



Commercialization of Sun-Based Fishing Lights to Improve the Fisherman's Economy in the Horse Area, East Java, Indonesia

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ABSTRACT: Fish Light is an innovation that uses solar panel lights with fishing techniques that have advantageous properties where fish are drawn to optical light stimulation in aids like lighting from lamps with electricity produced by Fish Light products so that fish catch fish more readily. reach out, gather, and seize. The goal of the project is to provide fishermen with the technology and catch maps they need to capture fish at a reasonable cost. Another objective of this research is to foster an entrepreneurial spirit to provide independent revenue for the University of Jember. It is envisaged that this would enable fishermen to replace energy sources from lights, which have an effect on boosting the income and profits of fishermen. Utilizing cutting-edge research and development techniques, the Horseshoe Area uses interviews, documentation, and light fish production to meet fishermen's demands. Fish Light is produced using cutting-edge research and development techniques for fisherman in the Horseshoe Area, with interviews, documentation, and manufacturing tailored to their needs. Applying the findings of the Fish Light innovation research is quite doable. They can provide for the demands of fishermen in a sustainable and ecologically responsible way. The Fish Light device has undergone successful testing for its utility on fishermen in Muncar Village. The product is prepared for widespread usage and commercialization. Through a product resonance program that goes straight to fishermen in the Horseshoe Area and digital commercialization via a marketplace, the light fish product commercialization scheme is carried out. Using the right technology to raise the value of natural resources and boost the livelihood of fisherman Fish Light promotes SDG 7: Providing everyone with access to cheap, ecologically sustainable energy.

KEYWORDS: Fish Light, Floating Chart, Fisherman, Solar Panels.

INTRODUCTION

Fishing is one of the most crucial activities for fishermen because it is their main source of revenue in the fisheries sector [1]. The most prevalent challenges faced by fishermen in the sport, though, are having trouble finding and effectively capturing fish. Therefore, it is necessary to innovate in order to enhance fishing in a way that is both more effective and more ecologically friendly [2]. A lot of factors affect fishing, one of them being the illumination over the waters [3]. Fish have optical properties that make them attracted to light, and by using the right illumination, one may more easily approach and catch the fish [4]. However, the majority of fishermen still use traditional generator-powered lanterns, which are not only prohibitively expensive but also have negative environmental implications [5].

The innovative solution that Fish Light has created is a fascinating response. A system of fishing energy sources known as Fish Light uses solar-powered lights to create illumination that draws fish. Fish Light is the firm that manufactures these lights. By utilising this technology, it is anticipated that fishermen will be able to improve the efficiency and production of their fishing operations. Additionally, the goal of this research is to affordably meet the needs of the fishing community. It is projected that by converting from conventional generator light energy sources to Fish Light, which is powered by solar energy, the fisherman would be able to enhance their earnings while also decreasing the costs of their operations.

This study focuses on both the entrepreneurial aspect of the sector as well as the indirect advantages that flow to fishermen. Through the commercialization of the Fish Light product line, the research team from the University of Jember hopes to promote an entrepreneurial attitude. In addition to helping fishermen, this will also give the research team a stream of money that is not dependent on any other revenue. Utilising energy sources that are less detrimental to the environment, like those used by Fish Light, is crucial in the context of sustainable growth. The seventh Sustainable Development Goal (SDG), which aims to make environmentally friendly energy available and affordable to all people, is furthered by this.



Fish Light's innovative research has the potential to greatly increase fish harvests, strengthen the economy of fishing communities, and significantly contribute to the sustainable expansion of the fisheries sector. In response to the needs stated by fishermen in the horseshoe region, this research was conducted using cutting-edge approaches, which included interviews, documentation, and the development of Fish Light. By implementing offline and online marketing strategies, you will be able to create product marketing not only in the horseshoe area but can develop throughout Indonesia.

