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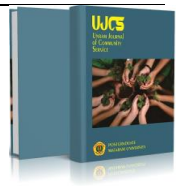

Production Process Optimisation: Implementation of Modern Ecoheat Technology Innovation to Improve Efficiency and Quality of Exported Sea Cucumber Products at Ukm Mitra Bintang Laut in Palu City

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Abstract: The implementation of Modern EcoHeat Technology Innovation is designed to overcome the challenges of the non-standardised sea cucumber drying process. This programme is conducted in several stages, namely: Installation of EcoHeat drying technology in the production facilities of partner SMEs, training on the use of technology for employees and students, development of quality SOPs, and improvement of logistics management for more efficient distribution. This activity also includes regular evaluation of production processes and results to ensure improved product quality according to international standards. In addition, a social media campaign was implemented to support product marketing and increase consumer awareness about the benefits and quality of dried sea cucumbers from Bintang Laut SMEs. The results of the programme showed significant improvements in the efficiency of the production process, which enabled Bintang Laut SME Partners to increase production capacity and reduce operational costs. Improved product quality of dried sea cucumbers with more consistency and longer shelf life was also achieved, resulting in a positive response from the market. The programme also successfully enhanced employee skills through technology training and quality SOPs. The programme successfully optimised the production process with the support of modern technology and better implementation of quality SOPs. The programme was able to improve the competitiveness of dried sea cucumber products in the export market and provide opportunities for SMEs to maintain quality and expand markets.

Keywords: Ecoheat; Quality; Sea Cucumber

Introduction

The potential of capture fisheries in Central Sulawesi Province has high economic value. In particular, the biggest potential for non-fish is sea cucumber. Although there is no official data in the BPS report and the Marine and Fisheries Office of Central Sulawesi Province. This data collection is rather difficult due to the lack of strict management of marine products, such as many sea cucumber commodities leaving Central Sulawesi that are not recorded. This is necessary given their high economic value in foreign markets (Martoyo et al., 2006).

Mitra Bintang Laut SME is a processor of wet sea cucumbers into dry sea cucumber products located in Palu City. The dried sea cucumber production business produced by Bintang Laut SME partners whose raw materials come from Tomini Bay, Parigi Moutong Regency, Donggala Regency, Buol Regency to Gorontalo Province with a direct purchase system from fishermen or direct transactions at the partner SMEs. This is done easily because each coastal area already has collectors

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who help partners. The partner SMEs are only able to process sea cucumbers with an average export destination of 100 kg per month while for local destinations as much as 200 kg per month. the difficulty of partners meeting the requirements of export quality standards results in local scale sales. Marketing of partner SME products that come directly to the location of partner SMEs such as large cosmetics companies such as Wardah to sort the raw materials they want to buy themselves. While local delivery to Jakarta through cargo expeditions. For export purposes so far, partners have only been able to use the company's services due to a lack of knowledge and experience, including an understanding of export regulations.

Processing is still done manually (traditional) so that product quality is low and not uniform. In addition, the types of products produced are still limited, namely in the form of dried sea cucumbers (Sudrajat, 2002). The five-member Bintang Laut SME, consisting of the SME leader, workers, and administration, has an average education of elementary to high school level, and the leader has a high school education. The SME, which became a partner in the P3E programme, is located in Balaroa Village, Palu City. In running their business, partners only have minimal facilities, namely a place to process and dry, electricity facilities and simple equipment (boiling pans, gas stoves, drying racks, basins, baskets, and scales). The marketing of the products of the partner SMEs is through exporters who come directly to the location of the partner SMEs. With this simple production model, the quality of the exported sea cucumber products produced is also quite low, causing the product price to be easily manipulated by exporters.

First problem the main problems that are quite critical and need attention in relation to obtaining good quality dried sea cucumbers are the handling of raw materials, splitting / gutting, boiling, calcification on the surface of the skin, drying, and warehousing methods (Tangko, 2010).

