ | เพื่อประเมินการพัฒนาความรู้ความเข้าใจเกี่ยวกับการแยกและการใช้ประโยชน์ขยะพลาสติ | |
| | กของผู้เข้ารับการอบรม | |
| การเก็บรวบรวม | ผู้สอนจะประเมินผู้เข้ารับการอบรมแต่ละคนเป็นรายบุคคล โดยใช้แบบทดสอบก่อน | |
| ข้อมูล | และแบบทดสอบหลังการฝึกอบรม | |
| | ผลคะแนนจากการทดสอบจะใช้ในการประเมินการพัฒนาที่เกิดขึ้นในระหว่างการเข้าฝึกอบ | |
| | รม | |
| ความถี | ทุกการฝึกอบรมที่จัดขึ้น | |
| ผู้รับผิดชอบ | สมาชิก CMU SWAP | |
| การรายงานผล | คะแนนการทดสอบของผู้เข้ารับการฝึกอบรมทังหมดจะนำไปใช้วิเคราะห์ทางสถิติ เช่น | |
| | คะแนนเฉลี่ย และส่วนเบี่ยงเบนมาตรฐาน และจัดทำรายงานให้แก่ ศูนย์ฝึกอบรม CMU | |
| | และโครงการ SWAP | |

| ตัวชีวัด | คะแนนสอบ |
|--------------------|--|
| นิยาม | คะแนนของผู้เข้ารับการฝึกอบรมแต่ละคนที่ได้รับจากการทดสอบก่อนและหลังการฝึกอบ |
| | รม |
| วัตถุประสงค์ | เพื่อประเมินความรู้และทักษะของผู้เข้ารับการฝึกอบรม ในช่วงก่อนและหลังการฝึกอบรม |
| การเก็บรวบรวมข้อมู | ผู้เข้ารับการฝึกอบรม จะได้รับชุดคำถามทีเกี่ยวข้องกับการแยกขยะพลาสติกและ |
| ล | การใช้ประโยชน์ ก่อนการฝึกอบรมและหลังจากเสร็จสิ้นการฝึกอบรม |
| ความถี | ทุกการฝึกอบรมที่จัดขึ้น |
| ผู้รับผิดชอบ | สมาชิก CMU SWAP และอาจารย์ผู้สอน |
| การรายงานผล | คะแนนการทดสอบจะถูกใช้เป็นดัชนีชี้วัดความสำเร็จของผู้เข้ารับการฝึกอบรม |
| | ผลคะแนนการทดสอบจะรวบรวมและรายงานให้แก่ผู้เข้ารับการฝึกอบรม ศูนย์ฝึกอบรม |
| | CMU และโครงการ SWAP |

| ตัวชีวัด | จำนวนผู้เข้ารับการฝึกอบรมทีสำเร็จการฝึกอบรม 2 วัน |
|---------------|---|
| นิยาม | จำนวนผู้เข้ารับการฝึกอบรมในหัวข้อ |
| | การแยกขยะพลาสติกและการใช้ประโยชน์จากขยะพลาสติกบนแนวคิดแบบหมุนเวียน ณ |
| | ศูนย์ ฝึกอบรม CMU |
| | โดยผู้เข้ารับการฝึกอบรมต้องเข้าร่วมการบรรยายและการประชุมเชิงปฏิบัติการทั้งหมดตลอด |
| | ระยะเวลาจัดการฝึกอบรม 2 วัน |
| วัตถุประสงค์ | เพื่อสร้างขีดความสามารถและการสร้างสัมพันธ์ระหว่างกลุ่มผู้ฝึกอบรม ณ ศูนย์ฝึกอบรม |
| | CMU |
| การเก็บรวบรวม | จำนวนผู้เข้ารับการฝึกอบรมจะถูกรวบรวมจากเอกสารลงลายมือชื่อเข้ารับการฝึกอบรม |
| ข้อมูล | |
| ความถึ่ | ทุกการฝึกอบรมที่จัดขึ้น |





| ผู้รับผิดชอบ | สมาชิก CMU SWAP |
|--------------|--|
| การรายงานผล | ตัวเลขจำนวนผู้เข้ารับการฝึกอบรมทีสำเร็จการฝึกอบรม 2 วัน จะรายงานผลให้แก่ |
| | ศูนย์ฝึกอบรม CMU และโครงการ SWAP |

| ตัวชีวัด | จำนวนครั้งการจัดฝึกอบรมในช่วงการดำเนินงานของโครงการ SWAP |
|---------------------|---|
| นิยาม | การจัดฝึกอบรมทีศูนย์ฝึกอบรม CMU ในหัวข้อ |
| | "การแยกขยะพลาสติกและการใช้ประโยชน์จากขยะพลาสติก |
| | บนแนวคิดแบบหมุนเวียน" ในช่วงการดำเนินงานของโครงการ SWAP |
| วัตถุประสงค์ | เพื่อสร้างขีดความสามารถและการสร้างสัมพันธ์ระหว่างกลุ่มผู้ฝึกอบรม ณ |
| | ศูนย์ฝึกอบรม CMU |
| การเก็บรวบรวมข้อมูล | แผนการดำเนินงานศูนย์ฝึกอบรม CMU |
| ความถี | ทุกการฝึกอบรมที่จัดขึ้น |
| ผู้รับผิดชอบ | สมาชิก CMU SWAP |
| การรายงานผล | ตัวเลขจำนวนครังของการจัดฝึกอบรมจะรายงานผลให้แก่ ศูนย์ฝึกอบรม CMU และโครงการ SWAP |

นอกเหนือจากตัวชี้วัดข้างต้น

โครงการจะทำการประเมินผลการดำเนินการฝึกอบรมโดยใช้แบบสอบถาม ทำการสอบถามระดับความคิดเห็นจากผู้เข้ารับการฝึกอบรม และพันธมิตรผู้สอน เกี่ยวกับความเหมาะสมของการจัดฝึกอบรมในหัวข้อดังต่อไปนี้

- สถานที่ฝึกอบรม
- ระยะเวลาการฝึกอบรม
- วิชาการฝึกอบรม
- สื่อที่ใช้ในการการฝึกอบรม
- การสาธิตอุปกรณ์
- การให้คำปรึกษาแนะนำ

การประเมินด้วยแบบสอบถามข้างต้นจะดำเนินการเมื่อสิ้นสุดการฝึกอบรม และจะสรุปผลการประเมินให้แก่ คณะทำงานของศูนย์ฝึกอบรม CMU และโครงการ SWAP





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HUAF Training Hub Solid Waste Management Feasibility Study

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Training Hubs feasibility studies



HUAF Training Hub

Solid Waste Management Feasibility Study

| Project Acronym | SWAP |
|----------------------------|---|
| Work Package | WP4 |
| Deliverable | D 4.4. Training Hub Feasibility studies |
| Deliverable Lead | HUAF |
| Туре | Report |
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ABSTRACT

As a part of Work Package 4, this deliverable 4.4 report has been done to make the feasibility study of Training Hub in the framework of the SWAP project. This report indicates that the needs of Training Hub establishment is very essential in Vietnam. The report also shows the risks and mitigation measures when setting up the Training Hub. Both severity and likelihood levels of risks are medium and low. The goal of the Training Hub is towards environmental protection. The long-term plan of training and services offered includes of academic training, VET courses, informal educational products and research activities. One training course with the topic "Agricultural waste utilization into organic fertilizer for crop production" is conducted during the SWAP project implementation. In order to maintain the sustainability of the Training Hub, the business plan has been done to show the key activities, the targets, time, channels of dissemination for each key activity and its outcomes. Besides, the report also reveals that there are 6 criteria to evaluate the success of the Training Hub. The monitoring and evaluation plan are very important to operate the Training Hub effectively.

KEYWORDS

HUAF Training Hub, solid waste management, agricultural waste, organic fertilizer

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ABBREVIATIONS

HUAF: Hue University of Agriculture and Forestry SWM: Solid Waste Management




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1 PHYSICAL LOCATION

The Traning Hub "Solid Waste Management" will be operated by Department of Crop Science and Centre for Agricultural Research and Services, Hue University of Agriculture and Forestry.



2 NEEDS ANALYSIS

The amount of household solid waste generated in Vietnam is currently about 25.5 million tons/year, of which urban household solid waste is about 38,000 tons/day, and rural one is about 32,000 tons/day (VEA, 2019). Household solid waste in urban areas currently accounts for more than 50% of the total household solid waste in the country. It accounts for about 60-70% of the total amount of urban solid waste (MONRE, 2017). Besides household solid waste, many other

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types of solid waste are also increasing rapidly in recent years, such as construction, industrial, medical, electrical, plastic, and agricultural solid waste. It is estimated that the amount of household solid waste in urban areas increases by an average of 10-16 % per year, of which the amount of construction solid waste accounts for 10-15% of urban solid waste. By 2025, medical solid waste will be generated about 33,500 tons/year nationwide (MONRE, 2017).