LITERATURE REVIEW

To maintain sustainable fisheries, it is important to comprehend how technological advancements have affected production efficiency [6]. It is crucial to comprehend this influence since technological developments might lead to increased efficiency. The usage of light-emitting diode (LED) lighting systems has the potential to have significant effects on fisheries that rely on light to attract fish [7]. As part of our examination into the switch from kerosene lamps to LED lamps, we examined the factors that led to the adoption of LED lights in Lake Tanganyika, East Africa, as well as the impact of the new light sources on fish collection and composition [8]. We used a variety of field studies including catch evaluations, fishermen surveys, measurements of underwater light spectra, and cost assessments to determine the impact of switching from kerosene to LED illumination. Generally speaking, we discovered that DIY LED lighting systems are widely used in Lake Tanganyika.

The city's electrical system is utilised to charge the bulk of the batteries that run these lights. This is true even if solar cells have the capacity to reduce greenhouse gas emissions [9]. Kerosene light's spectrum is notably different from that of LED light, and LED light may penetrate the water column further [10]. The bulk of the fish taken are young fish from the two dominant species, regardless of the type of light utilised. Even though LED lights have been associated with a little increase in fish captures, environmental conditions, particularly the distance from the shore, are frequently more important in determining the volume and make-up of fish catches. The biggest benefits of employing LED lighting are operational cost reductions and reliability in inclement weather [11]. It would seem that the main benefit of using a battery-powered LED lighting system to draw fish to Lake Tanganyika would be to decrease expenses while increasing effectiveness. On the other hand, lake fisheries remain susceptible to both commercial and recreational fishing.

Investigating the viability of employing solar systems to produce the electrical energy needed for fishing activities on small-scale fishing vessels in Indonesia is the goal of the study carried out by Nugraha et al. [12]. In order to improve the lives of fisherman, this study aims to address the issues of fuel stock shortages and price volatility. In this study, a solar system and underwater fishing equipment were used. The study examined how solar systems produced energy and how the environment was affected. The outcomes showed that the efficiency of fishing was increased by the solar system and underwater lights. The study found that the quantity of electricity produced is 393,24 Wh/day, which is enough to keep the ship powered for four days.

The technical, financial, environmental, health, and safety implications of employing solar systems with underwater illumination were assessed by Nugraha et al. using Wilcoxon tests. According to the test findings, using this system had a significance value of 0.001 ($p < 0.05$), meaning that using photovoltaic systems with underwater illumination had a variety of good effects. The advancement of sustainable and ecologically friendly fishing techniques is aided by this study. Fishermen may lessen their dependency on fossil fuels and the damaging effects they have on the environment by using solar energy. Additionally, the adoption of solar systems and underwater lights has the potential to boost fishing production, which would improve the fishermen's financial situation. This research provides a firm foundation for future development in the field of sustainable fishing technology in Indonesia.

Another study demonstrates that electrical energy produced by generators or by cutting-edge renewable energy sources, including solar energy captured by PV, can power lighting sources aboard ships [13]. Based on its current resources, Indonesia has a significant potential for solar energy [14]. The results showed a 6.37 kWh/m²/day solar energy potential. The maritime and fishing sectors may surely make use of this potential [15]. It is envisaged that the adoption of PV as a source of electricity on fishing vessels would help government initiatives concerning the blue economy and get around the dearth of fossil fuels [16].

PV panels with a 100 WP capacity were put on fishing boats for this experiment. It can satisfy 50.52 percent of the power demand, according to the electricity demand for PV energy output. The Wilcoxon test, which shows that PV can satisfy electrical energy demands with $p = 0.005$, supports these results. According to economic study, using solar energy as a source of electrical energy results in an IRR of 9% and a return time of 8.87 years. The report offers crucial details on the benefits and practicality of



PV systems for powering fishing boat illumination. This study makes a substantial contribution to the utilisation of renewable energy in the fisheries sector by using solar energy as a sustainable and ecologically friendly substitute. "Technical-economic Assessment of Solar PV Systems on Small-Scale Fishing Vessels" by Nugraha et al. is cited in this article. The report offers a thorough understanding of the technical and financial analyses of the installation of PV systems on small-scale fishing boats.

