

# Designing Business Model and Implementation of Sustainability Evaluation Model for B20 Biodiesel Machinery Industry

Arman Hakim Nasution<sup>1,\*</sup> Dewie Saktia Ardiantono<sup>1</sup> Caesaratna Bunga Dwi Agusti<sup>1</sup>

<sup>1</sup>*Department Business Management, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia*

<sup>\*</sup>*Corresponding author. Email: armanhakim.nasution@gmail.com*

## ABSTRACT

Biofuel is an alternative energy for fossil fuel. Indonesia has oil palm as the main commodity that can produce biofuels, especially biodiesel. Indonesia has implemented B20, 20% biodiesel and diesel. On September 1, 2018, Indonesia has carried out mandatory B20 with the aim of reducing fossil oil imports. So that it requires the support of a diesel engine that is compatible with B20 fuel. In the previous research, it was stated that the increase in biofuel utilization was followed by the sale of machinery with modifications. Therefore, the B20 biodiesel machinery industry has market opportunities. This research was conducted to performance management to identify strategic targets and sustainable performance indicators. This study translate BMC to BSC to identify strategic objectives, and fulfill SEM to identify sustainable performance indicators. The design of the BMC was obtained by the value proposition by offering a low emission B20 biodiesel fuel engine to support the government in maintaining energy security by utilizing B20. In the customer section, the machining industry is obtained trying to maximize customer satisfaction by improving quality and service. In the infrastructure section, the machinery industry seeks to focus on employees to achieve company goals. This study obtained 21 strategic objectives and 39 sustainability performance indicators. The managerial implications are aimed at the B20 biodiesel machinery industry which can then be used to reach the market.

**Keywords:** *biodiesel engine, business model canvas, sustainability, sustainability performance indicator*

## 1. INTRODUCTION

Issues related to energy security are becoming a global problem. Alternative energy in the form of bioenergy as renewable energy is one of the solutions to reduce import pressures and overcome the threat of energy security [1]. One of Indonesia's main commodity products capable of producing bioenergy is palm oil, especially biodiesel. This is because biodiesel is an alternative to diesel fuel that can be directly used in diesel engines with a slight modification [2].

Indonesia has developed biodiesel and implemented B20, a mixture of 20% biodiesel and 80% diesel. On September 1, 2018, the Indonesian government conducted a B20 mandatory. In supporting the mandatory B20, diesel engine support that is compatible with B20 fuel is needed. For example, Brazil is the second largest producer of bioethanol fuels and the largest exporter in the world by producing flexible-fueled vehicle engines.

B20 testing on diesel engines with the coordinator of the Directorate General of New Renewable Energy and Energy Conservation (DJ EBTKE) has been carried out. The implementation test is carried out on motorized vehicles and heavy equipment. Based on the test results, there are no problems that occur with the use of B20 and

there are no significant changes in the performance of vehicles using B20. In this test also obtained CO, NOx, and HC emissions at B20 lower than B0, while particulate and opacity tend to be the same [3]. While the test on the train obtained good results, the test locomotive engine using B20 can reach its maximum power, CO exhaust emissions are lower than the use of B0, and the injector and filter are declared no problem. However, there is a drawback that the difference in fuel consumption between diesel and B20 has a range of 1-3%. In the mining sector constraints are obtained, namely the price difference between diesel and B20, machine warranties from heavy equipment manufacturers are only recognized for a maximum of B7, maintenance and storage of biodiesel requires special treatment where a biosolar storage period is recommended 3 months [3].

High demand from B20 due to mandatory policies and international demand due to concerns about fossil supply, but there are also problems in the market drivers for the biofuel industry in Indonesia, namely changes (technological innovation, way of life, socio-politics, and economic situation), customers, industry biofuels, and competition [4]. One of the main problems felt by consumers of B20 is the use of B20 is more often done filter replacement. Nevertheless, market demand for B20 is supported by sales of diesel engines that are compatible with B20 [5]. Although there are many European and

American car manufacturers certifying the use of biodiesel in their diesel engines, they are very strict on their standards and most of them do not provide service guarantees for the use of the Indonesian B20. So a special biodiesel engine marketed by local producers will increase user confidence. There are three approaches to building a special biodiesel engine [5]. First, the process of producing biodiesel with high yields will reduce the price of biodiesel. Second, modification of the fuel property will reduce the adverse effects on the engine. Third, good engine modification by design and adding new materials. Therefore, making diesel engines that are compatible with B20 is important in supporting the success of the B20 mandatory policy so that there is an opportunity for the B20 biodiesel machining industry.