The processing carried out by the partner SMEs, namely the cooking of raw materials using ordinary pans and stoves with uncontrollable cooking temperature and pressure, causes uneven cooking results that affect the texture of the sea cucumber meat which is not uniform (Bambang et al., 2021) Likewise, the drying method of the two partner SMEs which only relies on solar heat and ovens so that the drying time becomes quite long. For example, drying small to medium-sized sea cucumbers with a slightly soft texture takes 5 - 10 days, while for large sea cucumbers with a solid and chewy texture (donga type sea cucumbers) takes 21 - 30 days. The length of drying time has an impact on production volume and revenue.

Second Problem In addition, because it only relies on solar heat and use, the processing carried out produces dried sea cucumber products with a high moisture content, which is still above 20%. In addition, the partner SMEs lacked knowledge of export-grade product quality standards. Another weakness of the SME partners is the difficulty in storing the processed products because dried sea cucumber products are hygroscopic (easily absorb moisture and odour), which affects the moisture content and quality of the sea cucumber during storage.

The third problem is that the way the raw materials are handled/processed by the partners (traditional and minimal equipment) results in poor quality sea cucumbers (thus impacting the low purchase price with a price drop of up to 50% of the price of products with good quality). This is due to the time and cost needed to process them into dried sea cucumbers to meet export standards at the exporter level. Thus, there is no added value generated by SMEs both in terms of products and profits. In fact, sea cucumber raw materials can be processed easily and with simple equipment that can produce diversified products in the form of sea cucumber crackers or flour that can be value-added products and have the opportunity to be exported.

From the description above, the fundamental problem of the partners is the lack of knowledge and skills of SME partners about handling and good processing, quality and product standards of sea cucumbers for the market/export, all of which can increase the added value of sales.

Programme Objectives

The objective of this programme is to help partners overcome their problems and improve the quality, efficiency, and competitiveness of dried sea cucumber products. Through the coaching programme, partners can receive training in more efficient drying methods, product quality management, and better resource management. In addition, the coaching programme can provide assistance in terms of marketing networks, where needed. Thus, the coaching programme will help partners achieve their business goals in a sustainable and competitive manner.

Programme Benefits

The coaching programme proposed by the Innovation for Vocational Partners (INOVOKASI) scheme of the Export Product Development Program (P3E) for the dried sea cucumber business is expected to provide great benefits for partners and local community groups, such as improved product quality, improved quality and efficiency. Through training and guidance on better drying methods, partners can improve the quality of the dried sea cucumbers they produce. Better

product quality will help partners get a higher selling price and expand their market.

Figure 1. Initial condition of Mira Bintang Laut SME's business premises (A) Floor where sea cucumbers are dried (B) Sea cucumber sorting process on the floor (C) Sea cucumber sorting results (D) Storage warehouse.

Method

Time and Place

This service activity to partners was carried out from August to November 2024 located at UKM. Mitra Bintang Laut with the address Jl Manggis No 21 Kel Balaroa Kec Palu Barat, Palu, Central Sulawesi, which is approximately 20 KM from the location of the Palu Polytechnic campus implementation team. The implementation team consists of lecturers and students of Palu Polytechnic.

To achieve the service objectives that have been agreed with partners, there are several stages of activities carried out. The activity stage begins with conducting a Focus Group Discussion to build commitment and agree on an activity schedule. The next stage is the implementation of training activities for several activities, namely: (1) Installation of Ecoheat Modern Drying Technology, (2) Training on the Use of EcoHeat Technology (3) Development of SOPs (4) Social Media Campaign (5) Logistics Analysis and Improvement (6) Preparation of Feasibility Studies (7) Logistics Management Training (8) Evaluation of Results and Impacts.