The current status of solid waste management in Vietnam will reflect through collection, recycling, and handling/incineration stage. For urban household solid waste, the collection rate has increased from 78% in 2008 to 85.5% in 2017 (Party Affairs Committee of MONRE, 2018). The collection service has been extended to grade V cities. Some grade 1 cities, such as Ho Chi Minh City, Da Nang, and Hai Phong, have a collection rate of 100% of the inner city (MONRE, 2016). The collection rate in rural areas, peri-urban areas, or towns and townships is higher, about 60-80%, while in some remote areas, the collection rate is less than 10% (MOC, 2017).

The recycling rate of household solid waste is still low, with about 8-12% of urban household solid waste and 3.24% of household solid waste in rural areas (Party Affairs Committee of MONRE, 2018). Some waste recycling technologies have also been deployed for energy recovery, such as composting, fuel pellets, or incineration. There are about 35 solid waste treatment facilities using bio-composting technology to make organic fertilizers nationwide. Also, there are 01 rice husk-fired thermal power plant project, 01 power generation project from livestock and poultry manure waste, and 06 bagasse power projects (MONRE, 2017).

Currently, the primary method of solid waste handling/incineration is still landfill. It is estimated that 70-75% of household solid waste is being treated by this method. In 2016, there were about 660 household solid waste landfills with a total area of about 4,900ha, of which there were only 203 sanitary landfills, accounting for 31% (MONRE, 2017).

The mismanagement of solid waste is leading to pollute cities and beaches, to impact biodiversity and natural habits as well as to contribute to climate change.

That's the reason why it's essential to set up the Training Hub "Solid Waste Management" aiming at providing the training and services on solid waste management effectively.

3 RISK ANALYSIS

The below table is shown the risk analysis and the mitigation measures when establishing the Training Hub "Solid Waste Management" at Hue University of Agriculture and Forestry (hereafter called to as the "HUAF Training Hub").

| Risk Topic | Risk Description | Severity | Likelihood | Mitigation Measures |
|------------|---------------------------|----------|------------|-----------------------|
| Security | Get injury during the | low | low | Protection gear |
| | training for trainees and | | | Follow the regulation |
| | trainers | | | and guides during the |
| | | | | training |

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| Risk Topic | Risk Description | Severity | Likelihood | Mitigation Measures |
|-------------------------------------|---------------------------|----------|------------|------------------------|
| Technical | Insufficient advanced | medium | low | Update the advanced |
| problems | knowledge and | | | knowledge through |
| | technical skills to | | | conferences, staff |
| | undertake the training | | | exchange programs, |
| | actions | | | project implementation |
| Human resources | Lack of trainers | medium | low | Cooperate with experts |
| | | | | from other partners |
| Financial Going over budget, medium | | medium | low | Asking for sponsorship |
| | Business failure, or non- | | | from other sources and |
| | availability of funding. | | | collect some training |
| | | | | fees, use student |
| | | | | assistant for training |

4 GOALS

Goals:

To be leading Training Hub on Solid Waste Management in Central Vietnam and the whole country towards environmental protection.

Objectives:

- To support the academic and administrative staff in modernization and updating the SWM curricula of the Bachelor and Master levels;
- To support the university's staff to run VET courses or informal educational products;
- To develop high quality research on SWM to meet the labor needs in market;
- To become a member of SWM networking at national, regional and international levels.

5 TRAINING AND/OR SERVICE OFFERED

The long-term strategies of training and service offered under the HUAF Training Hub include:

- Modernizing and updating curricula of Bachelor and Master program on SWM
- Providing the VET courses on SWM and informal educational products to meet the society's demands
- Providing consultative services and assessment for national and international projects on SWM
- Organizing trainings, seminars and conferences
- Managing and implementing projects on SWM
- Connecting stakeholders to build networking on SWM

At the beginning the HUAF Training Hub's operation during the SWAP project implementation, we will focus on one training course with following information:





Training Topic: Agricultural waste utilization into organic fertilizer for crop production

Goals: to improve knowledge on how to recycle agricultural waste into valuable product.

Duration: 2 days.

Location: Main lab hall and field at Department of Crop Science and Centre for Agricultural Research and Service, HUAF.

Target Group: School teachers and students, households that are interested in gaining organic fertilizer from waste for crop.

Contents:

- Lecture: The overview and situation of using agricultural wastes for organic fertilizer in Vietnam.
- Lecture: Principles and Methods how to make agricultural wastes into organic fertilizer
- Lecture: How to use organic fertilizer for crop
- Hands-on field, practice of preparation, classification of wastes for organic fertilizer
- Hands-on field, practice for how to make wastes into organic fertilizer
- Hands-on field, practice on how to apply organic fertilizer from wastes for crops.

Activities:

We will accomplish aforementioned goals by carrying out the following activities:

- Training Conducting 1-2 training programs per year for School teachers and students, households that are interested in making wastes into organic fertilizer.
- Counselling providing following counselling or advisory services to help school teachers and students or households to recycle wastes in order to reduce environment problems and increase income as well as contribute in organic agriculture production.

Structure, role and responsibilities in governance bodies and functioning procedures *Main responsible organization:* Department of Crop Science, Hue University of Agriculture and Forestry.

Management representative: MSc. Le Thi Thuy Hang (Senior Officer of Department of Sciences - International Cooperation and Library)

Trainers: Prof. Dr. Hoang Thi Thai Hoa (Lead trainer)

Assoc. Prof. Dr. Tran Thanh Duc (Trainer) Dr. Ve Quoc Linh (Trainer) Dr. Le Dinh Huy (Trainer) Dr. Le Ngoc Phuong Quy (Trainer) Experts from VIPESCO Joint Stock Company (Trainer) 1 PhD and 2 Master students (Assistant trainer)

Partner: Experts from the company (VIPESCO Joint Stock Company) will be the technical support for agricultural waste recycle into organic fertilizer and for take initiative for business model from solid waste.

Location: The SWAP training room at HUAF.

Facility: a training room, laptop and screen. The equipment will be installed from the SWAP project budget.

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Notes: After each training course, the participants will be provided the certificates with logos of HUAF, SWAP project and Eramus+.

6 RESOURCES REQUIRED

Equipment: the equipment from the SWAP project budget will be installed and the available equipment from HUAF.

Material: Agricultural waste from fields or households can be collected by Centre for Agricultural Research and Service and students.

Facilities: a training room, computer and screen (belong to Department of Crop Science) and practical lab (Centre for Agricultural Research and Service belonging to HUAF)

Human resources: Academic staff with professional skills are lecturers and researchers from HUAF and graduate students.

Financial support: Sponsors from government and international organisations, NGOs and private companies; yearly fees from undergraduate and graduate students; training fee from trainees.

| Key activities | Targets | Time | Channels | Outcomes | |
|--|---|---|---|--|--|
| Lecture on SWM for Bachelor level Lecture on | Undergraduate students Graduate | Term 1: Sep-Dec Term 2: Jan-Jun Term 3: Jul-Au Term 1: Sep-Dec | HUAF's website Social media HUAF's | 40 students finished per tear 10 MSc | |
| SWM for Master level | students | Term 2: Jan-Jun Term 3: Jul-Au | website Social media | students per year | |
| VET courses | Enterprises, graduated student | Every 3 month (based on society's demands) | HUAF's website Social media | 03-04 VET courses and 30- 40 participants finished | |
| Informal educational products | Informal workers, Community Pupils, | Every 6 month (based on society's demands) | HUAF's website Social media | 01-02 events or 01-02 products per year | |
| Consultative services; research and development project; other activities | NGOs, international and national donors, | Every year | Website, social media | 01 proposal accepted OR 01 contract of consultative service per year | |

7 BUSSINESS PLAN

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8 INDICATORS OF SUCCESS

The success of the HUAF Training Hub will be considered by the following criteria:

- Number of undergraduate and graduate students registered;
- Number of trainees;
- Number of training courses;
- Number of research and development projects approved by government and international organizations or NGOs;
- Number of consultative service activities done
- Feedback of trainees after training activities

9 MONITORING AND EVALUATION PLAN

The monitoring and evaluation will be applied as a tool to steer the HUAF training hub management effectively.