In facing the opportunity of the diesel engine market that is compatible with B20, the Indonesian machinery industry needs to arrange sustainable performance management as a plan of action in achieving organizational goals. The preparation of strategic objectives is carried out by translating Business Model Canvas (BMC) to Balanced Scorecard (BSC). Then do the Triple Bottom Line (TBL) correlation dimensions and BSC perspective on Sustainability Evaluation Model (SEM) to obtain sustainable performance indicators. Sustainable development indicators based on the TBL approach that have been widely accepted, there are three dimensions namely social, economic, and environmental. Govindan et al. [6] states the importance of a balance between economic, environmental and social dimensions in a company through the correlation of performance and TBL dimensions. Previous research on BSC design with various approaches, integration of BMC and BSC, and integration of BSC and sustainable development has been carried out. Social and environmental problems are problems currently faced by the industry. Therefore, a sustainable development approach is needed to overcome social and environmental problems. The researcher believes that there is an opportunity to conduct exploratory research on the design of the BSC to set strategic objectives and indicators of sustainable performance. This study translates BMC to BSC. Next, determine the indicators of sustainable performance by meeting the sustainability evaluation model, which correlates the TBL dimension and BSC perspective that was initiated by Junior et al. [7]. The purpose of the sustainability evaluation model is to increase the scope of sustainable assessments by considering social and environmental responsibility and actions that seek to maintain the company's competitiveness in the market.

## **2. LITERATURE REVIEW**

### ***2.1 Translate BMC to BSC***

The strategy map needs to be prepared in order to bridge the gap between the real conditions of the company's achievements and those expected in the future by

synthesizing nine building blocks or BMC elements with a perspective on the BSC [8]. The top of the strategy map, the company's vision and mission are included in the top of the strategy map. Although the vision and mission are not included in the BMC section, the vision and mission are important items in the implementation of business models and strategies. In this section it is also necessary to include the Value Proposition given to the customer based on the customer segment.

Second is the financial perspective. In this perspective, the financial planning covers how the company obtains revenue sources (Revenue stream) and corporate planning in its expenditure (Cost structure). Finance becomes an important benchmark in summarizing the economic consequences of the actions taken by the company.

Third is the customer's perspective. In this perspective contains the development of Value propositions aimed at customers (Customer segments) so that also thought about relationships with customers (Customer relationships). The customer perspective articulates matters relating to customers and the market that will benefit the company including measuring the VP that the company submits to consumers in certain market segments.

Fourth, namely the perspective of internal business processes and the perspective of suppliers and partners. From an internal business process perspective, managers identify critical processes that must be carried out to meet consumer demand. This was derived from the expectations of external parties. These things are depicted in the KA, KP, Ch, and CS blocks in BMC as details of implementing business processes and operational activities carried out by the company.

Fifth is the perspective of learning and growth. In this perspective, it discusses matters that are directly related to the organization, namely strategies in realizing superior performance in general, including investments in HR, systems and processes in building organizational capabilities so that BMC blocks are able to become part of the learning & growth perspective.

The sixth is the bottom of the strategy map. At the bottom of the strategy map is the core values or core values of the company is the beliefs and principles that govern organizational behavior and support the implementation of the company's business model.

### ***2.2 Sustainability Evaluation Model***

In the current era, the development of the world industry is developing rapidly causing the level of competitiveness between companies to be tighter, the higher the public demand for sustainable concept considerations. Indicators that represent the concept of sustainability are the Triple Bottom Line (TBL), social, environmental and economic dimensions. This requires every company to have performance in accordance with standardization in achieving organizational goals in realizing the objective strategy of the organization. Therefore, the concept of integration of performance and sustainability is proposed. Junior et al. [7] build a model for manufacturing systems

based on TBL correlation and BSC perspective. The model is then called the Sustainability Evaluation Model (SEM). In constructing the SEM model, Junior et al [7] adopted from the criteria review model on corporate sustainability, Sustainability Balanced Scorecard (SBSC) strategy maps, and Springboard for Sustainable Enterprise Excellence (SEE).

