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Project-Based Learning: Analysis of the Otto Robot Commercialization in Terms of Business Aspect, Costing, and Operating Budget

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Abstract

This research discusses the commercialization analysis of the Otto Robot in terms of business, costing, and operating budget aspects. The purpose of this research is to find out the cost of sales of Robot Otto and to make Standard Cost Sheets and Operating Budgets as a basis for evaluating performance at Barelang Roboschool BRAIL Batam State Polytechnic. This research used a qualitative method with a project-based learning approach based on primary and secondary data. Data collection was carried out using documentation techniques, interviews, and direct observation at the research site. The results of indicating that the calculation of the Operating Budget can be used as a tool to analyze the operational income and expenses of Roboschool BRAIL Batam State Polytechnic in a 5-month period, the creation of a Standard Costing Sheet as a determinant of the cost of the product Otto Robot produced as well as the results of Porter's Five Forces analysis and SWOT analysis are used to know the business conditions and be able to implement strategies that suit the conditions.

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1. Introduction

The development of advanced businesses and economies has very strong competitiveness resulting in the emergence of various types of industries, namely industries that are both national companies and multinational companies that continue to increase and increase in complexity. Business actors are needed for business growth or the business world because every company must succeed effectively and efficiently in managing its potential to compete in the market.

A detailed budget for the company's future operations must be prepared, and this is done using historical data that has been adjusted for future circumstances. One of the most important sources of data for examining a company's strategy is cost. Effective cost control is one approach to calculating production costs. Cost management is needed in every job so that the activities carried out can be evaluated in accordance with what was previously planned.

BRAIL (Barelang Robotics and Artificial Intelligence Lab) has several business activities, namely Barelang Roboschool and External Projects. Barelang Roboschool is a training robot that aims to teach the basics of robotics from elementary school (SD) to high school (SMA). Roboschool activities have been carried out in several schools in the previous year, where which product taught is Robot Otto. However, in practice, this activity is considered to still require improvement in terms of planning and implementation.

Apart from not having good business process planning, Roboschool is also constrained in the field of financing and accounting which still uses traditional cost accounting where traditional costing only takes into account production costs into the cost of production. It is hoped that all RoboSchool activities can be attended by all groups at an affordable price. Therefore, an accurate calculation is needed and adjusted to the intended market share, so that BRAIL goal of educating all people can be achieved.

The traditional costing approach is considered an inaccurate application for calculating manufacturing costs because it has deficiencies in manufacturing processes that provide distorted cost information. This cost allocation error results in distortion, which then affects costing, decision-making, planning, and control. These distortions also result in undercoats or overcoats in the product. Based on the background and problem analysis at BRAIL Polibatam, the researcher is interested in researching with the theme "Project-Based Learning: Analysis of the Otto Robot Commercialization in terms of Business Aspect, Costing, and Operating Budget "

Project-Based Learning (PBL)

Project-based learning is a teaching method that can motivate students to work together actively in solving problems and building the main points of their assignments or project. Students are taught to analyze problems, then investigate, collect data, interpret, and evaluate when working on projects related to the challenges, they have learned using this paradigm (Kanza et al., 2020). The use of project-based learning can improve critical and analytical thinking, independence, responsibility, and creativity in students. And the use of this method adapts to the subject matter and the stage of student development (Fahrezi et al., 2020).

Standard Cost

Standard cost is an important instrument for evaluating the application of established regulations. The adoption of standard cost gives management direction on how much it should cost to complete a particular task, making it possible to minimize costs by improving production processes, selecting labor, and other actions (Lalamentik et al., 2022). Standard costs are very important in keeping production activities under control, but they also help the company in planning production costs related to increasing profits to achieve the best results (Fitri, 2019).

Budgeting Cost

Budgeting costs are costs incurred in managing finance to identify significant revenue and expense and assist in planning and decision-making (Romenda & Ningsih, 2020). Budgets provide guide companies regarding the selection of investment sources and funds to be used, limiting the amount of money that can be raised and spent. With this, it makes it easier for companies to use the budget to determine the desired profit level (Lius et al., 2019).

Porter's Five Forces

Porter's five forces are an analytical approach used by businesses to assess their situation and choose the best course of action. These forces are industry competitors, possible new entrants, threats from alternative products, and threats to power (Jaya & Yuliarmi, 2019). Porter's five forces categorize factors affecting markets and industries into five categories: supplier power, buyer power, competition between comparable businesses, the threat of substitute products, and the threat of new entrants (Wellner & Lakotta, 2020).