The operation of HUAF Training Hub will be monitored monthly and evaluated every 6 months by HUAF team members

The monitoring and evaluation report will be sent to to HUAF training hub management board, SWAP committees, HUAF executives, and funders.

Besides, the evaluation forms will be provided to the trainees and partner instructors to ask their opinions of the training. The choices of answer have different scores to indicate the level of agreement for each question. The questions will be related to training facility, training duration, training subjects, training materials, equipment demonstration and suggestions. The evaluation form for trainees and instructors will be provided to all trainees at the end of the training and will be evaluated for the suitability of the training. The results of the evaluation form will be available to HUAF training hub management board and SWAP committees.



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D 4.4. BÁO CÁO NGHIÊN CỨU TIỀN KHẢ THI THÀNH LẬP TRUNG TÂM ĐÀO TẠO

| Viết tắt dự án | SWAP | | |
|------------------------|--|--|--|
| Hợp phần | WP 4 | | |
| Sản phẩm | D 4.4.Báo cáo nghiên cứu tiền khả thi thành lập TT đào tạo | | |
| Đơn vị thực hiện | HUAF | | |
| Hình thức sản phẩm | Báo cáo | | |
| Mức độ nhân rộng | Công khai | | |
| Ngày giao nộp sản phẩm | M 20 (15/9/2022) | | |
| Ngày thực tế nộp | 15/9/2022 | | |
| Tác giả | Lê Thị Thúy Hằng, Vệ Quốc Linh và Hoàng Thị Thái Hòa_Trường ĐH Nông Lâm | | |









TÓM TẮT

Như là một công việc của Hợp phần 4, báo cáo sản phẩm 4.4 được thực hiện để nghiên cứu tiền khả thi thành lập Trung tâm Đào tạo trong khuôn khổ dự án SWAP. Báo cáo này đã chỉ ra rằng việc thành lập Trung Tâm Đào tạo là rất cần thiết ở Việt Nam. Báo cáo cũng nêu ra các rủi ro và các biện pháp giảm thiểu rủi ro khi thành lập Trung tâm. Mức độ nghiêm trọng và khả năng xảy ra của các rủi ro này đều ở mức trung bình và thấp. Mục đích thành lập Trung tâm Đào tạo là hướng đến bảo vệ môi trường. Bản kế hoạch dài hạn về các dịch vụ đào tạo của Trung tâm bao gồm đào tạo các khóa học chính thống bậc đại học và sau đại học, các khóa học nghề, phát triển các sản phẩm giáo dục không chính thống và các hoạt động nghiên cứu. Một khóa tập huấn có chủ đề "Sử dụng rác thải nông nghiệp để sản xuất phân hữu cơ cho canh tác cây trồng" được tổ chức trong thời gian thực hiện dự án SWAP. Để duy trì tính bền vững của Trung tâm Đào tạo, bản kế hoạch kinh doanh được phát triển để liệt kê các hoạt động chính, đối tượng tham gia, thời gian, kênh quảng bá và sản phẩm đầu ra cho từng hoạt động. Bên cạnh đó, báo cáo cũng đưa ra 6 tiêu chí để đánh giá sự thành công của Trung tâm Đào tạo. Kế hoạch giám sát và đánh giá cũng rất quan trọng để vận hành Trung tâm Đào tạo một cách có hiệu quả.

TỪ KHÓA

Trung tâm Đào tạo HUAF, quản lý rác thải rắn, rác trải nông nghiệp, phân hữu cơ

TỪ CHỐI TRÁCH NHIỆM

Hỗ trợ của Ủy ban châu Âu trong việc xuất bản ấn phẩm này không bao gồm bất kỳ sự bảo chứng nào về mặt nội dung, vốn chỉ thể hiện góc nhìn của người biên soạn và Ủy ban sẽ không chịu bất kỳ trách nhiệm nào về việc sử dụng những thông tin ở trong ấn phẩm này.

Văn bản này có thể có chứa các tài liệu mà là bản quyền của các đơn vị tham gia dự án SWAP và không thể sao chép nếu không xin phép. Tất cả các đơn vị tham gia dự án SWAP đồng ý cho công khai hoàn toàn văn bản này. Việc sử dụng để thương mại hóa bất kỳ các thông tin có trong văn bản này đòi hỏi bản quyền từ chủ sở hữu của thong tin đó.

Tất cả các đơn vị tham gia dự án SWAP hay một đơn vị tham gia dự án SWAP bảo đảm rằng thông tin chứa trong văn bản này không thể sử dụng, và việc sử dụng các thông tin đó không trả tiền từ các rủi ro và không chịu trách nhiệm bất kỳ pháp lý nào cho sự thiệt hại mà gây ra bởi người sử dụng thông tin này.

LỜI CÁM ƠN

Văn bản này là một sản phẩm của dự án SWAP. Dự án này được tài trợ bởi Chương trình Eramus+ thuộc Liên minh Châu Âu trong khuôn khổ kêu gọi mời thầu đề xuất dự án EAC/A02/2019 và thực hiện dự án mã số 618723-EPP-1-2020-1-DE-EPPKA2-CBHE-JP.





VIẾT TẮT

HUAF:Trường Đại học Nông Lâm Huế SWM: Quản lý rác thải rắn (QLRTR)





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1 ĐỊA ĐIỂM

Trung tâm Đào tạo "Quản lý rác thải rắn" sẽ được vận hành bởi Bộ môn Khoa học cây trồng và Trung tâm Dịch vụ & Nghiên cứu Nông nghiệp thuộc Trường Đại học Nông Lâm Huế.



2 HÂN TÍCH NHU CẦU

Số lượng rác thải rắn sinh hoạt ở Việt Nam hiện nay khoảng 25.5 triệu tấn/năm trong đó rác thải sinh hoạt ở thành phố là khoảng 38.000 tấn/ngày, và rác thải sinh hoạt ở nông thông là khoảng



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32.000 tấn/ngày (VEA, 2019). Rác thải rắn sinh hoạt ở các khu vực thành phố hiện nay chiếm hơn 50% tổng số rác thải rắn sinh hoạt trong cả

nước. Nó cũng chiếm khoảng 60-70% tổng số rác thải rắn thành phố (MONRE, 2017). Bên cạnh rác thải rắn sinh hoạt, nhiều loại rác thải rắn khác cũng đang tăng nhanh chóng trong những năm gần đây như rác thải xây dựng, công nghiệp, y tế, điện tử, nhựa và rác thải rắn nông nghiệp. Người ta ước tính rằng số lượng rác thải sinh hoạt ở vùng thành phố tăng trung bình từ 10-16 % một năm trong đó số lượng rác thải xây dựng chiếm 10-15% rác thải rắn thành phố. Vào năm 2025, rác thải y tế cả nước thải ra khoảng 33.500 tấn/năm (MONRE, 2017).

Thực trạng hiện nay trong công tác quản lý rác thải rắn ở Việt Nam sẽ được phản ảnh thông qua công tác thu gom, tái chế và xử lý/thiêu đốt. Đối với rác thải sinh hoạt, Số lượng rác thải thu gom từ các hộ gia đình tăng từ 78% năm 2008 lên đến 85.5% năm 2017 (Party Affairs Committee of MONRE, 2018). Dịch vụ thu gom đã tăng lên ở các thành phố loại V. Một số thành phố loại 1 ví dụ như Thành phố Hồ Chí Minh, Đà Nẵng và Hải Phòng, tỷ lệ thu gom trong nội thành tăng 100% (MONRE, 2016). Tỷ lệ thu gom rác ở nông thôn, các vùng ven đô thành phố hay thị trấn và thành phố nhỏ là tăng cao hơn khoảng 60-80%, trong đó tỷ lệ thu gom rác ít hơn 10% ở một số vùng xa (MOC, 2017).

Tỷ lệ tái chế rác thải sinh hoạt vẫn còn thấp, khoảng 8-12% rác thải sinh hoạt ở thành phố và 3.24% rác thải sinh hoạt ở nông (Party Affairs Committee of MONRE, 2018). Một số công nghệ tái chế rác thải đã được triển khai để tạo nguồn năng lượng chẳng hạn như ủ phân, viên nhiên liệu hoặc thiêu đốt. Cả nước có khoảng 35 nhà máy xử lý rác thải rắn sử dụng công nghệ ủ phân sinh học để sản xuất phân hữu cơ. Hơn nữa, có 01 dự án nhà máy năng lượng nhiệt đốt trấu; 01 dự án nhà máy năng lượng từ chất thải chăn nuôi và gia cầm và 06 dự án năng lượng đốt từ bã mía (MONRE, 2017).