The proposed model adopts the SBSC model. For the results of the strategy the organization adopts from the governance model proposed in the SEE model. In SEM it connects the four BSC perspectives with three TBL dimensions. The correlation between the three dimensions of TBL and the BSC matrix resulted in 12 correlations. The correlation between growth and learning perspective and TBL dimensions results in attractiveness, recognition and company reputation. Then, the correlation between process perspective and TBL dimensions results in productivity, social and environmental regulatory compliance. The correlation between market perspective and TBL dimensions results in QCDI (quality, cost, delay, innovation), social and environmental impacts. Furthermore, the correlation between financial and TBL dimensions results in profitability, social investment and the environment.

The achievement of 12 proposed correlations ensures the fulfillment of the correlation between TBL dimensions and BSC perspectives. This application shows that the 12 correlations of the TBL X BSC matrix allow for a comprehensive and detailed evaluation of the manufacturing system, because it involves the TBL dimension and BSC perspective, and allows indicator definitions for each correlation. This model can also be useful for determining performance indicators for the sustainability assessment model and can be integrated into multi-criteria decision methods to improve sustainability and organizational performance.

<i>Sustainability Evaluation Model (SEM)</i>				
Perspective Dimension	Learning and growth	Process	Market	Financial
Economic	Attractiveness	Productivity	Quality, cost, delay, innovation (QCDI)	Profitability
Social	Acknowledgement	Social legislation compliance	Social impacts	Social investment
Environmental	Company's reputation	Environmental legislation Compliance	Environmental impacts	Environmental investment
Strategy and Governance	Attract, develop and retain people	Meet good practices and legislation	Meet customer needs and expectations	Achieve sustainable profitability

**Figure 1** Sustainability Evaluation Model

### 3. RESEARCH METHODS

There are three stages in research that are case studies in the B20 biodiesel machining industry, namely the first stage is the identification of strategic targets in the B20 biodiesel machining industry, the second stage is the identification of performance indicators, and the third stage is the identification of sustainability performance indicators by fulfilling the Sustainability Evaluation Model (SEM).

### 4. DATA COLLECTION AND DATA ANALYSIS

#### 4.1 BMC of B20 BIODIESEL MACHINERY INDUSTRY

The BMC formula is shown in the value proposition, namely the B20 fuel engine, service and spare parts sales. In the customer segment blocks, they are the transportation sector, security and resilience sector, industrial sector, and electricity sector. In the customer relationship block, namely personal assistants, service centers, communities, advertising media, websites, and social media. The channel blocks are open tenders, BUMN synergy, delaeer, and exhibition. Then in the infrastructure section, the key activities are research and development, procurement, production, sales and marketing, after sales service, and employee training. The key resource blocks are spare parts, equipment, employees, knowledge and skills resources, and capital. In the key partners block, they are design and production partner companies, spare parts material suppliers, government, and universities. In the financial sector, revenue streams include sales, service services, and spare parts sales. The cost structure block includes development costs, fixed costs, operational costs, supplier development costs, employee training costs, employee salaries, and social and environmental investment.

#### 4.2 Translate BMC to BSC

In determining sustainable performance indicators, the initial stage is to identify sustainable performance indicators by reducing nine BMC blocks from the BSC perspective. BMC translation at BSC is done to design an action plan in achieving company goals. In translating BMC to BSC, it starts with defining strategic objectives derived from the design of the BMC B20 biodiesel machining industry. The translation of BMC to the BSC perspective is explained as follows:

##### 1. Financial

In the financial perspective contains the revenue stream and cost structure. The revenue stream from BMC in the machinery industry is the sale of fuel engines, spare parts

sales, and service services. The industry has a goal to increase revenue every year. So it can be concluded as a strategic goal that is to increase revenue on an ongoing basis.

The cost structure in the BMC design of the machinery industry includes development costs, fixed costs, variable costs, employee training costs, employee salaries, environmental investment costs, supplier development costs, and social investment costs. To be able to maximize customer satisfaction is necessary to minimize costs to be paid by customers in order to obtain an affordable price. Environmental investment costs, social investment costs, and supplier development costs represent social and environmental investment by the machinery industry. So, from the financial perspective three strategic objectives are obtained namely increasing revenue in a sustainable manner, creating cost efficiency, and increasing social and environmental investment.