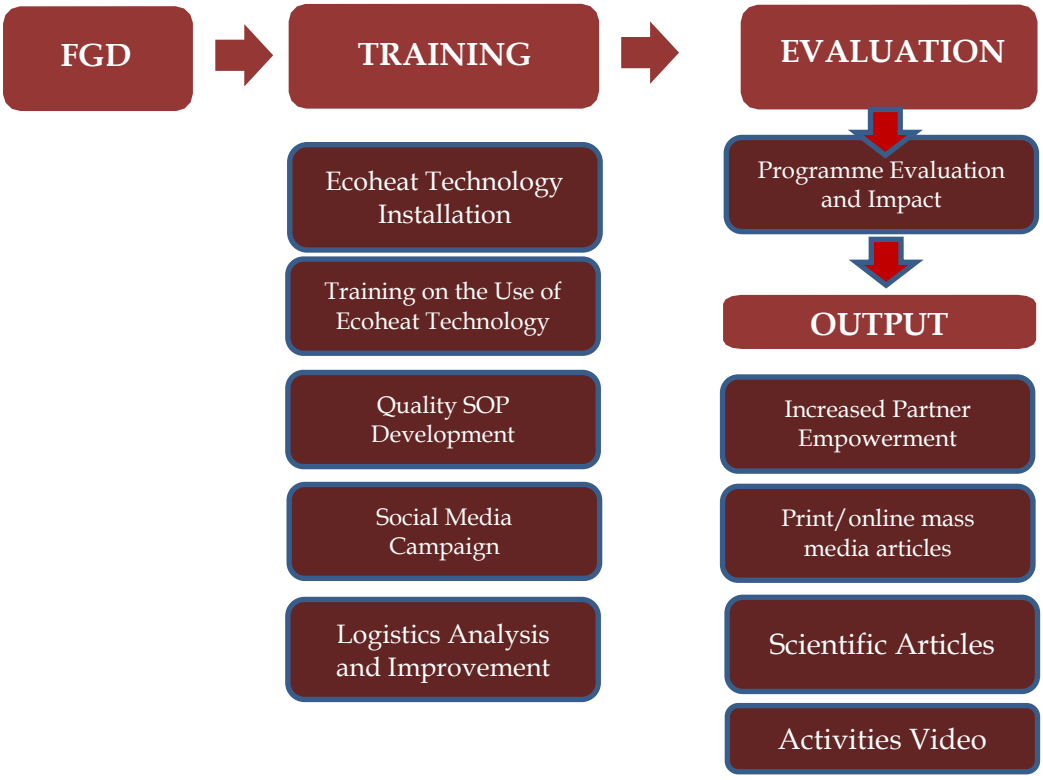

Figure 2. The implementation stage of the Innovation and technology application activities at Industrial Partners

Result and Discussion

Innovation and technology activities for partners are carried out by the Implementation Team with the support of the Innovative Grant for Export Product Development (P3E) scheme for the 2024 budget year by the Director General of Vocational Education, Ministry of Education and Culture of the Republic of Indonesia.

Activities that have been carried out in the span of August to November 2024. The participants were partners, lecturers of Palu Polytechnic, practitioners as resource persons, and students.

Focus Group Discussion (FGD)

FGD activities were carried out at the Bintang Laut SME Partner location on 22 August 2024. The implementation of FGDs at partner locations also aims to find out in more detail the conditions and facilities owned by partners and meet with partner members. The benchmarks for the success of the FGD carried out are the level of attendance of partner members, understanding of the stages of activities, and agreement on the schedule for implementing service activities.

The FGD was attended by 5 partner members (100%) so it can be concluded that the partners were quite enthusiastic about the implementation of the activity. The implementation team has explained the stages of the activities carried out and based on the question and answer process, the FGD participants as a whole have understood the purpose and objectives of each stage of the activity. Based on the results of the FGD, a schedule for the implementation of each training that will be carried out has also been agreed upon. This discussion aims to understand the challenges faced by partners and find solutions together to improve efficiency and product quality according to export standards.

