

BUSINESS MODEL IN PLASMA NANO BUBBLE TECHNOLOGY FOR PALM OIL WASTE PROCESSING

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Article history:

Received
13 February 2024

Revised
5 March 2024

Accepted
15 May 2024

Available online
31 May 2024

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Abstract:

Background: The palm oil industry strives to implement sustainable development, maintaining the environmental quality. However, the palm oil industry has problems processing liquid waste, often known as palm oil mill effluent (POME), since it could pollute the environment. This waste also requires a large costs to be processed. On the other hand, there is potential economic value from liquid waste to be processed into several products, namely biogas, organic fertilizer, and refining value-added compounds. Currently, POME waste processing innovation could be conducted by applying plasma nanobubble (PNB) technology. This creates opportunities for a business that is engaged in developing this technology.

Purpose: The aim of this research is to analyse the business model of the Plasma Nano Bubble (PNB) technology development business for the palm oil industry.

Design/methodology/approach: This research uses the Business Model Canvas (BMC) to map the business processes of the Plasma Nano Bubble (PNB) technology development.

Findings/Result: This study indicate that the most prominent attribute exhibited by PNB technological enterprises is their value offer, which is demonstrated by their ability to deliver efficient processing time and cost effectiveness, resource efficiency, adherence to government regulations, and the establishment of strategic collaborations with external entities. Meanwhile, the weakest element is customer relations, as only long-term relationships, and the provision of intensive training for PNB technology resellers were found in this aspect. Several indicators were proposed to improve the business model of PNB's technology, namely key partnership, the key activity, value proposition, and customer relationship.

Conclusion: This research gives an important contribution related to the environmental benefits of implementing this business. The continuous development for this technology needs to be implemented to process POME waste effectively and efficiently.

Originality/value (State of the art): The state of the art of this research is the development of business models for environmentally friendly products in the palm oil sector, which is currently rarely conducted, in this case the study of PNB technology products.

Keywords: business model canvas, palm oil, plasma-nano bubble (pnb) technology, sustainable development, palm oil waste

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INTRODUCTION

Palm oil is an important commodity in Indonesia. According to data sourced from Indexmundi (2023), palm oil production reached a total of 46 million tons in the year 2022. This number is experiencing significant growth in comparison to the previous decade, specifically reaching 28.5 million tons in 2012. This is a positive effort for local governments to create foreign exchange and employment opportunities which have implications for improving people's welfare (Suroso & Ramadhan, 2012). Oil palm plantations can improve the standard of living and household income of farmers (Acosta & Curt, 2019). Oil palm plantations in Indonesia are steadily growing in 22 out of the total 33 provinces, with the primary regions for these plantations being Sumatra and Kalimantan (Purba & Sipayung, 2017).

On the other hand, the palm oil industry is currently facing problems related to waste processing in line with the rapid increase in palm oil production. Operational activities at the Palm Oil Mills (PKS) produce main products in the form of crude palm oil (CPO) and palm kernel oil (PKO), as well as by-products in the form of solid waste, liquid waste, and air pollutants (Ilmannafian et al. 2020). The type of waste that often becomes a problem for the palm oil industry is palm oil mill effluent (POME). POME can pollute the ecosystem, implicating that this waste must be treated before being discharged into the environment because the Chemical Oxygen Demand (COD) content is 100,000 mg/L (Kartika et al. 2022). It can become a serious problem if it is not addressed properly as the level of palm oil production continues to increase. Typically, an anaerobic process and an aerobic process using several ponds follow each other in palm oil processing factories (Silalahi & Supijatno, 2017). However, this process requires quite a long time to process the waste, as well as large costs for building and maintaining the pond. Innovation from Plasma Nano Bubble (PNB) technology can be an alternative to support the needs in processing liquid waste from palm oil mills in the Business and Industrial World (DUDI). The PNB technology can provide better benefits for environmental quality and reduce costs incurred by palm oil companies for waste processing. As an innovative product, commercial development of this technology can provide large profit potential. It is also supported by the large number of palm oil companies, with 721 companies registered with the Indonesian Palm Oil Entrepreneurs

Association (GAPKI). However, currently, there is no previous literature related to mapping business processes in this business. Therefore, this study aims to analyze the business model of the Plasma Nano Bubble (PNB) technology development business for the palm oil industry.