SWOT Analysis

SWOT analysis is a planning strategy for assessing aspects that affect an organization's ability to achieve its goals and includes strengths, weaknesses, opportunities, and threats, whether these goals are short-term or long-term (Bina et al., 2019). With the application of SWOT analysis, a business owner will more easily measure resources, weaknesses, market prospects, and external threats (Kusmiarti, 2020).

2. Methods

This research was conducted at BRAIL (Barelang Robotics and Artificial Intelligence Lab) Batam State Polytechnic. This study uses a qualitative method with a project-based learning approach based on primary and secondary data. Primary data was obtained from direct interviews with the Robot Education Team at BRAIL Batam State Polytechnic. Meanwhile, secondary data was obtained from the documents of the educational robot team and several relevant research articles. The population in this study was BRAIL Batam State Polytechnic while the research sample was Robot Otto. The data collection method used is:

1. Interview technique
   Researchers conducted interviews with the Batam State Polytechnic BRAIL Educational Robot Team
2. Documentation Techniques
   Researchers evaluate and analyze related documents such as BHP Robot Otto Excel data
3. Direct observation
   The research location, namely observing the process of making the Otto Robot from the initial stages of product assembly to the finished product and carrying out costing and operating budget calculations.

In analyzing the data, this study uses a qualitative descriptive method that explains the conditions that occur in the field. To get the results of the analysis, the steps that must be taken by the researcher:

1. Retrieving raw material data for Robot Otto
2. Retrieving documents in the form of consumable goods of Robot Otto excel data
3. Compile a list of questions and conduct direct interviews.
4. Processing interview results
5. Perform calculations of Costing and Operating Budget
6. The research results of the analysis of the commercialization of the Robot Otto in terms of business, Costing, and Operating Budget Aspects
7. Provide suggestions on the results of the analysis

3. Results and Discussion

Based on the information obtained from the BRAIL Educational Robot Team, Batam State Polytechnic researchers have made calculations of Standard Costing, Operating Budget and

analysis from a business perspective which aims to determine the cost of production of the Otto Robot and as a basis for evaluating performance. The calculation and analysis results are as follows:

A. Standard Costing

1. Direct Material Robot Otto

The following is the Actual Direct Material Cost for making the Robot Otto. Based on the table, it shows that the total raw material used to produce the Otto Robot is Rp 257.973.

Table 1. Table of Actual Direct Materials of Robot Otto

No	Material	Q	Unit	Unit Price (Rp)	Amount
1.	Filalment 3D Blue	0,056	kg	Rp 191.000	Rp 10.696
2	Filament 3D White	0,041	kg	Rp 191.000	Rp 7.831
3	Buzzer mini	1	pcs	Rp 2.257	Rp 2.257
4	Push on off 6p	1	pcs	Rp 1.957	Rp 1.957
5	Cap Self-locking Square push button	1	pcs	Rp 1.057	Rp 1.057
6	Free Wheel	1	pcs	Rp 10.757	Rp 10.757
7	Shield Nano	1	pcs	Rp 22.380	Rp 22.380
8	Arduino Nano + Cable USB A to Mini B	1	pcs	Rp 57.220	Rp 57.220
9	Battery Rechargeable USB 9V	1	pcs	Rp 66.167	Rp 66.167
10	Battery Socket/Connector 9V	1	pcs	Rp 3.667	Rp 3.667
11	Micro Servo SG 90	2	pcs	Rp 20.000	Rp 40.000
12	Sensor Ultrasonic HC-SR04	1	pcs	Rp 15.000	Rp 15.000
13	Module TP 4056	1	pcs	Rp 7.000	Rp 7.000
14	Jumper cable female to male	4	pin	Rp 750	Rp 3.000
15	Jumper cable female to female	4	pin	Rp 750	Rp 3.000
16	Solder Tin 0.8 mm	0,05	meter	Rp 15.000	Rp 750
17	Burn Cable	0,1	meter	Rp 2.000	Rp 200
18	Attached Cable (Red Black)	0,50	meter	Rp 2.500	Rp 1.250
19	Double Tape merk 3M	0,05	meter	Rp 35.000	Rp 1.750
20	Resistor 10k Ohm	4	pcs	Rp 500	Rp 2.000
Total				**Rp 645.960**	**Rp 257.937**