Installation of Ecoheat Modern Drying Technology

The technician team assisted by students installed the EcoHeat machine according to the manufacturer's instructions and guidelines at UKM Mitra Bintang Laut. Previously, it had been built by lecturers and students of Palu Polytechnic. The machine was designed with care to ensure every part was installed correctly, and tested for durability and safety. The machine is also calibrated to adjust the ideal temperature in the sea cucumber drying process. The EcoHeat installation is expected to increase the production capacity of dried sea cucumbers, speed up drying time, and produce products with stable and consistent quality. After the installation is complete, initial testing is conducted to ensure the machine works according to the standard. This trial involved drying a small volume of product to evaluate the machine's performance. This test also helped assess whether the drying time and final product quality were in line with the expected targets. The technology enables automatic temperature regulation, resulting in high quality products in less time, while reducing energy costs. The basic principle is to utilise the main energy source of solar heat, to dry materials. The previous drying time was up to 14 days in the sun, after the device, the drying time is down to 2-3 days.

Training on the Use of EcoHeat Technology

After the machine was installed and the SOP was developed, the implementation team and students conducted hands-on training for SME employees. The training covered machine operation, temperature and time settings, as well as how to maintain and clean the machine. It is hoped that this training can help employees operate the machine safely and effectively. This training covers machine operation, temperature and time settings, and how to maintain and clean the machine. It is hoped that this training will help employees operate the machine safely and effectively. After the machine has been used for several drying processes, the team evaluates the machine's performance and product yield. The team and technicians provided a manual book for the use of the ecoheat equipment.

Figure 3. (A) Training on the use of ecoheat oven (B) Products inside the Ecoheat Oven (C) Products from sun drying (D) Products from ecoheat drying.

The results of the dried sea cucumber test analysis can be seen in Table 1.

Table 1. Dried sea cucumber test analysis results

Parameters	Value % (Sun)	Value % (Ecoheat)	Standard (%)	Description
Water Content	19 %	5 %	Max. 20	Meet
Ash Content	10 %	14 %	Min. 7	Meet

Table 1 shows that the dried sea cucumbers from the study have met the standards set for dried sea cucumber products through SPIkan/02/29/1987 the moisture content of dried sea cucumbers is lower than the maximum limit set. This indicates that the dried sea cucumber product has good quality. The low moisture content will affect the longevity of the sea cucumber during storage. The drier a product is, the longer its shelf life will be (Herliany, 2011). Moisture content also affects

the texture of the final product. The desired texture of dried sea cucumber products according to SNI 01-2346-2006 is hard solid, compact and clayey with an organoleptic value of 9. If the moisture content is too high, the texture of the dried dried sea cucumber becomes mushy and not compact, thus affecting consumer acceptance of the product. This difference is thought to be caused by differences in processing, drying temperature and drying time as well as the composition of the raw materials used. But when compared to the research of Karnila et al. (2011), the moisture content of dried sea cucumber from this study is not different from the results of the research of Inayah et al (2013) which produced dried sea cucumber with a moisture content of 7.773%.

The ash content of the dried sea cucumber has met the standard set by SNI, which is at least 7%. When compared to Jalaludin et al (2020) research where the ash content reached 16.8%, the ash content of the dried sea cucumber was lower. The higher the ash content contained in a food, the more mineral content is produced (Herniawan, 2010). According to Kustiariyah (2007), sea cucumbers contain mineral substances such as chromium, ferum, cadmium, manganese, nickel, cobalt and zinc. Nofrini (1993) added that the mineral content in sea cucumbers is phosphorus, magnesium, calcium, iodine, iron and copper.

Quality SOP Development

At the initial stage of the training, participants were given an understanding of the basics of quality SOPs, the purpose of developing SOPs, and the importance of quality control in production. The presentation also covered the benefits of implementing quality SOPs in improving product competitiveness in the export market and maintaining customer confidence. The resource person came from the expert team of the Fisheries and Marine Products Quality Control Agency by Mr Irmawan. In this session, participants were invited to identify the stages of sea cucumber production that could potentially affect the final quality of the product, such as the cleaning, drying, and packaging processes. Each critical stage was analysed to understand the risks that could arise, so that the SOPs developed could include appropriate control measures. The training was provided to the employees and management of Mitra Bintang Laut SMEs. Participants were taught to document the results of quality control at each stage of production for easy analysis if quality problems occur. These records also serve as evidence that the quality SOPs have been properly implemented.