There are several previous studies that analyze the business model of a business. Anggraini (2019) analyzed business models using the Business Model Canvas (BMC) analysis technique. The results of the analysis show that there is a need for innovation and creativity in introducing products to consumers based on the value proposition generated. Wati et al. (2019) analyzed the tourism boat business development strategy on Pahawang Island, Lampung, using the BMC analysis technique. The results of the analysis show that the priority for developing the business model for this business is developing key activities and business partners to attract the number of tourists who will come. Dasairy et al. (2023) used BMC to analyze the business model of the Mandala Presto Soft Duri Milkfish Business in Bogor Regency. The findings demonstrated that the presented business model has been operating successfully with the support of a number of ongoing tasks, including: 1) forging partnerships; 2) standardizing the production process; 3) promotion on social media to convey information and product marketing; and 4) technology development.

METHODS

This study utilized the two types of data sources, namely primary and secondary data. Primary data was obtained from the results of in-depth interviews with two inventors of PNB technology and manager in PT. XYZ as one of the PNB users. The information obtained includes the benefits and costs of developing PNB technology as well as the business conditions or competition faced. Secondary data was obtained through literature studies, internet searches, and institutions related to Indonesian palm oil industry data. The duration of this research was carried out for five months, namely August to December 2023. This research is a descriptive study with the aim of studying the business model by using qualitative analysis, in this case the business of developing PNB technology for processing palm oil industrial waste. Figure 1 displays the framework for this research.

The Business Model Canvas (BMC) technique was utilized to examine PNB's technology development business model. BMC aids in creating value-focused business models by integrating customer value, resources, capabilities, and stakeholder interests into the conceptualization and implementation of the business model (Sibalija et al. 2021). BMC is a tool that helps users identify smaller elements of a business model and provides a visual map to record those details (Osterwalder & Pigneur, 2010). BMC is also known as a strategic tool for translating concepts, consumers, infrastructure, and company finances into visual elements so that BMC can get real information about the target consumers, expenses, and how a business works (Fourqoniah et al. 2021). The analytical framework of BMC consists of nine aspects that summarize business processes, namely: 1) key partnership; 2) key activities; 3) key resources; 4) value proposition; 5) customer relationships; 6) channels; 7) customer segments; 8) cost structure; and 9) revenue streams. A description of the PNB technology's operation will accompany the BMC analysis.

RESULTS

PNB technology is an innovative technology that combines lightning or plasma to form nanobubbles with very small diameters that are very stable in water. The development of electrified nanobubbles can create their own ozone in a plasma reactor which can be used for water and waste treatment according to a modified design, so that the combination of plasma with nanobubbles on the surface of the water also increases the effectiveness of processing, with reactor test characteristics showing the emission spectrum, ozone, dissolved oxygen, and some clear radicals (Luvita et al. 2022). This technology has been applied in several cases, one of which is that this technology has succeeded in reducing the residues of organophosphate group pesticides and increasing the shelf life of cayenne pepper by 14 days (Syafadriana, 2023). The wastewater treatment plant system in PKS involves biological methods: anaerobic - process without oxygen, and aerobic - process with oxygen) (Al-Amshawee et al. 2020). In aerobic ponds, aerators are usually to increase the oxygen content in the water,

which allows microbes to work better in breaking down organic material. Anaerobic and aerobic processing methods in the palm oil industry wastewater treatment process rely on microorganisms to process pollutant content in wastewater such as Total Suspended Solid (TSS), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and ammonia. Generally, 9-10 ponds are used in this microbiological process. Apart from that, in the aerobic process there is often a lack of oxygen in the pond which results in the low effectiveness of aerobic microbes in the process of decomposing organic compounds. This has an impact on the quality of the processed wastewater, which still has colour and smell. The process of waste processing in POME can be seen in Figure 2.