(Source: Processed by Researchers, 2022)

2. Direct Labor Robot Otto

The costs calculated are 1 robot technician, namely a BRAIL student, and 1 person who monitors activities, namely a Lecturer at BRAIL. Salary costs are calculated for 22 working days a month, with one day counting 8 hours of work, with wages following the Regional Minimum Wage that applies in Batam 2022, which is Rp 4.186.359 with the following calculations:

Table 2. Reference for Calculation of Direct Labor Cost

No	Time	Salary Amount
1	Per Month	Rp 4.186.359
2	Per Day	Rp 190. 289
3	Per Hour	Rp 23.786
4	Per Minute	Rp 396

(Source: Processed by Researchers, 2022)

Based on the table data above the UMR per month is Rp 4.186.359, divided by the number of working days (22 days) it produces Rp190.289 wages per day, divided by the number of hours worked in a day (8 hours) then Rp 23.786 wages per hour, and divided by the number of minutes in an hour (60 minutes) then Rp 396 is the wage per minute.

Table 3. Direct Labor Robot Otto Cost Calculation per Unit

No	Activity	Time (Hour)	Cost (Hour)	Labor Cost
ROBOT TECHNICIAN				
1	Robot Assembly	0,50	Rp 23.786	Rp 11.893
2	Programming	0,17	Rp 23.786	Rp 3.964
3	Wiring & Soldering	0,50	Rp 23.786	Rp 11.893
4	Packaging	0,17	Rp 23.786	Rp 3.964
5	Printing	0,17	Rp 23.786	Rp 3.964
Total Direct Labor Cost per Unit				**Rp 35.679**

(Source: Processed by Researchers, 2022)

Based on the table data above, shows that the Labor Cost per unit is obtained from the Time (Hour) used, multiplied by the Cost per Hour, resulting in Rp 35.679 Direct Labor Cost per unit.

3. Overhead Cost

The following is an identification of activities that use Overhead costs, as well as the tools used. BRAIL uses the electricity tariff group of 1.300-5.600 VA and above, so the basic electricity tariff that must be paid is Rp 1.468 per KWH.

Table 4. Calculation of Electrical Robot Otto Wheel Costs per Unit

No	Activity	Item	Time (Minute)	Time (Hour)	Electrical Power per Hour (Watt)	Electrical Councumed (Watt)	Kilo Watts Hours (KWH) 1000	Cost per KWH (Rp)
1.	Printing	3D Printing	521	8,68	300	2605,00	2,6050	Rp 3.824
2.	Wiring & Soldering	Solder	30	0,50	300	150,00	0,1500	Rp 220
3.	Robot Assembly	Glue Gun	10	0,17	15	2,50	0,0025	Rp 4
4.	Programming	PC Programming	10	0,17	65	10,83	0,01083	Rp 16
Total Overhead (Electrical) per Unit								**Rp 4.064**

(Source: Processed by Researchers, 2022)

The way to calculate it is to first find out how much electricity is consumed by multiplying the time used by the watts of the device. After that, change it to KWH by multiplying it by 1000. So that you get the electricity tariff that must be paid is Rp 4.064 per unit.

Table 5. Calculation of Depreciation of Otto Robot Manufacturing Equipment according to Activity

No	Activity	Items	Usage Time (Hour)	Depreciation (Hour)	Total
1.	Printing	3D Printing	8,683	Rp 651	Rp 5.653
2.	Wiring & Soldering	Solder	0,50	Rp 12	Rp 5,9
3.	Robot Assembly	Glue Gun	0,17	Rp 4	Rp 0,7
4.	Programming	PC Programming	0,17	Rp 296	Rp 49
Total Overhead (Depreciation) per unit					**Rp 5.709**

(Source: Processed by Researchers, 2022)

4. Cost Production

The results of the calculation of Total Production per unit of Robot Otto are as follows:

Table 6. Total Cost of Product Robot Otto per Unit

No	Item	Cost
1.	Direct Material Cost	Rp 257.937
2.	Direct Labor Cost	Rp 35.679
3.	Overhead Cost (Electrical)	Rp 4.064
4.	Overhead Cost (Depreciation)	Rp. 5.709
Total Cost of Production		**Rp. 303.389**

(Source: Processed by Researchers, 2022)

It can be concluded that the Cost of Production of Otto Robot is Rp 303.389 or Rp304.000.