Based on earlier studies, the study on the use and effects of modern light-fishing technology (LEDs) in Lake Tanganyika, East Africa, offers insightful information [8]. The switch from oil-based lanterns to LED lights demonstrated a quick uptake rate and emphasised the advantages of LED lights, including lower running costs and weather durability. It's important to remember that environmental conditions, particularly distance offshore, continued to have a significant role in influencing the quantity and composition of fish harvests even though the major objective of employing battery-powered LED lighting systems was to lower economic expenses and boost efficiency [17].

These results lead to the conclusion that fishing technology breakthroughs like Fish Light have a high commercialization potential. Fish Light could offer a practical and ecological way to draw fish with its solar-powered lighting system. By taking the place of conventional generator-powered lamps, Fish Light can lower operational expenses for fishermen while minimising environmental effects. Furthermore, Fish Light's successful commercialization may have far-reaching effects. By enhancing catch efficiency and lowering operating costs, it can raise the income and living standards of fishermen. Additionally, Fish Light promotes sustainable fisheries management techniques and upholds the principles of the blue economy.

The utilisation of renewable energy sources, such solar energy, helps to reduce greenhouse gas emissions and makes it easier to accomplish sustainable development goals [18]. According to earlier studies, Fish Light has a substantial marketing potential, to sum up. Its creative use of solar energy for underwater illumination in fishing operations has exciting possibilities to increase fishing productivity, assist fishermen's livelihoods, and promote the sustainable growth of the fisheries industry.

METHODS

The Fishermen in the horseshoe region were interviewed for this study's data collection. On the basis of their active involvement in fishing operations, informants are chosen. Interviews are conducted to determine the requirements of fisherman, comprehend the difficulties they confront, and provide input on how Fish Light is being used. Other data sources include pertinent literature on the use of light to entice fish and paperwork pertaining to contemporary fishing technology. Since the primary goal of this study was to gather qualitative data through interviews with chosen informants, quantitative sampling techniques were not used. In order to guarantee that fishermen with relevant experience and understanding of fishing are represented, the selection of informants is made purposefully.

The study's foundation is a comprehension of the difficulties that fisherman have when fishing and the possibility for Fish Light to be a useful remedy. The initial data gathering method was conducting structured interviews with fisherman using a prepared question manual. The informant is interviewed face-to-face, and the conversation is taped for later study. In order to learn more about current fishing technologies and pertinent literature, documentation is also done. Data validation and verification are done using triangulation to make sure the acquired data is of high quality. To achieve this, information from various sources, including paperwork and literature, is compared to the information gleaned during the interview. Additionally, the quality of the data is assessed by thematic analysis to detect important trends and conclusions.

The hypothesis test was not used in this study since the emphasis was mainly on gathering qualitative data and comprehending the demands of fisherman. On the basis of a thematic analysis of the data gathered, conclusions are formed, highlighting trends and discoveries from the interviews and other data sources. The results were utilised to confirm Fish Light's efficacy, the demands of fisherman, and the possibilities for the product's commercialization. The methodologies and tactics employed in this study were adapted from a number of other approaches and techniques used in related investigations in the past. The pertinent literature on fishing and light use contains citations to established techniques.

RESULTS

Fish Light by using solar energy as an alternative power source to traditional generators to power lamps aboard fishing vessels, Fish Light provides a ground-breaking option. This cutting-edge system consists of, among other things, solar panels, a tiny

circuit breaker, wires, VRLA batteries, an inverter, and a solar charge controller. Each part is necessary for the Fish Light system to function. The prototype of fish light shown in Figure 1.



Figure 1. Prototype of Fish Light

The solar panels are largely in charge of accumulating solar energy. Photovoltaic cells used in them turn sun energy into electricity. These panels are positioned carefully to maximise sunlight capture and produce the electricity required to power the Fish Light system. A safety measure that guarantees the electrical system's proper operation is the micro circuit breaker. It keeps track of the electrical current and instantly cuts it off in the event of an overcharge or short circuit to safeguard the components and the safety of the fisherman. The remaining parts of the Fish Light system receive the electrical energy produced by the solar panels through cables. They guarantee the smooth flow of energy by establishing a safe and reliable connection between the various parts.