Hiện nay, phương pháp chính xử lý và thiêu đốt rác thải rắn vẫn là chôn lấp. Người ta ước tính khoảng 70-75% rác thải sinh hoạt đang được xử lý bằng phương pháp này. Năm 2016, có khoảng 600 hố chôn lấp rác thải sinh hoạt với tổng diện tích 4.900 hecta, trong đó chỉ có 203 hố chôn lấp bảo đảm vệ sinh chiểm 31% (MONRE, 2017).

Việc quản lý rác thải rắn không đúng đang dẫn đến ô nhiễm ở các thành phố và bờ biển, tác động đến môi trường sống tự nhiên và đa dạng sinh học cũng như góp phần đến biến đổi khí hậu.

Đó là nguyên nhân tại sao rất cần thiết để thành lập Trung tâm Đào tạo "Quản lý rác thải rắn" nhằm cung cấp các khóa tập huấn và các dịch vụ liên quan đến quản lý rác thải rắn một cách có hiệu quả.

3 PHÂN TÍCH RỦI RO

Bảng dưới đây trình bày phân tích các rủi ro và các giải pháp giảm thiểu rủi ro khi thành lập Trung tâm Đào tạo 'Quản lý rác thải rắn" tại Trường Đại học Nông Lâm, Đại học Huế (sau đây gọi tắt là Trung tâm Đào tạo HUAF).

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| Rủi ro | Mô tả | Mức độ | Khả năng xảy | Giải pháp giảm |
|-----------------|-----------------|--------------|--------------|--------------------|
| | | nghiêm trọng | ra | thiểu |
| An toàn | Dễ bị tai nạn | Thấp | Thấp | Mặc đồ bảo hộ |
| | nghề nghiệp | | | Theo các quy |
| | trong suốt qua | | | định và hướng |
| | trình tập huấn | | | dẫn trong suốt |
| | cho học viên và | | | quá trình tập |
| | giáo viên | | | huấn |
| Vấn đề kỹ thuật | Không đủ kiến | Vừa | Thấp | Cập nhật kiến |
| | thức mới và | | | thức mới thông |
| | trình độ kỹ | | | qua hội nghị, |
| | thuật để thực | | | chương trình |
| | hiện các hoạt | | | trao đổi và các |
| | động tập huấn | | | dự án |
| Nguồn lực con | Thiếu giáo viên | Vừa | Thấp | Hợp tác với các |
| người | | | | chuyên gia từ |
| | | | | các đối tác khác |
| Tài chính | Hết kinh phí, | Vừa | Thấp | Xin tài trợ từ các |
| | kinh doanh | | | nguồn khác và |
| | không thành | | | thu học phí từ |
| | công, không có | | | hoạt động tập |
| | kinh phí để sử | | | huấn, tận dụng |
| | dụng | | | sinh viên làm trợ |
| | | | | giảng |

4 MỤC ĐÍCH

Mục đích: Trở thành Trung tâm Đào tạo về quản lý rác thải rắn đứng đầu ở Miền Trung Việt Nam và cả nước nhằm hướng đến bảo vệ môi trường.

Mục tiêu

Hỗ trợ đội ngũ giảng dạy của trường làm mới và cập nhật các bài giảng về QLRTR cho bậc đại học và cao học;

Hỗ trợ đội ngũ cán bộ trường tổ chức các khóa tập huấn hoặc phát triển các sản phẩm giáo dục phi chính thống về QLRTR;

Phát triển các nghiên cứu chất lượng cao về QLRTR để đáp ứng nhu cầu thị trường lao động;

Trở thành một thành viên trong mạng lưới về nghiên cứu QLRTR ở cấp quốc gia, cấp vùng và quốc tế.





5 TẬP HUẤN VÀ/HOẶC DỊCH VỤ CUNG CẤP

Chiến lược dài hạn cho hoạt động tập huấn và các dịch vụ cung cấp bởi Trung tâm Đào tạo HUAF bao gồm:

- Làm mới và cập nhật các bài giảng liên quan đến QLRTR cho chương trình bậc đại học và cao học
- Cung cấp các khóa đào tạo nghề về QLRTR và các sản phẩm giáo dục phi chính thống để đáp ứng nhu cầu xã hội
- Cung cấp các dịch vụ tư vấn và đánh giá cho các dự án trong nước và quốc tế liên quan đến QLRTR
- Tổ chức tập huấn, các buổi học thuật và hội nghị
- Quản lý và thực hiện các dự án về QLRTR
- Kết nối các bên liên quan để xây dựng mạng lưới liên kết về QLRTR

Chúng tôi sẽ tập trung tổ chức một khóa tập huấn với các thông tin sau khi Trung tâm Đào tạo HUAF bắt đầu khởi động trong suốt thời gian thực hiện dự án SWAP:

Tên khóa tập huấn:

"Sử dụng rác thải nông nghiệp để sản xuất phân hữu cơ cho canh tác cây trồng"

Mục đích: nâng cao kiến thức để làm thế nào tái chế rác thải nông nghiệp thành sản phẩm có giá trị.

Thời gian: 2 ngày.

- Địa điểm: Phòng họp chính và trại thực hành thuộc Bộ Môn Khoa học Cây trồng và Trung tâm Nghiên cứu & Dịch vụ Nông nghiệp thuộc HUAF.
- **Nhóm đối tượng:** Giảng viên và sinh viên của khoa, các hộ gia đình mà quan tâm đến việc làm phân hữu cơ từ rác thải cung cấp cho cây trồng.

Nội dung:

- Lý thuyết: Tổng quan và thực trạng việc sử dụng rác thải nông nghiệp ở Việt Nam.
- Lý thuyết: Nguyên lý và Phương pháp làm thế nào để sử dụng rác thải nông nghiệp thành phân hữu cơ
- Lý thuyết: Làm thế nào để sử dụng phân hữu cơ vào canh tác cây trồng
- Thực hành trên đồng ruộng, chuẩn bị thực hành, phân loại rác thải để tạo ra phân hữu cơ
- Thực hành trên đồng ruộng, thực hành làm thế nào để sử dùng rác thải thành thành phân hữu cơ
- Thực hành trên đồng ruộng, thực hành làm thế nào để ứng dụng phân hữu cơ từ rác thải nông nghiệp cho canh tác cây trồng

Hoạt động:

Chúng tôi sẽ hoàn thành mục đích đã đề cập trên thông qua các hoạt động sau:

 Tập huấn – tổ chức 1-2 chương trình tập huấn mỗi năm cho Giảng viên và sinh viên của khoa, các hộ gia đình mà quan tâm đến việc làm phân hữu cơ từ rác thải cung cấp cho cây trồng.

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 Tư vấn – cung cấp các dịch vụ tư vấn và hướng nghiệp để hỗ trợ Giảng viên và sinh viên của khoa hoặc các hộ gia đình để tái chế rác thải nhằm giảm thiểu ô nhiễm môi trường và tăng thu nhập cũng như góp phần vào việc canh tác nông nghiệp hữu cơ.

Cơ cấu tổ chức, vai trò, trách nhiệm và chức năng trong vận hành Trung tâm Đào tạo

Đơn vị chịu trách nhiệm chính: Main responsible organization: Bộ Môn Khoa học Cây trồng, Trường Đại học Nông Lâm Huế.

Management representative: ThS. Lê Thị Thúy Hằng (Chuyên viên chính Phòng Khoa học, Hợp tác Quốc tế & Trung tâm thông tin thư viện)

Giáo viên: GS.TS. Hoàng Thị Thái Hòa (Trưởng nhóm)
PGS.TS. Trần Thanh Đức (Giảng viên)
TS. Vệ Quốc Linh (Giảng viên)
TS. Lê Đình Huy (Giảng viên)
TS. Lê Ngọc Phương Quý (Giảng viên)
Chuyên gia từ Công ty Cổ phần VIPESCO (Người hướng dẫn)
01 NCS và 2 học viên cao học (Trợ giảng)

Partner: Chuyên gia từ Công ty Cổ phần VIPESCO sẽ hỗ trợ về kỹ thuật trong việc tái chế rác thải nông nghiệp thành phân hữu cơ và đề xuất đổi mới sáng tạo mô hình kinh doanh từ rác thải rắn.

Địa điểm: Phòng họp SWAP tại HUAF.

Cơ sở vật chất: phòng tập huấn, máy tính và màn hình. Thiết bị được tài trợ từ dự án SWAP sẽ được lắp đặt.