5. Cost History Robot Otto

The following is a Cost History Robot Otto for 5 months if Roboschool produces 15 unit each month:

Table 7. Table of Cost History Robot Otto

Product	Description	Month				
		January	February	Maret	January	Mei
Robot Otto 15 Unit	Direct Material Cost	Rp 3.869.005	Rp 3.869.005	Rp 3.869.005	Rp 3.869.005	Rp 3.869.005
	Direct Labor Cost	Rp 535.188	Rp 535.188	Rp 535.188	Rp 535.188	Rp 535.188
	Overhead Cost (Electrical)	Rp 60.960	Rp 60.960	Rp 60.960	Rp 60.960	Rp 60.960
	Overhead Cost (Depreciation)	Rp 85.637	Rp 85.637	Rp 85.637	Rp 85.637	Rp 85.637
Total		**Rp 4.550.840**	**Rp 4.550.840**	**Rp 4.550.840**	**Rp 4.550.840**	**Rp 4.550.840**

(Source: Processed by Researchers, 2022)

6. Cost Prediction Robot Otto

The following is a Cost Prediction Robot Otto for 5 months if Roboschool produces 15 units each month:

Table 8. Table of Cost Prediction Robot Otto

Product	Description	Month				
		June	July	August	September	October
Robot Otto 15 Unit	Direct Material Cost	Rp 3.869.005	Rp 3.869.005	Rp 3.869.005	Rp 3.869.005	Rp 3.869.005
	Direct Labor Cost	Rp 535.188	Rp 535.188	Rp 535.188	Rp 535.188	Rp 535.188
	Overhead Cost (Electrical)	Rp 60.960	Rp 60.960	Rp 60.960	Rp 60.960	Rp 60.960
	Overhead Cost (Depreciation)	Rp 85.637	Rp 85.637	Rp 85.637	Rp 85.637	Rp 85.637
Total		**Rp 4.550.840**	**Rp 4.550.840**	**Rp 4.550.840**	**Rp 4.550.840**	**Rp 4.550.840**

(Source: Processed by Researchers, 2022)

7. Standard Cost Sheet Robot Otto

The following is the Standard Cost Sheet for Robot Otto in producing each unit:

Table 9. Table of Cost Prediction Robot Otto

Description	Standard Price	Standard Usage	OUM	Standard Cost	Sub Total
Direct Material:					
Filalment 3D Blue	Rp 191.000	0,056	kg	Rp 10.696	
Filament 3D White	Rp 191.000	0,041	kg	Rp 7.831	
Buzzer mini	Rp 2.257	1	pcs	Rp 2.257	
Push on off 6p	Rp 1.957	1	pcs	Rp 1.957	
Cap Self-locking Square push button	Rp 1.057	1	pcs	Rp 1.057	
Free Wheel	Rp 10.757	1	pcs	Rp 10.757	
Shield Nano	Rp 22.380	1	pcs	Rp 22.380	
Arduino Nano + Cable USB A to Mini B	Rp 57.220	1	pcs	Rp 57.220	
Battery Rechargeable USB 9V	Rp 66.167	1	pcs	Rp 66.167	
Battery Socket/Connector 9V	Rp 3.667	1	pcs	Rp 3.667	
Micro Servo SG 90	Rp 20.000	2	pcs	Rp 40.000	
Sensor Ultrasonic HC-SR04	Rp 15.000	1	pcs	Rp 15.000	
Module TP 4056	Rp 7.000	1	pcs	Rp 7.000	
Jumper cable female to male	Rp 750	4	pin	Rp 3.000	
Jumper cable female to female	Rp 750	4	pin	Rp 3.000	
Solder Tin 0.8 mm	Rp 15.000	0,05	meter	Rp 750	
Burn Cable	Rp 2.000	0,1	meter	Rp 200	
Attached Cable (Red Black)	Rp 2.500	0,50	meter	Rp 1.250	
Double Tape merk 3M	Rp 35.000	0,05	meter	Rp 1.750	