## 2. Customer

In the customer's perspective contains the value proposition, customer segments, and customer relationships. The value proposition of the machinery industry is to offer a fuel engine capable of consuming B20, spare parts, and service. The machinery industry in offering products continues to develop to answer the needs of customers and adjust to existing changes, such as the availability of fuel. So it can be concluded as a strategic target that is to improve the quality of the B20 biodiesel engine. It added that the industry has a responsibility to the environment and has a role in increasing the use of B20. So it can be concluded as a strategic target that is increasing the environmental impact of the use of biodiesel B20. The industry also has a social responsibility by creating products that have an impact on local communities, such as increasing the level of local content and increasing the economic added value of oil palm plantation companies. So it can be concluded as a strategic target that is increasing the social impact of using B20 biodiesel. In service, the time it takes for customers to service, customers experience the sacrifice of time, cost, and opportunity to use the B20 biodiesel engine. The faster the duration of service time the less sacrifice customers can maximize customer satisfaction. So that it can be summarized as a strategic goal of increasing service time. Customer segments in the machinery industry are categorized into two, categories based on sector and ownership. The machinery industry needs to meet the needs of its customers so as to achieve customer satisfaction. So it can be concluded as a strategic goal that is increasing customer satisfaction. Customer relationship is a relationship that is established by the company with customers in two directions. From the customer's point of view, customer relationship will improve the company's image, by helping to solve problems through service. Professional service will maximize customer satisfaction followed by increased customer loyalty. So it can be concluded as a strategic goal that is increasing customer loyalty. On websites, advertising media, and social media

can be information media from industry to customers to increase customer awareness of the need for a B20 biodiesel engine. So it can be concluded as a strategic target that is increasing customer awareness of the B20 biodiesel engine.

## 3. Internal Business Process

In the perspective of internal business processes include key activities, key partners, channels, and cost structures. Key activities and cost structures are interrelated in creating operational costs. The first activity of the machinery industry is research and development to design the B20 biodiesel engine. So that it can be a strategic target that is to increase the development of the B20 biodiesel engine. The second activity is procurement, in the procurement of components and spare parts the selection of components and spare parts is carried out with the 3R principle. So it can be concluded as a strategic target that is increasing the use of components and spare parts with the 3R principle. Poor procurement activities can hamper further industrial activities, namely producing B20 biodiesel engines. So it is necessary to improve the procurement system. So it can be concluded to be a strategic target that is to improve the procurement system. The third activity is production, to be able to increase the number of products produced can be done to increase productivity. This also relates to the cost structure, which is how much it costs to produce a product. So it can be concluded to be a strategic target that is increasing productivity. In operational activities, the machinery industry considers environmental issues to create environmentally friendly operational activities. So it can be concluded as a strategic goal that is creating an environmentally friendly business process environment. The fourth activity is after-sales service, in the after-sales service there is a relationship with customers in helping to solve customer problems for the B20 biodiesel engine. To be able to maximize customer satisfaction requires satisfying service delivery. So it can be concluded to be improving services.

The fifth activity is sales and marketing. This is also related to the channel block of the machinery industry which is the way the industry conveys the value offered, namely open tenders, BUMN synergy, dealers, and exhibitions. In sales and marketing activities have the aim to increase sales by increasing market share. So it can be concluded as a strategic target that is increasing market share.

Key partners from the machinery industry, especially partners who support production activities, namely material supply companies. To obtain quality products obtained from quality materials. Added to being able to enhance product development, collaboration with strategic partners is needed. So it can be concluded that the strategic goal is to increase the number of strategic partners.

#### 4. Learning and Growth

Learning and growth perspectives include key resources and cost structure, especially in human resources. Employees are the main assets of the company in producing quality products. Increasing employee commitment will increase employee productivity. So it can be concluded as a strategic goal that is increasing employee commitment. Employee training and development is important to improve the ability of employees to produce quality products. So it can be concluded to be a strategic goal that is increasing the ability of employees.

