REENGINEERING THE NEW PRODUCT DEVELOPMENT ON BIEICHI TECHNOLOGY – A TECHNOLOGY WHICH CONVERTS PLASTICS INTO FUELS

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ABSTRACT: The purpose of this study was to identify activities involved in implementation of reengineering in new product development process on Bieichi technology. The process consisted of ways in which Bieichi technology could be reengineered and developed in Malaysia. The study used a case study through semi-structured interview sessions with 16 respondents from Ministry of Science, Technology and Innovation (MOSTI), National Solid Waste Management Department (NSWMD) and Syngas Sendirian Berhad (Syngas Sdn. Bhd). The findings yielded that there have 7 process the organizations could use to turn their ideas in reengineering on Bieichi technology into a potential valuable product in the future. Moreover, this study provides guidelines to developers in the development of Bieichi technology. Future study should analyze Bieichi technology in terms of challenges and it's commercialize values in Malaysia in order to ease the implementation of Bieichi technology in Malaysia in the future.

KEYWORDS: *Activities; Product Development; Re-engineering; Malaysia; Bieichi Technology*

1.0 INTRODUCTION

In the recent years, the numbers of new products that been produced were increased dramatically due to the firms have realized the importance of new products for their business. Most of the firms force to produce and launch new products frequently due to the economic

growth, technological progress, high standard of living, increasingly pressure from global and local competitor and also product life cycles that occur in the market [1-3]. Therefore, to ensure firms can produce new product frequently and remain competitive in this competition, most of firms have strategies their product development time by reducing cycle time in producing and launching new product to their customer [4].

Generally, to develop a new product, New Product Development (NPD) process will be employ in producing and delivering new products into the market. The NPD process can be defined as a template or maps which consist of several activities and process for guiding firms in bringing a new product from an idea into market launch [1, 5]. The manner original NPD model (Figure 1) consists of 7 steps such as; New Product Strategy; Idea Generation; Idea Screening; Concept Development and Testing; Business Analysis; Product Testing; and Commercialization [5].

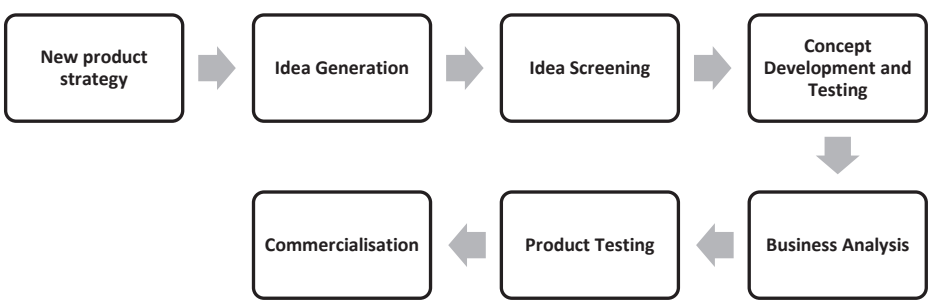

Figure 1: NPD process [5]

In producing new product, firms will follow all stages that have in NPD process. However, to design, develop, and launch a total brand new products to the market will take many years as firms need to understand new requirements from their customer [1, 6-8]. Therefore, it will take around 1 - 3 ½ years for a firm in developing a new product either to the world or to the firm [9].

To reduce cycle time in producing new products, many firms have implemented re-engineering concept to their product development process. The nature of re-engineering is to improving or transforming existing products and make the products better than before with

minimum design and production costs [10-11]. In addition, the firms will redesign several parts that have in order to ensure the products can be produce in large quantities in manufacturing process.

The use of reengineering strategy on NPD process is important in product development. Through this process, it will help Research and Development (R&D) based organizations to adapt changes in market and technology for competitive advantage in a speedy [12]. As such, this study used the model of NPD process in determining activities that have if re-engineering process being implement. Besides, this implementation will be link with development of existing technology in Japan which is Bieichi technology where the researcher will identify how this technology can be produce in Malaysia.

Bieichi or Be-H (Figure 2) is a clean technology that has been developed by Blest Corporation (Blest Co.) in Japan. The technology can convert different types of plastics such as polypropylene (PP), polyethylene (PE) and polystyrene (PS) into crude oils [13]. Moreover, these crude oils can be processed again using heating process to produce gasolines, diesels, and kerosene [14] (Figure 3). This technology used simple principled technology such as thermodynamic and condensation to produce oils.