Resistor 10k Ohm	Rp	500	4	pcs	Rp	2.000		
Total Direct Materials							**Rp**	**257.937**
Direct Labor:								
Robotic Technician	Rp	23.786	1,5	hour	Rp	35.679		
Total Direct Labor							**Rp**	**35.679**
Overhead:								
Variable Overhead Cost (Electrical)								
3D Printing	Rp	1.468	2,6050	kwh	Rp	3.824		
Solder	Rp	1.468	0,1500	kwh	Rp	220		
Glue Gun	Rp	1.468	0,0025	kwh	Rp	4		
PC Programming	Rp	1.468	0,01083	kwh	Rp	16		
Total Overhead Cost (Electrical)					**Rp**	**4.064**		
Fixed Overhead Cost (Depreciation)								
3D Printing	Rp	651	8,683	hour	Rp	5.653		
Solder	Rp	12	0,50	hour	Rp	5,9		
Glue Gun	Rp	4	0,17	hour	Rp	0,7		
PC Programming	Rp	296	0,17	hour	Rp	49		
Total Overhead Cost (Electrical)					**Rp**	**5.709**		
Total Overhead							**Rp**	**9.773**
Total Standard Unit Cost							**Rp**	**303.389**

(Source: Processed by Researchers, 2022)

B. Operating Budget

1. Sales Budget (Schedule 1)

The following is the Sales Budget Robot Otto, which produces 15 units of robots every month for 5 months, with a selling price per unit of Rp 600.000

Table 10. Sales Budget (Schedule 1)

Sales Budget						
For the Month Ended May 31, 2022						
	Month					**Year**
	January	**February**	**March**	**April**	**May**	
Units	15	15	15	15	15	75
Unit Selling Price	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000	Rp 600.000
Sales	**Rp 9.000.000**	**Rp 9.000.000**	**Rp 9.000.000**	**Rp 9.000.000**	**Rp 9.000.000**	**Rp 45.000.000**

(Source: Processed by Researchers, 2022)

2. Production Budget (Schedule 2)

The following is Otto's Robot Production Budget which produces 15 units of robot every month for 5 month and if every month there is no Desire Ending Inventory.

Table 11. Production Budget (Schedule 2)

Production Budget						
For the Month Ended May 31, 2022						
	Month					**Year**
	January	**February**	**March**	**April**	**May**	
Sales (Schedule 1)	15	15	15	15	15	75
Desire Ending Inventory	-	-	-	-	-	-
Total Needs	15	15	15	15	15	75
Less: Beginning Inventory	-	-	-	-	-	-
Unit to be produced	**15**	**15**	**15**	**15**	**15**	**75**

(Source: Processed by Researchers, 2022)

3. Direct Material Purchase Budget (Schedule 3)

The following is the Direct Material Purchase Budget for Robot Otto with a total cost per unit of Rp 257.937 and a total monthly purchase cost of Rp 3.869.055

Table 12. Direct Material Purchase Budget (Schedule 3)

Direct Material Labor Budget						
For the Month Ended May 31, 2022						
	Month					**Year**
	January	**February**	**March**	**April**	**May**	
Units to be produced (Schedule 2)	15	15	15	15	15	75
Direct materials per unit	1	1	1	1	1	1
Production needs	15	15	15	15	15	75
Desired ending inventory	-	-	-	-	-	-
Total needs	15	15	15	15	15	75
Less: Beginning Inventory	-	-	-	-	-	-
Direct materials to be purchased	15	15	15	15	15	75
Cost per unit	Rp 257.937	Rp 257.937	Rp 257.937	Rp 257.937	Rp 257.937	Rp 257.937
Total purchase cost	**Rp 3.869.055**	**Rp 3.869.055**	**Rp 3.869.055**	**Rp 3.869.055**	**Rp 3.869.055**	**Rp 19.345.275**

(Source: Processed by Researchers, 2022)

4. Direct Labor Budget (Schedule 4)

The following is Robot Otto Direct Labor Budget of 15 units per month for 5 months, which uses Direct Labor for 1.5 hours for each robot with Direct Labor Cost every hour being Rp 23.786.

Table 13. Direct Labor Budget (Schedule 4)

Direct Labor Budget						
For the Month Ended May 31, 2022						
	Month					**Year**
	January	**February**	**March**	**April**	**May**	
Units to be produced (Schedule 2)	15	15	15	15	15	75
Direct labor time per unit (hours)	1,5	1,5	1,5	1,5	1,5	1,5
Total hours needed	22,50	22,50	22,50	22,50	22,50	112,50
Wage per hour	Rp 23.786	Rp 23.786	Rp 23.786	Rp 23.786	Rp 23.786	Rp 23.786
Total direct labor cost	**Rp 535.185**	**Rp 535.185**	**Rp 535.185**	**Rp 535.185**	**Rp 535.185**	**Rp 2.675.925**

(Source: Processed by Researchers, 2022)

5. Overhead Budget (Schedule 5)

The following is Robot Overhead Budget which consists of Electrical Depreciation as Variable Overhead Machine Depreciation as Fixed Overhead.