In the cost structure there are costs for employee salaries as employee performance wages provided by the company. Providing employee salaries in accordance with the performance of employees will increase employee satisfaction. So it can be concluded to be a strategic goal that is increasing employee satisfaction.

#### 4.3 Preparation of Corporate Level Strategy Maps

The strategy map or strategy map that has been designed shows a comprehensive and coherent relationship between each strategic objective in the four BSC perspectives. The top linkage to the strategy map is to increase long-term shareholder value. To achieve this goal, a non-financial perspective is needed as a driver for improving financial performance. On the strategy map, it can be seen that learning and growth encourage the success of strategic objectives from the perspective of internal business processes, which can then drive performance to the customer's perspective, and have an impact on the financial perspective.

##### 4.4 Identification of Performance Indicators for B20 Biodiesel Machinery Industry

The identification of performance indicators was obtained from the reduction of BMC to BSC, and secondary data, namely the Doosan Infracore integration report and Toyota's ongoing report. The following is an identification of performance indicators in the B20 machinery industry:

1. Increase revenue continuously  
Increasing revenue on an ongoing basis can be measured by a percentage of the level of income growth
2. Creating cost efficiency  
Creating cost efficiency can be measured by the ratio of the level of operating expenses
3. Increase social and environmental investment  
Increased social and environmental investment can be measured by the ratio of the cost of social contributions, the ratio of investment costs to supplier development, and environmental investment namely the ratio of tree planting costs [8] and the cost ratio of creating a clean environment in the local community [9].
4. Improve the quality of biodiesel engines

Improving the quality of the B20 biodiesel engine can be measured by the number of complaints using the B20 biodiesel engine.

5. Increase the environmental impact of using B20 biodiesel  
Increasing the environmental impact of using B20 biodiesel has lower emissions compared to diesel. So the performance indicator on this strategic target is the percentage of the amount of fuel emissions of the B20 biodiesel engine in the engine test.
6. Increase the social impact of using B20 biodiesel  
Increasing social impact can be achieved by increasing product development that has an impact on social welfare, such as the use of local components and spare parts by increasing local content on the products offered because it can increase added value to the local industry. So it can be concluded as a performance indicator that is the percentage absorption rate of local components and spare parts (TKDN). The use of the B20 biodiesel engine will increase the utilization of B20 which will be followed by the absorption of palm oil as raw material for biodiesel. So as to increase the economic added value of oil palm plantations. So it can be concluded to be a performance indicator that is the percentage increase in economic value added of oil palm plantations.
7. Increase customer satisfaction  
Improving customer satisfaction can be measured by the customer satisfaction index through the distribution of questionnaires.
8. Increase customer loyalty  
Increasing customer loyalty can be measured by the percentage of customer retention, namely how many customers reorder.
9. Increase customer awareness of the B20 biodiesel engine  
Increasing customer awareness of the B20 biodiesel engine can be measured by the number of website visitors and the number of followers on social media which is assumed to convey information to the public.
10. Increase the development of the B20 biodiesel engine  
Increasing the development of B20 biodiesel engines that can meet customer needs can be measured from the percentage growth rate of B20 biodiesel engine sales
11. Increase the use of components and spare parts with the 3R principle  
Increasing the use of components and spare parts with the 3R principle can be measured by the percentage of the level of components and spare parts with the 3R principle.
12. Improve the procurement system  
Improving the procurement system can be measured by the percentage of the number of goods on time and the percentage of the number of goods in accordance with demand.
13. Increase productivity  
Increasing productivity can be done by optimizing non-productive assets by measuring the asset turnover ratio.

14. Improve the environment of environmentally friendly business processes  
Improve the environment of environmentally friendly business processes, according to Doosan Infracore Integrated Report [9] including the percentage of the amount of greenhouse gas emissions, the percentage of the amount of air pollutant emissions, the percentage of the amount of water pollutant emissions, the percentage of the amount of waste disposal, and the percentage of recycling rates waste.
15. Improve service  
Improving service can be measured from the value of employee services.
16. Increase service time  
Increasing service time can be measured by the duration of service time
17. Increase market share  
Increasing market share can be measured by market share.
18. Increase the number of strategic partners  
Increasing the number of strategic partners can be measured by the number of contracts with strategic partners.
19. Increase employee commitment  
Increasing employee commitment will increase employee productivity. Increasing employee commitment can be measured by the percentage of employee turnover.
20. Improve the ability of machine assembly in employees  
Improving the ability of employees can be measured by the amount of employee training.
21. Increase employee satisfaction  
Increasing employee satisfaction can be achieved with indicators increasing employee salaries and benefits. Employee salaries are nominal expected by prospective employees and employees as payment after performing their duties and showing their performance in the company. Improving employee satisfaction can be measured by the ratio of salaries and employee benefits.