Batteries called VRLAs (Valve-Regulated Lead-Acid) are used to store surplus electrical energy produced by the solar panels. In times of low sunlight or at night when solar panels are not actively producing electricity, these batteries work as a backup power source to provide a steady supply of electricity. Direct current (DC) power from solar panels and batteries is converted into alternating current (AC) electricity by an essential device called an inverter. The fishing boat's lamps are often powered by AC energy, which makes them compatible with common lighting fixtures. Solar charge regulator The battery's charging and discharging are controlled by the solar charge controller. It optimizes the charging process to prevent overcharging, which can shorten battery life, and safeguards against severe discharge, which can damage the batteries. The charge controller assures efficient energy management and increases the batteries' overall lifespan.

These parts are included into the Fish Light system, which uses sustainable solar energy to illuminate fishing vessels. This technique eliminates the need for conventional fossil fuel-powered generators, giving fisherman a sustainable and affordable answer. The batteries store the electricity generated by the solar panels, which is subsequently transferred to the inverter and used to power the lighting. The system's architecture guarantees a stable and effective lighting source, lowering operational costs and the damaging environmental effects of conventional energy sources. Overall, the Fish Light system's main components provide fishermen with an independent and sustainable energy source for their lighting requirements during fishing operations.

The results of the interview that the cost of fuel oil (BBM) is very burdensome for fishermen. The fishermen interviewed consistently stated that the high cost of fuel was a heavy burden for them. Significant operating costs for purchasing and filling fuel tanks reduce their revenues substantially. In this context, innovations such as Fish Light that can reduce fishermen's reliance on fossil fuels are becoming highly relevant and needed. Respondents gave various answers when asked about the need for the ship's electrical load capacity in one sailing. The vessel's electrical load capacity must range from 50 to 300 watts. Factors that affect these needs include the size of the ship, the type of equipment used, and the duration of the trip. Despite these variations, it is important to understand that sustained electricity demand is crucial to the success of fishing operations.

Additionally, respondents noted that the need for electricity during a single cruise ranged from 11 to 24 hours. The trip's duration is influenced by the weather, the distance travelled, and the sort of fishing done. Long journeys may need a constant source of energy to keep the fish's cooling, communication, and navigational systems running. Respondents noted a variety of instruments used in fishing, including nets, ne, fishing rods, and net yields. The species of fish being pursued and the technique thought to be



most productive in their catchment region impact the use of these instruments. It is important to consider the preferences and needs of fishermen when developing innovative solutions such as Fish Light to integrate well into existing fishing practices.

The marketing strategy that we will set is through segmenting targeting and positioning strategies: Segmentation involves dividing the market into distinct groups based on shared characteristics. In this case, the goal is to identify specific groups of fishermen who would benefit most from the Sun-Based Fishing Lights:

1. Demographic Segmentation:

- Age: Middle-aged and older fishermen who are actively engaged in fishing.
- Gender: Primarily male fishermen.
- Income: Low to middle-income fishermen who rely on fishing for their livelihood.

2. Geographic Segmentation:

- Location: The Horse Area, East Java, Indonesia, where fishing is a significant economic activity.
- Proximity to Water Bodies: Fishermen who operate in lakes, rivers, and coastal areas.

3. Psychographic Segmentation:

- Lifestyle: Traditional and community-oriented individuals who value preserving local fishing practices.
- Values: Fishermen who are environmentally conscious and seek sustainable fishing solutions.

Targeting Based on the segmentation, you can select the most promising segments to target with your marketing efforts. In this case, the primary target segment could be Primary Target Segment: Traditional and community-oriented fishermen in the Horse Area, East Java, who value sustainable fishing practices and are looking to improve their catch rates and economic outcomes. Positioning involves defining how you want your product to be perceived in the minds of your target audience. It's about creating a unique and compelling value proposition that addresses the needs and desires of the target segment.

1. Value Proposition for Positioning: "Empowering Tradition with Innovation: Sun-Based Fishing Lights for Bountiful Catches and Sustainable Livelihoods"

2. Key Messages:

- Enhance Catch Rates: Illuminate the night waters with our Sun-Based Fishing Lights to significantly increase your catch rates and boost your income.
- Preserve Traditions: Our lights are designed to complement your traditional fishing practices, respecting the heritage of the Horse Area's fishing community.
- Eco-Friendly Solution: Contribute to a sustainable fishing ecosystem by adopting solar-powered lights that minimize environmental impact.
- Reliable and Affordable: Access innovative fishing technology that's reliable, easy to use, and tailored to the needs of local fishermen.