Table 14. Overhead Budget (Schedule 5)

Overhead Budget						
For the Month Ended May 31, 2022						
	Month					**Year**
	January	**February**	**March**	**April**	**May**	
Budgeted direct labor hour (Schedule 4)	22,50	22,50	22,50	22,50	22,50	112,50
Variable overhead rate	Rp 4.064	Rp 4.064	Rp 4.064	Rp 4.064	Rp 4.064	Rp 4.064
Budgeted variable overhead	Rp 91.438	Rp 91.438	Rp 91.438	Rp 91.438	Rp 91.438	Rp 457.190
Budgeted fixed overhead	Rp 5.709	Rp 5.709	Rp 5.709	Rp 5.709	Rp 5.709	Rp 5.709
Total Overhead	**Rp 97.147**	**Rp 97.147**	**Rp 97.147**	**Rp 97.147**	**Rp 97.147**	**Rp 462.899**

(Source: Processed by Researchers, 2022)

6. Ending Finished Goods Inventory Budget (Schedule 6)

Table 15. Ending Finished Goods Inventory Budget (Schedule 6)

Ending Finished Goods Inventory Budget			
For the Month Ended May 31, 2022			
Unit Cost Computation:			
Direct Material (S3)	1	Rp 257.937	Rp 257.937
Direct Labor (S4)	1,50	Rp 23.786	Rp 35.679
Overhead:			
Variable	2,7683	Rp 4.064	Rp 11.250
Fixed	9,52	Rp 5.709	Rp 54.332
Total Unit Cost			
	Unit	**Unit Cost**	**Total**
Finish Goods	-	Rp 359.198	-

(Source: Processed by Researchers, 2022)

7. Cost of Goods Sold Budget (Schedule 7)

Table 16. Cost of Goods Sold Budget (Schedule 7)

Cost of Goods Sold Budget	
For the Month Ended Dec 31, 2022	
Direct material (Schedule 3)	Rp 19.345.275
Direct labor (Schedule 4)	Rp 2.675.925
Overhead (Schedule 5)	Rp 462.899
Budgeted manufacturing costs	Rp 22.484.099
Goods available for sale	-
Less: Ending finished good (Schedule 6)	Rp 22.484.099
Budgeted Cost of Goods Sold	**Rp 22.484.099**

(Source: Processed by Researchers, 2022)

8. Budgeted Income Statement

Table 18. Budgeted Income Statement

Budgeted Income Statement	
For the Month Ended May 31, 2022	
Sales (Schedule 1)	Rp 45.000.000
Less: Cost of Good Sold (Schedule 7)	Rp 22.484.099
Net Income	**Rp 22.515.901**

(Source: Processed by Researchers, 2022)

C. Porter's Five Forces Analysis

The following are the results of the Porter analysis that was carried out by researchers at the Barelang RoboSchool BRAIL Batam State Polytechnic:

Table 19. Porter's Five Forces Analysis

Industry Analysis With Porters Analysis
High: Threat of New Entrants a. Roboschool Training Service BRAIL Polibatam is the only one that provides robot training services as well as robot sales. b. Barelang RoboSchool is part of the BRAIL Batam State Polytechnic which is the only state university in the Riau Islands with a Robotic Engineering study program. c. The scope of Barelang RoboSchool is an educational institution because the Batam State Technical Polytechnic itself is very well known for its practicum and graduates.
High: Bargaining Power of Buyers a. The market share targeted by Barelang RoboSchool is at the school level and in collaboration with schools in the Riau Archipelago, both high schools and vocational schools that have majors in mechanical engineering, electronics, mechatronics, and robotics.
Medium: Bargaining Power of Suppliers a. BRAIL Batam State Polytechnic does not yet have cooperation with permanent suppliers. b. There are not many shops that provide complete robotics needs in Batam City and if there are, the prices are more expensive than online stores. c. If you want to buy a lot at a low price, BRAIL buys it online at several available online stores.
High: Threat of Substitute (Threat of Substitute Products) There are no substitute products a. There is no similar product that sells robots while simultaneously carrying out robotics training services both in theory and practice.
Low: Competitive Rivalry (Level of Competition with Competitors) a. Batam State Polytechnic is the only State University in Batam and provides robotics engineering study programs. b. Many companies have asked to cooperate with BRAIL Batam State Polytechnic in fulfilling industry needs. c. Many schools are asking to do robotics teaching.

d. Not many competitors offer the same thing with facilities that are good and complete because they are implemented by Polibatam.