#### **4.5 Identification of Sustainable Performance Indicators in the B20 Biodiesel Machining Industry**

This section answers the third objective of the research, namely the identification of sustainable performance indicators on the correlation between TBL dimensions and the BSC perspective on the Sustainability Evaluation Model (SEM). This correlation produces 12 correlations. Fulfillment of the correlation is done from the decline in performance indicators that have been identified previously and added from the Doosan Infracore company report, as well as literature studies. In fulfilling SEM, there are additional indicators of sustainable performance in the perspective of learning and growth, namely the employee satisfaction index and the percentage of risk mitigation

activities carried out from a risk analysis. SEM fulfillment can be seen in table 1.

## **5. CONCLUSION**

The strategic target of the B20 biodiesel machining industry is obtained by translating BMC into the Balanced Scorecard (BSC). This study obtained 21 strategic objectives. In the financial perspective there are 3 strategic goals, 7 strategic targets on the customer perspective, 8 strategic targets on the internal process of business perspective, and 3 strategic targets on learning and growth. Identification of sustainable performance indicators of the B20 biodiesel machining industry by fulfilling 12 Triple Bottom Line (TBL) dimension correlations and BSC perspective on the Sustainability Evaluation Model (SEM) obtained 33 indicators of sustainable performance. Suggestions given based on the results of the study are intended as a form of recommendation for the B20 biodiesel machinery industry, biodiesel producers, and the government related to the development and utilization of biodiesel, as well as suggestions for further research.

## **REFERENCES**

- [1]. R. Dutu, "Challenges and policies in Indonesia's energy sector", *Energy Policy*, vol. 98, pp. 513-519, 2016. Available: 10.1016/j.enpol.2016.09.009.
- [2]. EBTKE, "Sosialisasi Kewajiban Penggunaan B-20 dalam Industri Jasa Pertambangan", Jakarta, 2018.
- [3]. J. Jupesta, Y. Harayama and G. Parayil, "Sustainable business model for biofuel industries in Indonesia", *Sustainability Accounting, Management and Policy Journal*, vol. 2, no. 2, pp. 231-247, 2011. Available: 10.1108/20408021111185394.
- [4]. M. Jayed, H. Masjuki, M. Kalam, T. Mahlia, M. Husnawan and A. Liaquat, "Prospects of dedicated biodiesel engine vehicles in Malaysia and Indonesia", *Renewable and Sustainable Energy Reviews*, vol. 15, no. 1, pp. 220-235, 2011. Available: 10.1016/j.rser.2010.09.002.
- [5]. K. Govindan, S. Seuring, Q. Zhu and S. Azevedo, "Accelerating the transition towards sustainability dynamics into supply chain relationship management and governance structures", *Journal of Cleaner Production*, vol. 112, pp. 1813-1823, 2016. Available: 10.1016/j.jclepro.2015.11.084.

- [6]. Nicoletti Junior, M. de Oliveira and A. Helleno, "Sustainability evaluation model for manufacturing systems based on the correlation between triple bottom line dimensions and balanced scorecard perspectives", *Journal of Cleaner Production*, vol. 190, pp. 84-93, 2018. Available: 10.1016/j.jclepro.2018.04.136.
- [7]. "Business Model Canvas and Strategy Map Fusion - Your Best Approach for Business Success", *Linkedin.com*, 2020. [Online]. Available: <https://www.linkedin.com/pulse/20140911153223-3251275-business-model-canvas-and-strategy-map-fusion-your-best-approach-for-business-success>. [Accessed: 25- Mar- 2019].
- [8]. Toyota, *Laporan Keberlanjutan Toyota 2018*. 2018.
- [9]. Doosan Infracore Co. Ltd., *Doosan Infracore 2017 Integrated Report*. 2017.