3. Points of Parity and Differentiation:

- Parity: Sun-Based Fishing Lights provide improved catch rates and illuminate night fishing.
- Differentiation: The lights are specifically designed to respect and enhance traditional fishing practices while being environmentally conscious.

4. Communication Channels:

- Collaborate with local fishing associations and community leaders to spread awareness.
- Use local radio, newspapers, and social media platforms to reach the target audience.
- Arrange community gatherings or workshops to demonstrate the lights' benefits.

By implementing this segmentation, targeting, and positioning strategy, you can effectively reach and engage the right audience in the Horse Area, East Java, and position the Sun-Based Fishing Lights as a solution that aligns with their values and economic aspirations while preserving their traditions. A strategy framework 5 a marketing: aware, appeal, ask, act, and advocate to product Commercialization of Sun-Based Fishing Lights to Improve the Fisherman's Economy in the Horse Area, East Java, Indonesia. Aware consists of first Target Audience Identification: Identify the primary target audience, such as local fishermen, fishing communities, and fishing equipment retailers. Second Education and Awareness: Create informative content about the benefits of Sun-Based Fishing Lights, focusing on increased catch rates, reduced environmental impact, and cost savings. Utilize



local media, social media platforms, and community gatherings to spread awareness. And last Local Influencers: Collaborate with respected local fishermen or community leaders to endorse and spread the word about the fishing lights.

Appeal consists of first Cultural Relevance: Highlight the cultural significance of fishing in the Horse Area and how Sun-Based Fishing Lights can honor traditions while improving outcomes. Second Localized Messaging: Craft marketing messages in the local language that resonate with the challenges faced by fishermen in the region, emphasizing improved catch, safety, and financial benefits. And last Visual Content: Develop compelling visuals, videos, and demonstrations showcasing the lights in action during night fishing trips. Ask consists of first Feedback Gathering: Engage with the local fishing community to understand their specific needs and preferences regarding the fishing lights. Second Surveys and Focus Groups: Conduct surveys and focus group discussions to gather insights about the features, pricing, and potential barriers to adoption. And last Feedback Incorporation: Use the collected feedback to refine the product offering and address any concerns raised by the community.

Act consist of first Localized Distribution: Establish partnerships with local fishing equipment retailers and suppliers to make the product easily accessible to fishermen in the Horse Area. Second Limited-Time Offers: Introduce introductory pricing or bundle deals to incentivize early adoption of the Sun-Based Fishing Lights. Third Product Demonstrations: Organize live demonstrations at fishing spots, showcasing the lights' effectiveness and ease of use to encourage immediate purchase. Advocate consists of first Success Stories: Share success stories from local fishermen who have experienced improved outcomes after using the fishing lights. Highlight their increased catch rates and economic benefits. Second User-Generated Content: Encourage users to share their own experiences on social media platforms using a unique hashtag. Feature the best posts on the company's official channels. And last Community Engagement: Support local fishing events, workshops, and initiatives that promote sustainable fishing practices, positioning the brand as a supporter of the fishing community.

Results of the generator substitution survey the majority of respondents (81%) in Figure 3 emphasised the importance of innovations that can replace generators with comparable functionality. This shows that fisherman are well aware of the need for effective and long-lasting alternative energy sources. Fishermen are searching for alternatives that will lessen their reliance on fossil fuels and lower their operational expenses as a result of rising fuel prices and their detrimental effects on their revenues. Agreement from a survey in light the majority of responders (56.3%) strongly agreed and 43.6% agreed that fishing boats should use energy supply technology based on solar panels. This enthusiastic response shows that fisherman are aware of the potential of renewable technology to offer a sustainable and eco-friendly energy source. The use of this technology is anticipated to lessen adverse environmental effects and increase fishing's operational effectiveness.