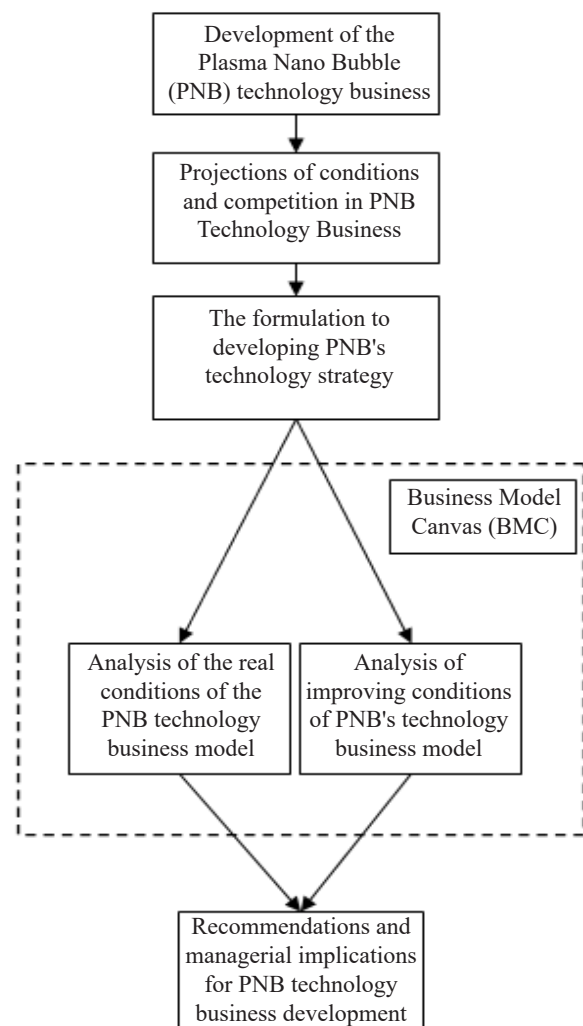


Figure 1. Research framework

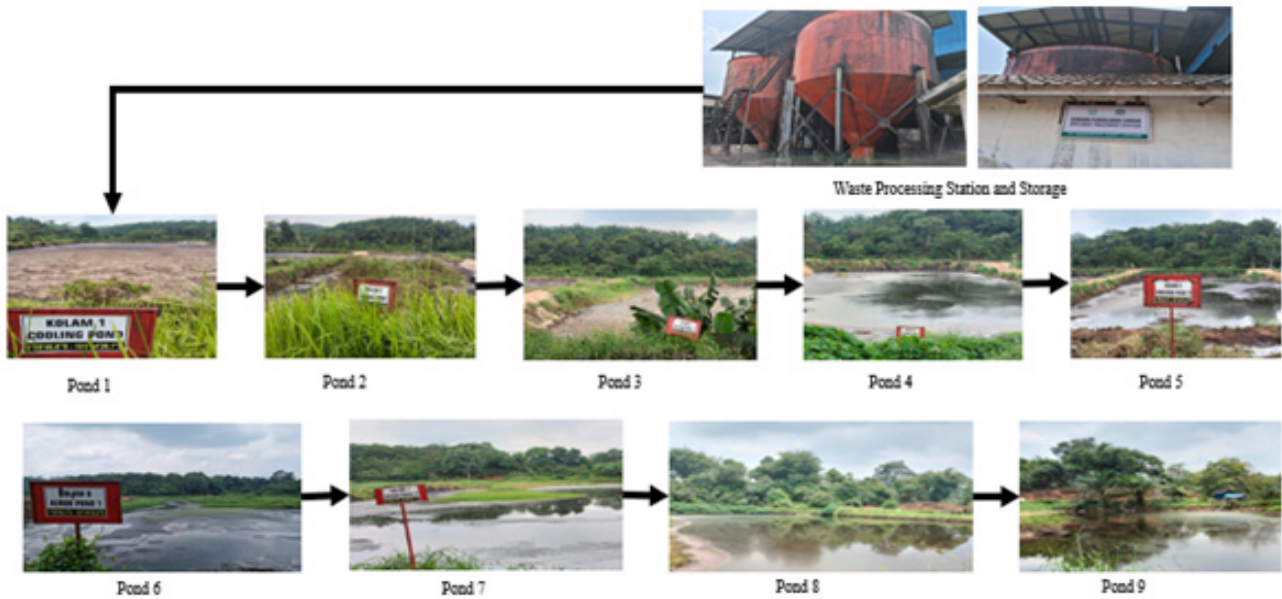


Figure 2. The processing of palm oil waste

PNB technology was developed to address obstacles arising from the waste processing procedures commonly used. Additionally, this technology has succeeded in accelerating the breaking of the dormancy period and increasing the germination of shallot bulb seeds to a higher level (Christopher, 2023). Testing of PNB technology has also been applied to processing waste from the palm oil industry. The test results demonstrated a reduction in waste processing costs from PKS and a decrease in Total Suspended Solid (TSS), Biological Oxygen Demand (BOD), and Chemical Oxygen Demand (COD) content before and after implementing PNB technology (Suroso et al., 2024). Furthermore, there is a noticeable color change from dark to light after applying PNB technology, helping PKS address issues in processing brownish POME waste with a water content of 95-96%, oil (0.6-0.7%), and 4-5% total solids with high BOD and COD values. This reduction has significant implications for environmental damage if disposed of directly. TSS, BOD, and COD values decreased by -969.8%, -1790.2%, and -2534.1%, respectively (Suroso et al., 2024). The visual results of POME waste processing are shown in Figure 3. Identifying possible business processes that occur within the business is essential for the commercialization of PNB technology. The Business Model Canvas (BMC) is useful for developing a business plan, especially for micro and small economic entities establishing a business activity (Tokarski et al., 2017). The indicators for each block are described as follows:

1. Key partnership