Ghi chú: Sau mỗi khóa tập huấn, người học sẽ được cấp giấy chứng nhận có logo của HUAF, dự án SWAP và Eramus+.

6 NGUỒN LỰC ĐƯỢC YÊU CẦU

Thiết bị: thiết bị được tài trợ từ dự án SWAP sẽ được lắp đặt và thiết bị sẵn có từ HUAF.

Nguyên vật liệu: Rác thải nông nghiệp từ đồng ruộng, vườn, trang trại hoặc từ hộ gia đình được thu gom bởi Trung tâm Nghiên cứu & Dịch vụ Nông nghiệp và sinh viên của trường.

Cơ sở vật chất: một phòng tập huấn, 1 máy tính và màn hình (thuộc Bộ môn Khoa học Cây trồng) và 1 phòng thì nghiệm để thực tập (Trung tâm Nghiên cứu & Dịch vụ Nông nghiệp thuộc HUAF).

Nguồn lực con người: Đội ngũ giảng dạy có kỹ năng chuyên môn là cán bộ giảng viên và nghiên cứu viên từ HUAF và nghiên cứu sinh/học viên cao học.

Hộ trợ tài chính: Các nhà tài trợ từ các tổ chức trong nước và quốc tế, các tổ chức phi chính phủ và doanh nghiệp tư nhân; học phí hàng năm từ sinh viên đại học và học viên cao học, học phí tập huấn từ người học.

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7 KẾ HOẠCH KINH DOANH

| Các hoạt động | Đối tượng | Thời gian | Kênh thông | Sản phẩm đầu |
|-----------------|-------------------|---------------------|-------------|-----------------|
| chính | | | tin | ra |
| Bài giảng về | Sinh viên đại học | Kỳ 1: Tháng 9-12 | Trang web | 40 sinh viên |
| QLRTR cho bậc | | Kỳ 2: Tháng 1-6 | HUAF | hoàn thành |
| đại học | | Kỳ 3: Tháng 7-8 | Mạng xã hội | khóa học/năm |
| Bài giảng về | Học viên Cao | Kỳ 1: Tháng 9-12 | Trang web | 10 học viên cao |
| QLRTR cho bậc | học | Kỳ 2: Tháng 1-6 | HUAF | học hoàn thành |
| Cao học | | Kỳ 3: Tháng 7-8 | Mạng xã hội | khóa học/năm |
| Khóa đào | Doanh nhiệp, | 3 tháng 1 lần (dựa | Trang web | 03-04 khóa học |
| tạo/tập huấn | Sinh viên tốt | vào nhu cầu thực tế | HUAF | and 30-40 |
| nghề | nghiệp | của xã hội) | Mạng xã hội | người học hoàn |
| | | | | thàn khóa học |
| Các sản phẩm | Công nhân, | 6 tháng 1 lần (dựa | Trang web | 01-02 sự kiện |
| giáo dục không | Cộng động | vào nhu cầu thực tế | HUAF | hoặc 01-02 sản |
| chính thống | Học sinh, | của xã hội) | Mạng xã hội | phẩm/năm |
| Dịch vụ tư vấn; | Các tổ chức phi | | Trang web | 1 đề xuất dự án |
| các dự án | chính phủ, các | Mãi năm | Mạng xã hội | được chấp nhận |
| nghiên cứu và | nhà tài trợ quốc | | | HOẶC 01 hợp |
| phát triển; các | tế và trong nước | | | đồng tư vấn |
| hoạt động khác | | | | /năm |

8 CHỈ SỐ THÀNH CÔNG

Sự thành công của Trung tâm Đào tạo HUAF sẽ được xem xét theo các tiêu chí dưới đây:

- Số lượng sinh viên bậc đại học và học viên cao học đăng ký học;
- Số lượng người học tham gia tập huấn;
- Số lượng khóa tập huấn được tổ chức;
- Số lượng dự án nghiên cứu và phát triển được phê duyệt bởi các tổ chức quốc tế và trong nước hay các tổ chức phi chính phủ;
- Số lượng các hoạt động dịch vụ tư vấn được triển khai;
- Phản hồi của người học sau tập huấn.

9 KẾ HOẠCH GIÁM SÁT VÀ ĐÁNH GIÁ

Việc giám sát và đánh giá sẽ được dùng như là một công cụ để điều hành công tác quản lý Trung tâm Đào tạo HUAF một cách hiệu quả.

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Việc vận hành Trung tâm Đào tạo HUAF sẽ được giám sát hàng tháng và được đánh giá 6 tháng một lần bởi các thành viên dự án HUAF.

Báo cáo giám sát và đánh giá sẽ được gửi đến Ban Quản lý Trung tâm Đào tạo HUAF, Ban Quản lý dự án SWAP, cố vấn HUAF và các nhà tài trợ.

Hơn nữa, bảng đánh giá sẽ được cung cấp cho người học và người dạy để đánh giá về khóa học. Sự lựa chọn câu trả lời sẽ có các thang điểm khác nhau để chỉ ra mức độ đồng ý cho mỗi câu hỏi. Nội dung các câu hỏi sẽ liên quan đến cơ sở vật chất lớp tập huấn, thời gian tập huấn, chủ đề tập huấn, tài liệu tập huấn, trang thiết bị và các đề xuất. Bảng đánh giá cho người học và người dạy sẽ được cung cấp vào cuối khóa học và sẽ đánh giá tính bền vững của khóa học. Kết quả đánh giá sẽ được trình lên Ban Quản lý Trung tâm Đào tạo HUAF và Ban Quản lý dự án SWAP.

TÀI LIỆU THAM KHẢO

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TUAF Training Hub Municipal Solid Waste Management Feasibility Study

English version

Training Hubs feasibility studies



TUAF Training Hub Municipal Solid Waste Management Feasibility Study

| Project Acronym | SWAP |
|----------------------------|---|
| Work Package | 4 |
| Deliverable | D4.4: Training Hubs Feasibility studies |
| Deliverable Lead | TUAF |
| Туре | Report |
| Dissemination Level | Confidential |
| Contractual delivery date | M21 (15/09/2022) |
| Actual submission date | 12/09/2022 |
| Author(s) | Prof. Dr. Dang Van Minh, TUAF |
| | Dr. Truong Thi Anh Tuyet, TUAF |
| | Dr. Nguyen Duy Hai, TUAF |









Versions

| Version | Date | Main Author | Summary of updates |
|---------|------------|----------------------|--------------------|
| 1 | 12/09/2022 | Truong Thi Anh Tuyet | - |
| | | | |

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ABSTRACT

This report is prepared from the feasibility study of the training hub intended to be organized at the Mountainous Resources Environment Center and Faculty of Environment, Thai Nguyen University of Agriculture and Forestry. The need analysis indicates that the Municipal Solid Waste (MSW) has been one of the disturbing problems causing the chronically environmental impacts, the human health problems, and the prevention of the economic development. The increasing rate of MSW has put pressure for cities to have sufficient advanced techniques, economical conditions, and the human source to recover, dispose, and treat the MSW toward the eco-friendly way. With a view to improving waste treatment (90% urban waste treatment by 2025 and 100% by 2050), Vietnam needs comprehensive legislation and solutions to raising public awareness in sorting waste and capacity building for technician staff, and managers in this field. Therefore, this training hub will involve related parties to build professional skills in waste management for students, staff, facilitate activities of public awareness raising and promote mutual agreement among stakeholders in the training and implementation of waste management. The report will present planned activities, budget, organization and the methods to monitor and evaluate to maintain the sustainability of the training hub.

KEYWORDS

TUAF Training Hub; waste segregation, biochar, waste treatment

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1 Needs analysis

In most countries in the world, the Municipal Solid Waste (MSW) is one of the disturbing problems causing the chronically environmental impacts, the human health problems, and the prevention of the economic development. The high rate of MSW discharged into the environment is the consequence of the sharp increase in population, the rapid urbanization, and significant improvement of the living standards, resulting in generating around 1.3 billion tons of MSW per year. According to report of United Nation (UN), there are around 6.3 billion of urban population by 2050 with up to 90% increase in Africa and Asia urban areas. This will lead to a large number of cities of developing countries not to have sufficient advanced techniques, economical conditions, and the human source to recover, dispose, and treat the MSW toward the eco-friendly way.

According to statistics of the Department of Renewable Energy (General Department of Energy - Ministry of Industry and Trade, Vietnam), with a population of more than 93 million people, every year, the average amount of waste generated in Vietnam is very nearly 35,000 tons of urban domestic solid waste and 34,000 tons of rural domestic waste. By 2025, the rate of domestic solid waste generation is forecasted to increase by 10-16%/year.