The technology has been developed to reduce negative effect of plastic waste such as uncontrolled management of plastic wastes in landfills, benzene dioxin, and plastics entanglement [15]. Moreover, the technology can be used for educational purposes where it can educate society to handle their plastic waste efficiently after use [13]. Therefore, the advantages have raised the needs to study activities involved in reengineering new product development process on Bieichi technology. If this effort is successful, developer in clean technology industry can develop Bieichi technology in Malaysia and then the society will benefit in which it can handle its plastic waste efficiently and at the same time reduce negative effects from plastic wastes. Moreover, environment in Malaysia will be clean from the plastic wastes in the future.

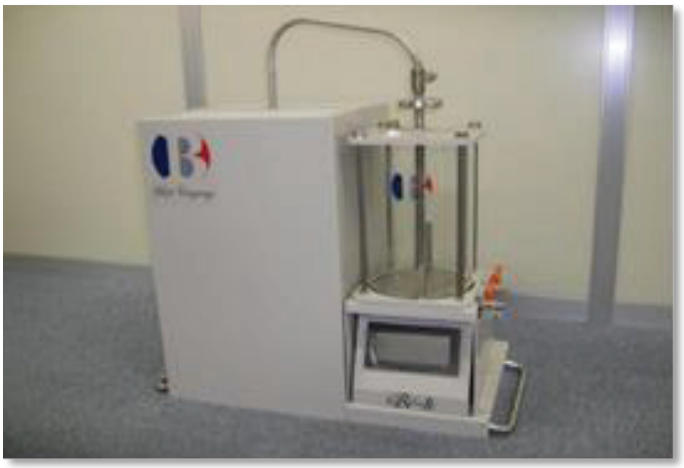

Figure 2: Bieichi technology

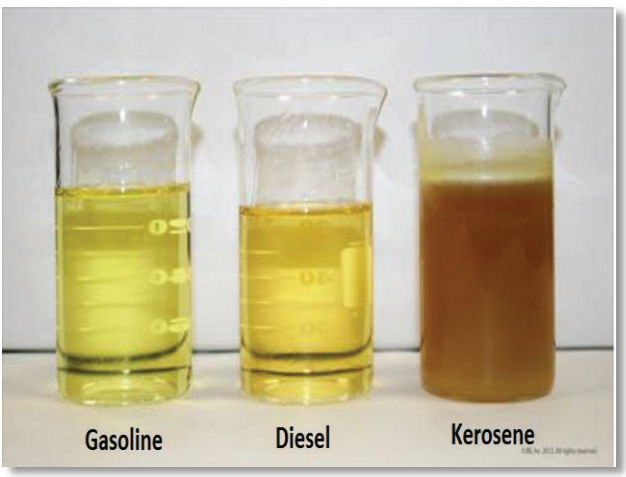

Figure 3: Fuel produced by Bieichi technology

2.0 METHODOLOGY

2.1 Data Collection

A case study through semi-structured interview sessions was utilized for this study. This case study was conducted in the Ministry of Science, Technology and Innovation (MOSTI), National Solid Waste Management Department (NSWMD) and Syngas Sendirian Berhad (Syngas Sdn. Bhd). A qualitative-based research is associated with interpretive philosophy [16-17]. Therefore, semi-structured interview method was used in this study to gain deeper insights among

respondents. In this study, 16 respondents were chosen through judgmental sampling. Table 1 shows the list of respondents:

Table 1: List of respondents

Respondents	Organization	Position
1	MOSTI	Executive 1 for Commercialization
2	MOSTI	Deputy Secretary of Commercialization
3	MOSTI	Executive 1 for fund division
4	MOSTI	Executive 2 for Fund Division
5	MOSTI	Executive 3 from Fund Division
6	MOSTI	Executive 4 from fund Division
7	MOSTI	Principal Assistant Secretary
8	MOSTI	Assistant Chief Secretary
9	MOSTI	Assistant Secretary 1
10	MOSTI	Assistant Secretary 2
11	MOSTI	Assistant Secretary 3
12	MOSTI	Deputy Secretary of Industry Division
13	MOSTI	Science Officer 2
14	NSWMD	Administrative Assistant Secretary
15	NSWMD	Administrative Executive
16	Syngas Sdn. Bhd	Sales Executive

2.2 Data Analysis

The interview data were analyzed by adopting explanation building method. Explanation building method is a deductive process for analyzing qualitative data that involves the iterative examination of a number of strategically selected cases to test a theoretical proposition [16]. Therefore, this study will test theory that have with the findings. Then, an explanation will be given for each finding.