The PNB technology development business has a number of key partners: 1) producers of equipment and raw materials for PNB technology, 2) distributors for marketing PNB technology, 3) Research institutions for PNB technology development, 4) Universities as educational institutions that conduct advanced research on technology, and 5) certification institutions to guarantee the quality and quality of PNB technology.

2. Key activities

Key activities in PNB's technology business include: 1) research and development, 2) survey and customization, 3) market opportunity analysis, 4) application creation, 5) promotion and marketing, and 6) repair and maintenance.

3. Key resources

Key resources in this PNB technology business include: 1) PNB technology, environmental certification, patent rights and related intellectual property rights, 2) Human Resources (HR), and 3) Raw materials for PNB technology.

4. Value proposition

The value proposition resulting from this PNB technology business is: 1) PNB technology can be an effective and efficient POME waste treatment, 2) there is

an increase in efficiency in POME waste management, and 3) PNB technology is an innovation that can help Palm Oil Mills (PKS) to comply with environmental regulations.

5. Customer relationship

To maintain relationships with customers, efforts that can be made are: 1) long-term partnerships with customers for maintenance and technology updates, and 2) providing intensive training for white label resellers on PNB products and technology.

6. Channels

Channels that can be used to market PNB technology are: 1) direct sales through a technically capable marketing team and manager, 2) collaboration with industrial distributors or PNB technology intermediaries and 3) online platforms for delivering information and sales.

7. Customer segments

The target customer segments in PNB's technology business are: 1) oil palm plantation companies without plantations, 2) oil palm plantation companies, and 3) companies processing palm oil derivative products.