However, about 85% of the current waste in Vietnam is being treated mainly by landfill technology which is not only wasteful but also requires a lot of lands and seriously pollutes the environment. Of 1,000 landfills, less than 20% are sanitary. Most of MSW have not been classified at the source. Many unsanitary landfills have been a source of environmental pollution, affecting the health of the surrounding community.

Currently, Vietnam is setting a target of 90% urban waste treatment by 2025 and 100% by 2050. To achieve this goal, Vietnam needs comprehensive legislation. Raising public awareness in sorting waste and capacity building for technician staff, and managers in this field is necessary. Therefore, this training hub will involve related parties in the decision-making process to select a series of training hubs to build professional skills in waste management for students, staff, facilitate activities of public awareness raising and promote mutual agreement among stakeholders in the training and implementation of waste management.

| RISK TOPIC | RISK DESCRIPTION | SEVERITY | LIKELIHOOD | Mitigation Measures |
|-------------------|--------------------------|----------|------------|---------------------------------|
| Sercurity | Accidents can happen | Low | Low | - All trainees must follow the |
| | during the training -> | | | regulation and guide during the |
| | injury for | | | training |
| | trainees/trainers | | | - Protection gears are equiped |
| Technical | Equipment broke | Medium | Low | - Collaboration with equipment |
| problems | | | | suppliers for good technical |
| | | | | support |
| | | | | - Regularly maintain equipment |
| Human | Lack of trainers | Medium | Low | -Reduce conflicts of time for |
| resources | | | | trainers |
| | | | | -Connect with experts from |
| | | | | partners |
| Financial | Over budget, Business | Medium | Low | Asking for sponsorship from |
| | failure, or non- | | | other sources and collect some |
| | availability of funding. | | | training fees, use student |
| | | | | assistant for training |

2 Risk analysis

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3 Goals

- Improve capacity and practical skills for lecturers, students and staff working in the field of solid waste management with more focus in organic waste
- Promote research activities related to solid waste management
- Connect with businesses, state management agencies and experts in domestic and foreign training institutions.

4 Training and/or services offered

| Training/services | Duration | Target audience | Tentative schedule |
|---|-----------------|---|------------------------|
| Provide practical skills training programs for students 1.Biochar in agricultural waste treatment 2.Ultilization of EM products in organic waste treatment | Half a day each | Undergraduate and graduate Students | March-April 2023 |
| Deploying research and projects | | Undergraduate and graduate Students; Faculty staff | Every year |
| Training certificate on request | | Students Anyone | Depending on demand |
| Connecting enterprises in training, graduate recruiting and jointly implementing solid waste projects | | Employers Students | Every year |

5 Structure, roles, responsibilities in governance bodies and functioning procedures

Main responsible organization: Mountainous Resources Environment Center and Faculty of Environment, TUAF

Management representative: Dr. Truong Thi Anh Tuyet

Trainers: Prof. Dr. Dang Van Minh (Lead trainer) Assoc. Prof. Dr. Do Thi Lan (Trainer) Dr. Nguyen Thanh Hai (Trainer) Dr. Nguyen Duy Hai (Trainer)





Dr. Tran Thi Pha (Trainer) Dr. Tran Hai Dang (Trainer) 1 PhD and 2 Master students (Assistant trainers)

graduate students.

Partners: Experts from EJC company, Institute of Technique and Environmental Technology will be the technical support for machine operation, training and employing graduates.

5.1 Facility

For TUAF training hub, training rooms, laboratory, computer, projector and IT system is located at laboratory of Environment Faculty, TUAF. All lab equipment and tools including the existing one and the one from SWAP budgets will be used during the training.

5.2 Resources required

| | Equipment: | | Material: | | | Facilities: | : |
|---|---|-----------------------|--|--|--|-------------|-----------|
| - Solia - Bioc Equip | d waste Crushers char/AC Production oment (Incinerator) | Organ univer: f | Organic waste material can be collected from university/production areas by faculty and student | | ste material can be ected from a trainin production areas by comput y and student proje | | om, nd |
| Human resource: | | | Financial support: | | | | |
| Trainers are lecturers from Faculty of Environment and | | | Sponsors from both government organisations and private companies. Training fee from trainees. | | | | |





6 Business plan

Funding sources

- University support (Electricity and water)
- Mountainous Resources Environment Center
- Government organisations and/or private companies
- Training fees

| | 2023 | 2024 | 2025 | 2026 | 2027 |
|---------------------------------|------|------|------|------|-------|
| REVENUES | | | | | |
| R1. Public sponsors/donors | | | | | |
| - public donor 1 | 2000 | 1500 | 1000 | 500 | 0 |
| - public donor 2 | 1000 | 1200 | 1200 | 1500 | 1500 |
| R2. Private sponsors/donors | | | | | |
| - private donor 1 | 1000 | 500 | 500 | 500 | 500 |
| - private donor 2 | 0 | 0 | 500 | 1000 | 1000 |
| R3. Fees from participants | | | | | |
| - target number of participants | 20 | 50 | 100 | 100 | 100 |
| - average fee | 50 | 50 | 50 | 60 | 70 |
| - expected revenue from fees | 1000 | 2500 | 5000 | 6000 | 7000 |
| TOTAL REVENUES | 5000 | 5700 | 8200 | 9500 | 10000 |
| COSTS | | | | | |
| C1. Direct costs | | | | | |
| - dedicated staff | 4000 | 4200 | 4400 | 4600 | 4800 |
| - purchase/rental of equipment | 0 | 0 | 700 | 800 | 800 |
| - promotion/communication | 500 | 500 | 500 | 500 | 600 |
| - travel | 100 | 100 | 200 | 200 | 300 |
| - subcontracts | 1000 | 1500 | 2000 | 2000 | 2500 |
| C2. Indirect costs | | | | | |
| - rental of premises/cleaning | | | 0.50 | 0.50 | 0.50 |
| services | 0 | 200 | 250 | 250 | 250 |
| - heating/cooling | 0 | 100 | 150 | 200 | 250 |
| - consumables | 0 | 50 | 50 | 50 | 50 |
| TOTAL COSTS | 5600 | 6650 | 8250 | 8600 | 9550 |
| TOTAL INVESTMENT REQUIRED | 600 | 950 | 50 | -900 | -450 |

7 Indicators of success

- Number of trainees
- Number of trainings provided during SWAP programme
- Number of research and collaboration activities
- Feedback of trainees after training

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



8 Monitoring and evaluation plan

- The operation of the training hub will be monthly monitored and evaluated every semester by TUAF SWAP team members.
- The M&E reports will be available to TUAF training hub management, SWAP committees, TUAF executives, and funders.

| | PROJECT SUMMARY | INDICATORS | MEANS OF VERIFICATION |
|------------|--|---|--|
| Goal | Capacity building in waste management and treatment | Numbers of trainees Evaluation after the trainings | Comparison of pre-training and post-training tests |
| Outcome | - Improved knowledge and skills in waste management | - Test results after training | Pre-training and post- training survey |
| Output | Training on waste classification Training on biochar production Training on composting Scientific research activities/projects funded/submitted | Number of trainees complete trainings Number of scientific research and number of students, staff joined in research | Training hub attendance records List of scientific research |
| Activities | - Provide at least 1 training course during the SWAP programme | Number of trainings provided during SWAP programme | Training hub records |



TUAF Training Hub Municipal Solid Waste Management Feasibility Study

Vietnamese version

Training Hubs feasibility studies


Nghiên cứu khả thi về việc thành lập Trung tâm đào tạo

| Từ viết tắt dự án | SWAP | | | |
|--|---|--|--|--|
| Gói công việc | 4 | | | |
| Sản phẩm nộp | D4.4: Nghiên cứu khả thi về việc thành lập Trung tâm đào tạo | | | |
| Khách hàng tiềm năng có thể giao hàng | TUAF | | | |
| Loại hình | Báo cáo | | | |
| Mức độ phổ biến | Bảo mật | | | |
| Ngày giao hàng theo hợp đồng | ÐIÈN - M21 (15/09/2022) | | | |
| Ngày gửi thực tế | 09/12/2022 | | | |
| (Các) tác giả | GS. TS Đặng Văn Minh, TUAF | | | |
| | TS Trương Thị Ánh Tuyết, TUAF | | | |
| | TS Nguyễn Duy Hải, TUAF | | | |
| | HAMBURG | | | |