3.0 RESULTS AND DISCUSSION

This section discussed and analyses finding for this study. According to [5], there have 7 stages in producing new products such as New Product Strategy; Idea Generation; Idea Screening; Concept Development and Testing; Business Analysis; Product Testing; and Commercialization. Therefore, Sections 3.1 until 3.7 discussed the activities that have in development of Bieichi technology in Malaysia.

3.1 New product strategy

A new product strategy draws managers' attention to reasons or rationales behind the organizations' search for innovation opportunities, product/market and technology in a speedy can to focus on, major goals or objectives (market share, cash flow, profitability, etc.) to be achieved and guidelines on the nature or level of innovativeness that will sell new products [18].

Respondent 4 and Respondent 12 stated that problem and objectives that had been identified before developing Bieichi technology would guide developers prior to development task. The problem statement reflected the customers' needs in the market since this is an industrial technology. Then, the objectives would provide a focus area for developers on the Bieichi technology. Once the developers determined which area to focus on and how to fulfill customers' needs, then they could develop plans on how to develop the technology in the next stage.

3.2 Idea Generation

Idea generation is the process where product team will make some analysis in order to find a few good ideas for new products [18]. Ideas can be generated whether from internal or external sources [5,18]. Here, the idea of technology can be obtained and evidenced. The product can be developed through reverse engineering.

Respondent 16 asserted that idea generation involved analyzing different kinds of plastics and the output from each of the plastic was the best way to generate ideas. Each of the outputs could generate few ideas on how Bieichi would look like in the future. Moreover, Respondent 16 also claimed that by analyzing the plastics, developers could find suitable process to melt the plastics.

Blest Co. had the idea for developing Bieichi technology when the company found that fuels had been used in producing plastics [14]. Moreover, the company also found that by using Japan technology, the plastics could be converted back into fuels. Therefore, a research was conducted by the company to find the most suitable type of plastics and process to produce the fuels. In short, analyzing type of

plastics and process to produce fuels are some of the best ways to generate ideas for this stage. Through these activities, the developers will acquire hundreds of ideas on these processes. Then, these ideas will help the developers on how to develop Bieichi for the next stages.

3.3 Idea Screening

The objective of the idea screening process is to eliminate ideas for new products that could not be profitably marketed by the organizations, and to expand viable ideas into full product concepts [19]. This stage is important in NPD process because the success or failure of NPD depends on the activities that have been implemented in this stage prior to the development process [20]. Thus, the developers need to be cautious in this stage.

Respondents 3 and 5 highlighted that, in the screening stage, ideas that were not viable were eliminated in this stage. Moreover, Respondent 5 also mentioned that, basically, in idea generation, the developers would generate hundreds of ideas. However, from hundreds of the ideas, only few of the ideas were used for some of the ideas were not realistic and impossible to be achieved in the development stage. Therefore, the screening was conducted to eliminate ideas for example, plastics which could not be converted to fuels.

From 7 types of plastics, only 5 types can be converted into fuels; Polyethylene Terephthalate (PET), High Density Polyethylene (HDPE), Low Density Polyethylene (LDPE), Polypropylene (PP) and Polystyrene (PS). Another 2 types which are Polyvinyl Chloride (PVC) and Unallocated References cannot be converted into fuels for these types are not easily melted [21]. To melt plastics into fuels, a technology that uses thermodynamic and condensation process was used. This technology or process can produce fuels from plastics and at the same time it will not produce dangerous chemical such as benzene dioxin [15].

In general, by eliminating plastics or process that are not suitable for Bieichi, the developers can focus more on the remaining plastics or processes for the next stages. Moreover, in developing the new technology, developers need to reduce their cost as much as possible.

Therefore, by choosing and focus more in the best ideas which guided by Bieichi on simple principled technology such as thermodynamics and condensation process, they can cut costs in developing Bieichi. Hence, this can reduce the probability of failures because the plastics or process are not realistic for Bieichi.

3.4 Concept Development and Testing

A product concept is a concept which can be subjected to test more than an idea [5]. The product team developed the product concept using left ideas in the idea screening. These ideas were combined together to create the product concepts. Then, in the concept testing, the product teams selected few groups of potential buyers and determined the customers' reactions. The potential buyers evaluated the product concepts that had been made by the product teams. In the product concept testing, the product teams must determine the view from customers and the product teams could not reject them [22].

Respondent 9 admitted that in this stage, the developers must ensure the given ideas could be turned into concepts. If the ideas were only ideas, the projects could not proceed. However, if the ideas could, indeed, be turned into a concept but it could not be proven in reality, this concept would also fail. Then Respondent 16 added that, in concept development, the chemists, engineering and business teams would sit together to find a solution on how to convert the plastics into the fuels. After they found the concept to produce the fuels, the developers tested the concept to the public in order to get their acceptance or rejection of this technology (Respondent 13).