8. Cost structure

Details of costs that can occur in PNB's technology business are: 1) mill and warehouse construction costs, 2) machine and tool costs, 3) patents or intellectual rights, 4) production and distribution costs, 5) product

research and development costs, and 6) marketing and promotion costs.

9. Revenue Streams

The potential profits obtained from this PNB technology business are: 1) Sales of PNB technology, 2) Service fees for waste processing, 3) Equipment training and consultation, and 4) License fees for technology use.

Based on the results of previous BMC analysis and interviews with inventors regarding the potential for PNB business development, there are BMC results for improving PNB's technology business as shown in Figure 4. There are a number of improvements in several aspects as follows:

1. Key partners

There are additional partners involved in the PNB technology business model, namely: 1) the association of palm oil entrepreneurs and 2) special media related to reporting on palm oil. Both can act as partners who help promote PNB technology to palm oil industry.

2. Key activities

In this aspect, there is the addition of one indicator, namely efforts to diversify products into other types of palm oil waste by investigating the problem related in palm oil waste management, and identification of product function and its benefit. This is done to create PNB product innovations for the development of greater benefits in the future.

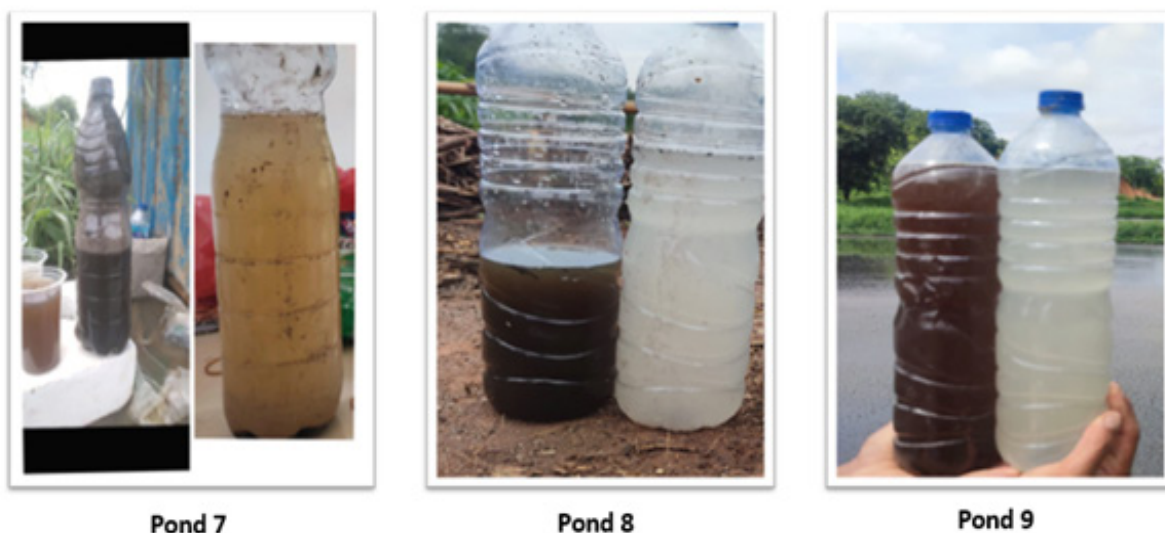


Figure 3. Application of PNB Technology at Mills

Key Partnership	Key Activities	Value Propositions	Customer Relationship	Customer Segments
<ol style="list-style-type: none"> 1. Producers of equipment and raw materials for PNB technology 2. Distributors for marketing PNB technology 3. Research institutions for PNB technology development 4. Universities as educational institutions that conduct advanced research on technology 5. Certification institutions to guarantee the quality and quality of PNB technology. 6. Association of palm oil entrepreneurs 7. Specific media related to reporting on palm oil 	<ol style="list-style-type: none"> 1. Research and development 2. Survey and customization, 3. Market opportunity analysis 4. Application creation 5. Promotion and marketing 6. Fix and maintenance 7. Product diversification into other types of palm oil waste 	<ol style="list-style-type: none"> 1. PNB technology can be an effective and efficient POME waste treatment 2. There is an increase in efficiency in POME waste management 3. PNB technology is an innovation that can help Palm Oil Mills (PKS) to comply with environmental regulation. 4. The PNB technology can initiate a partnership from PKS to non-governmental organizations or NGOs. 	<ol style="list-style-type: none"> 1. Long-term partnerships with customers for maintenance and technology updates 2. Providing intensive training for white label resellers on PNB products and technology. 3. Building a PKS membership program that uses PNB technology 	<ol style="list-style-type: none"> 1. Oil palm plantation companies without plantations 2. Oil palm plantation companies 3. Companies processing palm oil downstream products.
Key Resources <ol style="list-style-type: none"> 1. PNB technology, environmental certification, patent rights and related intellectual property rights 2. Human Resources (HR) 3. Raw materials for PNB technology. 		Channels <ol style="list-style-type: none"> 1. Direct sales through a technically capable marketing team and manager 2. Collaboration with industrial distributors or PNB technology intermediaries 3. Online platforms for delivering information and sales. 		