Social Media Campaign

The social media campaign aimed to introduce dried sea cucumber products resulting from the quality improvement programme with EcoHeat technology. Before starting the campaign, the implementation team together with SME partners Mitra Bintang Laut and students developed a content strategy that included themes, frequency of posts, and types of content that would appeal to the target audience. The main focus of the content was education about the benefits of dried sea cucumbers, the high-quality production process with EcoHeat, and the advantages of Bintang Laut SME products as an export option. The creative team created engaging visual content, including product photos, production process videos, and infographics explaining the advantages of EcoHeat technology in maintaining product quality. In addition, educational content was created on the health benefits of sea cucumbers and tips for consuming sea cucumbers. This content aimed to educate the audience while building trust in the product.

The campaign team regularly analysed the campaign performance by looking at engagement metrics, such as the number of likes, shares, comments, and the increase in followers on each platform. The results of this analysis become the basis for developing the next content strategy to better suit the audience's preferences. The social media campaign has successfully increased public awareness of Bintang Laut SME's dried sea cucumber products. There was an increase in followers and interactions on Instagram and Facebook

Logistics Analysis and Improvement

Logistics analysis and improvement activities are carried out to improve supply chain efficiency and ensure that dried sea cucumber products from Bintang Laut SME Partners can reach consumers in the best conditions. The focus of this analysis was to identify obstacles in the logistics process and make improvements to increase time efficiency, reduce costs, and maintain product quality during the delivery process. The team and partners mapped the current logistics flow, from product packaging at the factory, storage, to delivery to local and international consumers. This process involved collecting information on the time taken at each stage, transport costs, and product storage conditions during the journey.

After the mapping, problems that could potentially hinder logistics efficiency were identified. Some of the challenges found included limited storage facilities, shipping delays on some export routes, and high shipping costs that affected product selling prices.

Employees were trained on effective logistics management by a team of experts from the Central Sulawesi Provincial Industry and Trade Office, ranging from inventory management, proper packaging, to shipping administration processes. The training aims to ensure that each part of the logistics process is well managed and the risk of product delays or damage can

be reduced. With this logistics analysis and improvement, it is expected that the process of shipping dried sea cucumber products to Mitra Bintang Laut SMEs will be more efficient, logistics costs can be reduced, and product quality can be maintained during shipping.

Evaluation of Results and Impact

An evaluation of the results and impact of the programme was conducted to assess the extent to which the implementation of EcoHeat technology and the implementation of quality SOPs have affected the production process, product quality, and market performance of Bintang Laut SMEs.

The results obtained through the survey were then categorised into 3 (three) categories, namely: (1) Poor, (2) Fair (3) Good (4) Very Good. Meanwhile, there are 5 (five) indicators used, namely: (1) Understanding of Ecoheat technology (2) Effectiveness of training (3) Quality of sea cucumber products (4) Distribution efficiency, (5) Customer response. The samples and informants used are partners who receive the benefits of the P3E scheme Innovations programme, namely 5 (Five) people consisting of 1 leader and 4 staff of UKM Mitra Bintang Laut.

Evaluation and impact measurements were carried out in conjunction with programme activities carried out by the team, namely in October and November. While the survey recording was carried out by distributing boring surveys to beneficiary partners through questionnaires. After recording, data analysis was then carried out by juxtaposing 3 (three) categories and 5 (five) indicators to determine the level of programme impact on partners. The following Figure 1 shows the results of the evaluation and impact assessment of the programme.

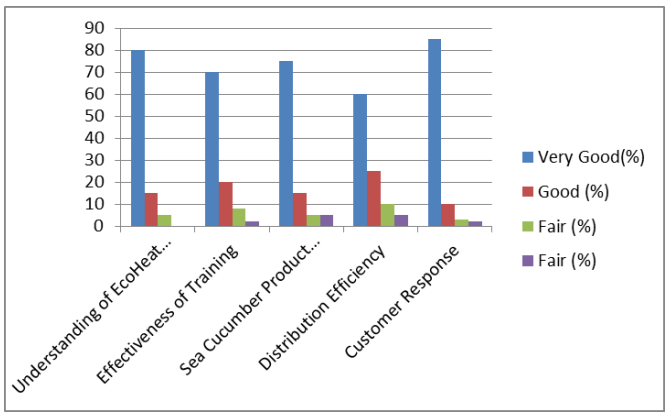

Figure 1. shows the results of the evaluation and impact assessment of the programme.