Phiên bản

| Phiên bản | Ngày | Tác giả chính | Tóm tắt các bản cập |
|-----------|------------|----------------------|---------------------|
| | | | nhật |
| 1 | 09/09/2022 | Trương Thị Ánh Tuyết | - |
| | | | |

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TÓM TẮT

Báo cáo này được lập từ nghiên cứu khả thi của trung tâm đào tạo dự kiến được tổ chức tại Trung tâm Môi trường Tài nguyên Miền núi và Khoa Môi trường, Trường Đại học Nông Lâm Thái Nguyên. Phân tích nhu cầu chỉ ra rằng Chất thải rắn đô thị (MSW) là một trong những vấn đề đáng lo ngại gây ra các tác động môi trường thường xuyên, các vấn đề sức khỏe con người và cản trở sự phát triển kinh tế . Tỷ lệ CTRSH ngày càng tăng đã tạo áp lực buộc các thành phố phải có đủ kỹ thuật tiên tiến, điều kiện kinh tế , nhân lực để thu hồi, tiêu hủy và xử lý CTRSH theo hướng thân thiện với môi trường. Với mục tiêu cải thiện xử lý chất thải (xử lý 90% chất thải đô thị vào năm 2025 và 100% vào năm 2050), Việt Nam cần có luật pháp và giải pháp đồng bộ để nâng cao nhận thức cộng đồng trong việc phân loại rác thải và nâng cao năng lực cho đội ngũ kỹ thuật viên, cán bộ quản lý trong lĩnh vực này. Do đó, trung tâm đào tạo này sẽ thu hút sự tham gia của các bên liên quan nhằm xây dựng kỹ năng chuyên môn về quản lý chất thải cho sinh viên, nhân viên, tạo điều kiện cho các hoạt động nâng cao nhận thức cộng đồng và thúc đẩy sự đồng thuận giữa các bên liên quan trong việc đào tạo và thực hiện quản lý chất thải. Báo cáo sẽ trình bày các hoạt động dự kiến, ngân sách, tổ chức và các phương pháp giám sát, đánh giá để duy trì tính bền vững của trung tâm đào tạo.

TỪ KHÓA

Trung tâm đào tạo TUAF; phân loại chất thải, than sinh học, xử lý chất thải

TUYÊN BỐ TỪ CHỐI

Sự hỗ trợ của Ủy ban Châu Âu đối với việc sản xuất ấn phẩm này không cấu thành sự chứng thực nội dung chỉ phản ánh quan điểm của các tác giả và Ủy ban không chịu trách nhiệm về bất kỳ việc sử dụng nào có thể được thực hiện từ thông tin trong đó.

Tài liệu này có thể chứa tài liệu, là bản quyền của các bên trong SWAP Consortium, và không được sao chép hoặc sao chép mà không được phép. Tất cả các bên của SWAP Consortium đã đồng ý xuất bản đầy đủ tài liệu này. Việc sử dụng thương mại bất kỳ thông tin nào trong tài liệu này cần phải có giấy phép của chủ sở hữu thông tin đó.

Cả Hiệp hội SWAP nói chung cũng như không một bên nào đó của Hiệp hội SWAP đảm bảo rằng thông tin trong tài liệu này có khả năng sử dụng, cũng như việc sử dụng thông tin đó là không có rủi ro và không chịu bất kỳ trách nhiệm pháp lý nào đối với mất mát hoặc hư hỏng bị ảnh hưởng bởi bất kỳ người nào sử dụng thông tin này.

NHÌN NHẬN

Tài liệu này thuộc sản phẩm của dự án SWAP. Dự án này được đồng tài trợ bởi Chương trình Erasmus+ của Liên minh Châu Âu theo lời kêu gọi đề xuất EAC / A02 / 2019 và mang dự án số 618723-EPP-1-2020-1-DE-EPPKA2-CBHE-JP.

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Sự hỗ trợ của Ủy ban Châu Âu đối với việc xuất bản ấn phẩm này không cấu thành sự chứng thực cho nội dung, nội dung chỉ phản ánh quan điểm của các tác giả và Ủy ban không thể chịu trách nhiệm về bất kỳ việc sử dụng nào có thể được thực hiện từ thông tin trong đó.





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1. Phân tích nhu cầu

Ở hầu hết các quốc gia trên thế giới, chất thải rắn đô thị (MSW) là một trong những vấn đề đáng lo ngại gây ra những tác động thường xuyên đến môi trường, ảnh hưởng đến sức khỏe con người và cản trở sự phát triển kinh tế. Tỷ lệ CTRSH thải ra môi trường cao là hệ quả của sự gia tăng dân số mạnh, tốc độ đô thị hóa nhanh, đời sống người dân được cải thiện rõ rệt dẫn đến phát sinh khoảng 1,3 tỷ tấn CTRSH mỗi năm. Theo báo cáo của Liên hợp quốc (LHQ), có khoảng 6,3 tỷ dân thành thị vào năm 2050, trong đó tăng tới 90% ở các khu vực đô thị châu Phi và châu Á. Điều này sẽ dẫn đến một số lượng lớn các thành phố của các nước đang phát triển không có đủ kỹ thuật tiên tiến, điều kiện kinh tế và nguồn nhân lực để thu hồi, tiêu hủy và xử lý CTRSH theo hướng thân thiện với môi trường.

Theo thống kê của Cục Năng lượng tái tạo (Tổng cục Năng lượng - Bộ Công Thương , Việt Nam), với dân số hơn 93 triệu người, hàng năm, trung bình lượng chất thải phát sinh ở Việt Nam là gần 35.000 tấn chất thải rắn sinh hoạt đô thị và 34.000 tấn chất thải sinh hoạt nông thôn. Dự báo đến năm 2025, tỷ lệ phát sinh chất thải rắn sinh hoạt tăng 10-16% / năm.

Tuy nhiên , khoảng 85% lượng rác thải hiện nay ở Việt Nam đang được xử lý chủ yếu bằng công nghệ chôn lấp , không những gây lãng phí mà còn tốn nhiều đất và gây ô nhiễm môi trường nghiêm trọng . Trong số 1.000 bãi chôn lấp, chỉ có dưới 20% là hợp vệ sinh. Phần lớn CTRSH chưa được phân loại tại nguồn. Nhiều bãi rác không hợp vệ sinh đã là nguồn gây ô nhiễm môi trường, ảnh hưởng đến sức khỏe cộng đồng xung quanh.

Hiện tại, Việt Nam đang đặt mục tiêu 90% xử lý rác thải đô thị vào năm 2025 và 100% vào năm 2050. Để đạt được mục tiêu này, Việt Nam cần có luật pháp toàn diện. Việc nâng cao nhận thức cộng đồng trong việc phân loại chất thải và nâng cao năng lực cho đội ngũ kỹ thuật viên và các nhà quản lý trong lĩnh vực này là cần thiết. Do đó, trung tâm đào tạo này sẽ có sự tham gia của các bên liên quan trong quá trình ra quyết định để lựa chọn một loạt các trung tâm đào tạo nhằm nâng cao kỹ năng chuyên môn về quản lý chất thải cho sinh viên, nhân viên, tạo điều kiện cho các hoạt động nâng cao nhận thức cộng đồng và thúc đẩy sự đồng thuận giữa các bên liên quan trong khóa đào tạo và thực hiện quản lý chất thải.