Then, the company would demonstrate the concept to the certain groups of customers. The customers were shown on how the plastics could be converted into fuels [14]. In the end of the demonstration, the company would ask the feedback from customers regarding this concept. Then, this feedback was used to improve the products in the future.

In general, developing for and testing the simple principle technology concepts to the target customers are essential activities in this stage. Feedback from customers is indeed essential to improve Bieichi technology concept prior to the development process.

3.5 Business Analysis

Business analysis involves a review of the sales, costs and profit projections for new products to ascertain whether these factors complement organizations' objectives [18]. In this stage, the organizations will decide whether to 'go-no-go' with the product concept. The organizations, basically, will conduct a business analysis in order to decide whether they will continue developing the product or terminating the development of the product and starting a new one.

Respondent 11 and Respondent 12 stressed that in business analysis, the developers must analyses cost for developing and selling Bieichi to the customers. If the cost for developing Bieichi was too expensive, the developers had to cancel the development. The cost would affect the price which in turn made customers changed their mind in purchasing the product. Moreover, to ensure other agencies wanted to purchase Bieichi after being developed, the developers must reveal the cost of this technology (Respondent 14). For example, the latest price for Bieichi technology is US$10,000/set (4/2016) and this price is based on FOB Yokohama, Japan [13].

Based on the interview, analysis of the costs for developing Bieichi is an important activity at this stage. These costs will determine whether developers should continue or cancel the development of Bieichi for the next stage. Moreover, this analysis could reduce potential for plastics waste reduction.

3.6 Product Testing

The purpose of product testing is to reduce risks further in the decisions leading to the product launch [5]. When the prototypes are ready, the organizations must have rigorous functional tests and consumer tests [23]. Then, the prototype will run through all the desired tests, and it will be presented to the target audience to see if changes need to make.

Respondent 5 asserted that, after Bieichi was developed, the developers had to test the technology to the target market in order to demonstrate whether the technology can be functional as planned.

Respondent 15 also suggested that a suitable place for this product testing could be made at landfills or households.

Bieichi could process PP, HDPE and PS types [13]. From the study PP and HDPE are converted to oils, which contained gasoline equivalent, kerosene equivalent, diesel equivalent and heavy oils. These oils are called the "Mixed Oil". Then, the PS oil contains styrene monomer, styrene dimer and styrene trimmer. PS oil can also, be used as assistant fuels or if the users purify the PS oil, Styrenemnomer rich is produced, which is a raw material for plastics.

In general, the developers can analyses whether the Bieichi can be functional as previously planned. Moreover, by testing Bieichi in front of customers or focus groups, the developers can analyse the reactions from their customers. These reactions will show to the developers whether their target customers are accepting or rejecting the technology.

3.7 Commercialization

In this stage, firms will introduce a product onto the market [19]. There are two processes for introducing new product onto the market [5]; test marketing and launch. In the test marketing, management team will go outside of the organizations and submit the product candidate for customers' approval [19]. The marketing team will analyses whether the product can be a success or failure. If the marketing tests are successful, the organizations will launch the product onto the national level.

Respondent 1 commented that, in this stage, the activities involved identifying the target market for Bieichi. The target market must be among customers that want to use it for daily use (Respondent 15).

Then, Respondents 7 and 8 articulated that, in order to ensure the developers succeeded in commercializing Bieichi to the public, the developers had to attend training on how to commercialize their products. Therefore, this will help the developers to succeed in commercializing Bieichi. Then, Respondents 2, 3, 10, and 6 stated that after preparations had been made, Bieichi could be launched onto the

market. Any suitable marketing programs could be devised by the developers in order to attract target customers to purchase Bieichi.

In summary, by identifying the target markets and attending training programs before commercializing Bieichi will help the developers to succeed in the market. Moreover, few marketing plans should be devised prior to the launching of Bieichi onto the industrial technology market.

4.0 CONCLUSION

In conclusion, reengineering new product development process is one of the models that help developers to reengineer and develop new products in the markets. Through this model, the organizations can turn their ideas in developing Bieichi into the potential valuable products in the future. Besides, the result also yields that important stages to increase the success rate in developing Bieichi technology are business analysis, product testing, and commercialization. This study provides guidelines to developers in the development of Bieichi technology. Future study should analyze Bieichi technology in terms of challenges and it's commercialize values in Malaysia in order to ease the implementation of Bieichi technology in Malaysia in the future.

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