Cost Structure <ol style="list-style-type: none"> 1. Mill and warehouse construction costs 2. Machine and tool costs 3. Patents or intellectual rights 4. Production and distribution costs, including labor wages 5. Product research and development costs 6. Marketing and promotion costs. 			Revenue Streams <ol style="list-style-type: none"> 1. Sales of PNB technology 2. Service fees for waste processing 3. Equipment training and consultation 4. License fees for technology use. 	

Figure 4. BMC PNB technology development efforts for the palm oil industry

3. Value proposition

One of the indicators added to the value proposition is the development of PNB technology which can initiate a partnership from PKS to non-governmental organizations or NGOs. This can create added value from PNB business implementation in the future.

4. Customer Relations

One step that can be taken to improve the customer relationship aspect of PNB's technology business is to build a PKS membership program that uses PNB technology through stakeholder collaboration, and continuous communication.

Managerial Implication

Based on the study results, we found that business development related to waste management technology provides sustainable benefits. Business development related to waste management benefits the business world and society, including the business model for developing PNB technology. Commercialization of PNB technology is a significant effort to introduce effective and efficient waste treatment technology to palm oil mills. In developing a business model, the value proposition outlined is essential to note, primarily related to the business benefits obtained by the company and the environmental benefits obtained by the community around the plant. Collaboration or Cooperation with stakeholders related to the palm oil industry is one of the essential steps that need to be

implemented in running the PNB technology business to market the technology to consumers, primarily palm oil mills.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The results of BMC's analysis have revealed the entire business process that occurred when this business was run. The value proposition in efforts to develop PNB technology is: 1) PNB technology can be an effective and efficient POME waste treatment by reducing COD, BOD and TSS, 2) there is an increase in efficiency in POME waste management, and 3) PNB technology is an innovation that can help Palm Oil Mills (PKS) to comply with environmental regulations. Therefore, there is an important contribution related to the environmental benefits of implementing this business. The continuous development for this technology must be implemented to processing POME waste effective and efficient, respectively.

Recommendations

There are a number of suggestions resulting from this research, namely: 1) developing further research by analyzing the advantages and disadvantages of implementing PNB businesses, 2) analyzing the behavior of using environmentally friendly technology by PKS to find out the determinants, and 3) analysis before and after implementing PNB technology needs to be done to increase the urgency for PKS to utilize PNB technology.

ACKNOWLEDGEMENT

The author would like to thank the Indonesian Ministry of Research, Technology and Higher Education through the Kedai Reka 2023 Matching Fund for funding the development of PNB technology. Furthermore, the author also would like to thank for manager in PT XYZ as a collaborative partner in this research program.

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