2. Phân tích rủi ro

| CHỦ ĐỀ RỦI RO | MÔ TẢ RỦI RO | BAO NHIÊU | LIKELIHOOD | Các biện pháp giảm thiểu |
|-------------------|---|--------------|------------|---|
| Sercurity | Tai nạn có thể xảy ra trong quá trình đào tạo -> chấn thương cho người tập / huấn luyện viên | Thấp | Thấp | Tất cả học viên phải tuân thủ các quy định và hướng dẫn trong quá trình đào tạo Bánh răng bảo vệ được trang bị |
| Sự cố kỹ thuật | Thiết bị bị hỏng | Vừa phải | Thấp | - Hợp tác với các nhà cung cấp thiết bị để được hỗ trợ kỹ thuật tốt |

Trang | 5 - TUAF - Feasibility study - Vietnamese version

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- Thường xuyên bảo dưỡng thiết bị Nguồn nhân Thiếu giảng viên Thấp - Giảm xung đột về thời gian Vừa cho giảng viên lưc phải - Kết nối với các chuyên gia từ các đối tác Tài chính Vượt quá ngân sách, Thất bại Vừa Thấp Yêu cầu tài trợ từ người trong kinh doanh hoặc không khác nguồn và thu một số phải có nguồn tài chính. học phí đào tạo, sử dụng trợ lý sinh viên để đào tạo

3. Mục tiêu

- Nâng cao năng lực và kỹ năng thực hành cho giảng viên, sinh viên và cán bộ làm công tác quản lý chất thải rắn, chú trọng hơn đến chất thải hữu cơ
- Thúc đẩy các hoạt động nghiên cứu liên quan đến quản lý chất thải rắn
- Kết nối với các doanh nghiệp, cơ quan quản lý nhà nước và các chuyên gia trong các cơ sở đào tạo trong và ngoài nước

4. Đào tạo và / hoặc các dịch vụ được cung cấp

| Đào tạo / dịch vụ | Khoảng thời gian | Khán giả mục tiêu | Lịch trình dự kiến |
|--|------------------------------|--|------------------------------------|
| Cung cấp các chương trình đào tạo kỹ năng thực tế cho sinh viên 1. Than củi trong xử lý chất thải nông nghiệp 2. Sử dụng các sản phẩm EM trong xử lý chất thải hữu cơ | Một nửa ngày Một nửa ngày | Sinh viên đại học và sau đại học | Tháng 3 đến tháng 4 năm 2023 |
| Triển khai các nghiên cứu và dự án | | Sinh viên Đại học và Cao học; Đội ngũ giảng viên | Mỗi năm |
| Chứng chỉ đào tạo theo yêu cầu | | Sinh viên Bất cứ ai | Tùy theo nhu cầu |
| Kết nối các doanh nghiệp trong đào tạo, tuyển dụng tốt nghiệp và cùng thực hiện các dự án chất thải rắn | | Người sử dụng lao động Sinh viên | Mỗi năm |

Trang | 6 - TUAF - Feasibility study - Vietnamese version

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5. Cơ cấu, vai trò, trách nhiệm trong các cơ quan quản lý và quy trình hoạt động

Đơn vị chịu trách nhiệm chính: Trung tâm Môi trường Tài nguyên Miền núi và Khoa Môi trường, TUAF

Đại diện lãnh đạo : TS. Trương Thị Ánh Tuyết

Huấn luyện viên: PGS.TS Đặng Văn Minh (Trưởng nhóm) PGS. PGS.TS Đỗ Thị Lan (Tập huấn viên) TS Nguyễn Thanh Hải (Tập huấn viên) TS Nguyễn Duy Hải (Tập huấn viên) TS Trần Thị Phả (Tập huấn viên) TS Trần Hải Đăng (Tập huấn viên) 1 Tiến sĩ và 2 học viên Cao học (Trợ giảng)

Đối tác: Các chuyên gia từ công ty EJC, Viện Kỹ thuật và Công nghệ Môi trường sẽ hỗ trợ kỹ thuật vận hành máy, đào tạo và sử dụng sinh viên tốt nghiệp.

6. Cơ sở

Đối với trung tâm đào tạo TUAF, các phòng đào tạo, phòng thí nghiệm, máy tính, máy chiếu và hệ thống CNTT được đặt tại phòng thí nghiệm của Khoa Môi trường, TUAF. Tất cả thiết bị và dụng cụ phòng thí nghiệm bao gồm thiết bị hiện có và thiết bị từ ngân sách SWAP sẽ được sử dụng trong quá trình đào tạo.

7. Tài nguyên cần thiết



Trang | 7 - TUAF - Feasibility study - Vietnamese version

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8. Kế hoạch kinh doanh (bao gồm chi phí tối thiểu dự kiến, các nguồn tài trợ và kế hoạch thu hồi ngân sách)

Nguồn hỗ trợ:

- Hỗ trợ từ trường đại học (Điện nước)
- Trung tâm Tài nguyên Môi trường Miền núi
- Tổ chức chính phủ và / hoặc các công ty tư nhân
- Phí đào tạo

| | 2023 | 2024 | 2025 | 2026 | 2027 |
|---------------------------------------|------|------|------|------|-------|
| DOANH THU | | | | | |
| R1. Nhà tài trợ / nhà tài công | | | | | |
| - nhà tài trợ công 1 | 2000 | 1500 | 1000 | 500 | 0 |
| - nhà tài trợ công 2 | 1000 | 1200 | 1200 | 1500 | 1500 |
| R2. Nhà tài trợ / nhà tài trợ tư nhân | | | | | |
| - nhà tài trợ tư nhân 1 | 1000 | 500 | 500 | 500 | 500 |
| - nhà tài trợ tư nhân 2 | 0 | 0 | 500 | 1000 | 1000 |
| R3. Phí từ người tham gia | | | | | |
| - số lượng người tham gia mục tiêu | 20 | 50 | 100 | 100 | 100 |
| - phí trung bình | 50 | 50 | 50 | 60 | 70 |
| - doanh thu dự kiến từ phí | 1000 | 2500 | 5000 | 6000 | 7000 |
| TỔNG DOANH THU | 5000 | 5700 | 8200 | 9500 | 10000 |
| CHI PHÍ | | | | | |
| C1. Chi phí trực tiếp | | | | | |
| - nhân viên chăm chỉ | 4000 | 4200 | 4400 | 4600 | 4800 |
| - mua / thuê thiết bị | 0 | 0 | 700 | 800 | 800 |
| - xúc tiến / giao tiếp | 500 | 500 | 500 | 500 | 600 |
| - đi du lịch | 100 | 100 | 200 | 200 | 300 |
| - hợp đồng phụ | 1000 | 1500 | 2000 | 2000 | 2500 |
| C2. Những chi phí gián tiếp | | | | | |
| - cho thuê mặt bằng / dịch vụ dọn | | | | | |
| dẹp | 0 | 200 | 250 | 250 | 250 |
| - sưởi ấm / làm mát | 0 | 100 | 150 | 200 | 250 |
| - vật tư tiêu hao | 0 | 50 | 50 | 50 | 50 |
| TỔNG CHI PHÍ | 5600 | 6650 | 8250 | 8600 | 9550 |
| TỔNG MỨC ĐẦU TƯ YÊU CẦU | 600 | 950 | 50 | -900 | -450 |

Trang | 8 - TUAF - Feasibility study - Vietnamese version

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



9. Các chỉ số thành công

- Số lượng thực tập sinh
- Số lượng đào tạo được cung cấp trong chương trình SWAP
- Số lượng các hoạt động nghiên cứu và hợp tác
- Phản hồi của học viên sau khi đào tạo

10. Kế hoạch giám sát và đánh giá

- Hoạt động của trung tâm đào tạo sẽ được giám sát và đánh giá hàng tháng qua mỗi học kỳ bởi các thành viên nhóm TUAF SWAP.
- Các báo cáo M&E sẽ có sẵn cho ban quản lý trung tâm đào tạo TUAF, ủy ban SWAP, giám đốc điều hành TUAF và nhà tài trợ.

| | TÓM TẮT Dự ÁN | CHỉ Số | PHƯƠNG PHÁP ĐÁNH GIÁ | |
|------------------|--|---|---|--|
| Mục tiêu | Nâng cao năng lực quản lý và xử lý chất thải | Số lượng học viên Đánh giá sau đào tạo | So sánh các bài kiểm tra trước đào tạo và sau đào tạo | |
| Kết quả | Nâng cao kiến thức và kỹ năng về quản lý chất thải | Kết quả kiểm tra sau đào tạo | Khảo sát trước và sau đào tạo | |
| Đầu ra | Đào tạo về phân loại chất thải Đào tạo về sản xuất than sinh học Đào tạo về ủ phân hữu cơ Các hoạt động / dự án nghiên cứu cụ thể được tài trợ / đệ trình | Số học viên hoàn thành khóa đào tạo s Số lượng nghiên cứu khoa học và số lượng sinh viên, cán bộ tham gia nghiên cứu | - Hồ sơ tham dự trung tâm đào tạo - Danh mục nghiên cứu khoa học | |
| Các hoạt động | Cung cấp ít nhất 1 khóa đào tạo trong chương trình SWAP | Số lần đào tạo được cung cấp trong chương trình SWAP | Hồ sơ trung tâm đào tạo | |

Mỗi nghiên cứu sẽ bằng tiếng Anh và ngôn ngữ quốc gia, và sẽ tạo cơ sở để đạt được sự đồng thuận và cam kết của tất cả các cổ đông, nhà đầu tư, nhà tài trợ, những người sẽ "thiết lập" các Không gian (tìm phòng/tòa nhà, mua/thuê đồ nội thất và thiết bị, thuê nhân công...).

Trang | 9 - TUAF - Feasibility study - Vietnamese version

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