D. SWOT Analysis

The following are the results of a SWOT analysis that was carried out by researchers at the Barelang RoboSchool BRAIL Batam State Polytechnic:

Table 20. SWOT Analysis

Threats
Having the same market share as other robot training in Batam, the Barelang RoboSchool Training must have a different selling point from its competitors.
Weaknesses
Limited supplier in Batam City so that BRAIL more often buys its raw material needs online. Because suppliers in Batam tend not to provide large quantities and the price is relatively more expensive.
Opportunities
Many schools with majors related to mechanical engineering, electronics, and mechatronics require the teaching of robotic as well as robot training in shaping the interest and talent of their students. As well as cooperating between the Batam State Polytechnic and schools in the Riau Archipelago.
Strength
a. Experienced trainers and presenters in the field of robotics b. Complete training kit c. Very low overhead cost so it can offer quite high margins d. Barelang RoboSchool Training has its place (working space) to carry out training activities. e. Barelang RoboSchool is located in an area that supports the industrial era 4.0

Discussion

The following are the results of the discussion based on calculations and analysis carried out by researchers as well as the results of observations and interviews conducted at the Barelang RoboSchool BRAIL Batam State Polytechnic:

1. Standard Costing calculations on the Otto Robot, the cost of production is Rp 303.389 per product, and the creation of a Standard Cost Sheet can provide information to Roboschool BRAIL Batam State Polytechnic regarding the opportunity cost of Robot Otto products and pricing of products produced
2. Based on the results of the calculation of the Operating Budget an estimated Net Income of Rp 22.515.901 is obtained and the calculation of the Operating Budget that has been carried out can be used as a tool to predict and analyze operational income and expense for Roboschool BRAIL Batam State Polytechnic in a 5-month period
3. Five forces analysis and SWOT analysis conducted by the researcher, it is used to analyze the possibility of competition and competitive advantage in the robotic industry

4. Conclusion

Barelang Roboschool BRAIL Batam State Polytechnic is a business engaged in training services and selling robots. The executors of this business are students and lecturers of the Batam State Polytechnic. The entire business process is also carried out at the Batam State Polytechnic. The author has calculated the production costs of making Robot Otto Wheel owned by Roboschool and continued by calculating Standard Costing and Operating Budget.

Based the calculation of the Operating Budget that has been carried out, it can be used as a tool to predict and analyze operational income and expense for Roboschool BRAIL Batam State Polytechnic in a 5-month period. As well as making a Standard Cost Sheet which provides information to Roboschool BRAIL Batam State Polytechnic regarding business control, as a basis or basis for conducting performance evaluations, providing information regarding opportunity cost regarding the production of a product, and

pricing main product of robots produced. Based on the results of Porter's Five Forces analysis and SWOT analysis that have been made by the author, BRAIL Batam State Polytechnic can determine business conditions and can implement strategies that are appropriate to the conditions, by implementing appropriate strategies, BRAIL Batam State Polytechnic can achieve its goal of educating all circles regarding robotics as well as conducting robot training.

Suggestion

In implementing Project-Based Learning at BRAIL Batam State Polytechnic, researchers focused on conducting research for one of the robots, Robot Otto. During the PBL, there were no big problems, it's just that BRAIL had not yet determined the exact raw materials used in making the robot in question. Because several revisions were made to raw materials, which resulted in the calculation process being hampered. However, the search for raw materials is assisted by researchers in finding the best price, resulting in minimal inefficient use of funds. Apart from that, the design of the robot was also changed several times, initially using legs was replaced with using wheels, so we had to wait again for the redesign process and readjust how much raw material was used in the new design. In determining the raw material, it was also changed several times, something was added or subtracted because it was adjusted to the design of the new robot model and adapted to the desired function of the robot.

In the discussion above, the author can provide advice to Barelang Roboschool BRAIL Batam State Polytechnic to immediately determine the exact raw materials for producing Otto Robots and other types of robots, so that you can also be sure of what the cost of production of these robots is. In addition, also determine members who are specifically focused on and responsible for Roboschool so that Roboschool activities can run immediately with a clear system.

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