The results and impact of the programme show the successful implementation of EcoHeat technology and significant quality SOPs. The evaluation illustrates that the programme not only improved product quality and production efficiency, but also opened up new market opportunities and increased the competitiveness of Bintang Laut SME Partners at the international level. It is hoped that the results of this evaluation will serve as a basis for programme sustainability and further improvement, so that the SMEs can continue to grow and produce products that are competitive in the export market.

Conclusion

Optimisation of Production Process: Implementation of Modern EcoHeat Technology Innovation to Improve Efficiency and Quality of Exported Sea Cucumber Products' implemented with Bintang Laut SME Partners in Palu City has achieved significant successes. The implementation of EcoHeat technology has improved production efficiency, accelerated the drying process, and produced dried sea cucumber products with more consistent quality.

The overall results and impacts of this programme show that the collaboration between the implementation team, vocational institutions, and partner SMEs has brought tangible benefits in improving the competitiveness and professionalism of SMEs in the sea cucumber industry. The sustainability of this programme is expected to maintain and even expand market opportunities, as well as inspire the development of similar innovations in other fisheries and marine sectors.

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We also express our appreciation to the entire implementation team, lecturers, students, and leaders and employees of UKM Mitra Bintang Laut who have collaborated well during the implementation of the programme. Without hard work, commitment, and synergy from all parties, the achievements would not have been possible.

References

Bambang, S., Sumardianto, & Purnamayati, L. (2021). *Tingkatkan Kualiatas Teripang Kering Di Karimunjawa.*

Herliany, N. (2011). *Aplikasi Kappa karaginan dari rumput laut Kappaphycus alavarezi sebagai edible coating pada*

udang kupas rebus. Institut Pertanian Bogor, Bogor.

Herniawan. (2010). *Pengaruh Metode Pengeringan Terhadap Mutu dan Sifat Fisika Kimia Tepung Kasava Terfermentasi*. Institut Pertanian Bogor. Bogor.

Inayah, N., Ningsih, R., & Adi, T. K. (2013). Uji Toksisitas Dan Identifikasi Awal Golongan Senyawa Aktif Ekstrak Etanol Dan N-Heksana Teripang Pasir (Holothuria Scabra) Kering Pantai Kenjeran Surabaya. *Alchemy*, *2*(1), 92–100. https://doi.org/10.18860/al.v0i0.2292

Jalaludin, M., Octaviyani, I. N., Praninda Putri, A. N., Octaviyani, W., & Aldiansyah, I. (2020). Padang Lamun Sebagai Ekosistem Penunjang Kehidupan Biota Laut Di Pulau Pramuka, Kepulauan Seribu, Indonesia. *Jurnal Geografi Gea*, *20*(1), 44–53. https://doi.org/10.17509/gea.v20i1.22749

Kustiariyah. (2007). Teripang Sebagai Sumber Pangan. *Buletin Teknologi Hasil Perikanan*, *10*(1), 1–8.

Martoyo, J., Nugroho, A., & Tjahjo, W. (2006). *Budidaya Teripang* (Edisi Revi). Penebar Swadaya.

Nofrini. (1993). *Analisa usaha pengolahan teripang asap di Kecamatan Padang Cermin Kabupaten Lampung Selatan Propinsi Lampung*. Institut Pertanian Bogor. Bogor.

Sudrajat, Y. (2002). Teknik Penghilangan Lapisan Kapur pada Teripang Pasir Menggunakan enzim papain. *Buletin Teknik Pertanian*, *7*(2), 41–43.

Tangko, A. M. (2010). *Present Status Produksi dan Budidaya Teripang di Sulawesi Selatan*. Balai Riset Perikanan Air Payau.