All respondents (100%) who were asked about their interest in using the Fish Light innovation products on offer indicated that they were interested. This demonstrates fishermen's keen interest in implementing cutting-edge solutions like Fish Light that can help them reduce operational costs in sailing. Also included in the responses were the respondents' expectations for the Fish Light developments. Expectations include lower operating costs, higher fish catches, sustainable fishing methods, and the use of eco-friendly energy sources. This hope represents the actual requirements fisherman have to carry out their fishing efforts. In terms of the training required to assist fishermen's education, the respondents identified a number of key topics. To enhance fishermen's knowledge and abilities in managing their enterprises, training is required in operational business management, using Fish Light instruments for fishing, marketing fisheries goods, and creating financial statements for businesses.

The majority of respondents to the survey (68.8%) indicated that they were prepared to commit money at first in the development of new Fish Light products, while 25% were still unsure. This suggests that fisherman have a high degree of interest in and would use this novel product. It should be mentioned, nevertheless, that some fisherman may find the initial expenditure to be a barrier due to concerns about it. To guarantee greater acceptance, marketing plans that take this into account must be created. Results of the survey for implementing agreements the majority of responders (87.5%) felt that it was time for fishermen to use more eco-friendly technologies. The significance of protecting the environment and the sustainability of marine resources has been recognised by fishermen. This optimistic outlook offers a strong foundation for deploying novel solutions like Fish Light and promotes a changeover to more sustainable fishing methods.

The majority of respondents expressed a strong interest in Fish Light items after hearing the product demo. They can understand how these things may increase the productivity and capture of their fish. Fish Light's brightness, which need improvement, was criticised by a number of responders. The recommendation is to keep raising product quality standards to better satisfy the demands and expectations of fisherman. The survey's findings, as shown in Figure 8, indicate that fisherman are very



interested in and supportive of the Fish Light invention. It is believed that this novel approach would ease the burden of operating expenses, increase productivity, and foster sustainability in the fishing business. This encouraging answer demonstrates that it is time for fisherman to move to more ecologically friendly technology as a source of energy. The product and training tailored for fisherman need to be improved in order to boost acceptance and success of this product. As a result, Fish Light invention has the potential to significantly assist fishermen and contribute to the sustainable growth of the fishing industry

CONCLUSION

In order to alleviate the burden of high operating expenses and the fishing industry's reliance on fuel oil (BBM), this research emphasises the significance of Fish Light innovation. The findings of interviews with fisherman indicate that they find the expense of fuel to be quite burdensome and that they are searching for alternatives to the usage of generators that may perform the same purpose. Applying solar panel-based energy supply technology to fishing boats is a desirable option in this situation. Most participants in the research indicated interest in and support for Fish Light innovation. These products have the potential to reduce operating expenses, increase fish catches, promote sustainability, and be ecologically benign. Additionally, the majority of respondents stated that they were willing to make the first financial expenditure and move to an energy source that was more ecologically friendly.

We suggest the next actions based on the findings of this investigation. Product Development: Businesses should keep enhancing Fish Light's functionality and quality depending on input from fisherman. To better satisfy the demands of fisherman, it is necessary to do ongoing research and development to improve the product's brightness and effectiveness. Education and Training: Along with the adoption of Fish Light, it's crucial to teach fishermen in the usage of the product, business operational management, marketing fishing goods, and creation of financial statements for businesses. By doing this, fisherman will be able to make the most of this innovation's advantages and maximise their fishing efforts.

Collaboration and Partnership: The implementation of Fish Light technologies depends heavily on cooperation and partnership between academics, governments, and the fishing industry. Providing resources, technical support, and aid with product application are all examples of cooperating. To make Fish Light items more accessible and widely distributed, partnerships with internet marketplaces must also be taken into account. Advanced Research: More study may be done to assess the effect of using Fish Light on fish capture, operational effectiveness, and greenhouse gas emissions reduction. Studies on the long-term advantages and possibilities for further development of solar panel-based energy supply solutions for fishing boats can also be conducted. It is anticipated that adopting Fish Light technologies and putting the aforementioned suggestions into practise will enhance the welfare of fishermen, lessen their negative effects on the environment, and promote sustainability in the fisheries industry. This invention may serve as a role model for other business sectors

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