

Development of Variable Angle Stand Engine Motorcycle

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Abstract

The motor industry is a very large industry, it has also covered the whole of Asia and the world market. In addition, in Malaysia there are many shops that sell motor accessories. Not counting the young and old who are interested in this motorsport. There are groups that make it a hobby as well as a source of livelihood, especially in the field of motoring. However, when compared to a large-scale motor workshop, it has a variety of equipment compared to a small-scale motor workshop. The main focus of this project is to identify the daily problems in carrying out work activities, especially in maintaining motorcycle engines. The purpose of the researcher is to help the problems faced by small and medium industries (SME) by designing products that can withstand the weight of motorcycle engines for workers who do any maintenance on motorcycle engines. Based on experiments carried out around Perlis at the Workshop A workshop. This product has been tested with its functionality variable angle stand engine motorcycle has been proven to save time and practical in its use. This project has also received positive views from motorcycle workshop operators with almost 6 years of experience. The researcher also used the engineering design process (EDP) model to solve problems by analyzing problems before interpretation. As a result of design selection, three types of design are developed. From the first design to the final design is an improvement from the suggestions from the workshop itself. The third sketch becomes the choice. The researcher succeeded in developing this product but had to go through several testing processes where the product was done based on advice from experts. The experiment conducted is to test the durability of the product in terms of the ability to withstand the weight of a motorcycle engine. For the average weight of a motorcycle engine which is 19.7 kg for a horizontal engine and 25.5 kg for a vertical engine. In terms of time, it can also be concluded that it can save time in doing the maintenance process. With an average of 16.4 minutes for horizontal engines and also 23.2 minutes for vertical engines.

1. Introduction

Small and medium industries (SME) are an important part of the economic growth that is led by the government. In Malaysia, SME contributes 98% to the national economy and has been successful in strengthening the business and competing with the existing industry. (Norazida Ibrahim, 2019) SMEs are an important part of Malaysia's economic sector, contributing 97.4% to the country since 2016 and 5.2% over the six years. Services such as motorcycles are growing rapidly due to TVET programs, but many SME still use old and time-consuming methods. (SME CORP Malaysia, 2022) This research aimed at speeding up engine installation service on motorcycles, improving the service work environment and safety for workshop staff, and providing benefits and profits to motorcycle SME entrepreneurs.

To further increase the income of the SME sector, it is necessary to produce versatile and high-quality products. (Kementerian Pengangkutan Malaysia, 2020) The motorcycle workshop is also opening rapidly, giving success to young people who have a strong spirit in the world of motoring and business. Ability is also emphasized in doing the work of servicing this type of motorcycle. A developer has developed a product to help workers install motorcycle engine components. This product has been able to save time and be able to complete the motorcycle more quickly. Previous products had deficiencies such as not being ergonomic in terms of durability and not having complete equipment to carry out work activities. Limitations on users exist as the focus is only for motorcycles with a capacity of CC 150 and below. The product focuses on workshops that do motorcycle repair workshops in the kapcai category due to affordable prices and low maintenance costs.

The automotive motorcycle industry continues to progress due to the high demand from customers. (Mohd Nor, 2018) Technology used by SMEs especially in the field of motorcycle service which may be less seen by the community to improve their economy. The use of equipment in their work activities is also quite impractical and inefficient. Only competent workers can maintain a motorcycle engine. Therefore, this product is developed to speed up the process in performing component assembly and assembly of motorcycle engines by following the appropriate angle specifications on each motorcycle engine.

1.1 Objective of Research

The objective of this project is to develop a variable angle stand motorcycle engine. Among the development objectives of this project is to design a product that can withstand the heavy load of the motorcycle engine for workers to do any maintenance on the engine. Next, to develop a tool to provide support to accommodate the weight of the motorcycle engine. Finally, to test the functionality of the Variable Angle Stand Engine Motorcycle from the time-saving and practical aspects of the product. The objective of this project is to develop a Variable Angle Stand Motorcycle Engine. Next, to develop a product that can withstand the heavy load of a motorcycle engine that has a limitation of 150 cc. Finally, is to test the functionality Variable Angle Stand Motorcycle Engine from the aspect of saving time. To achieve the objective several research procedures are made to ensure that this product development process can be carried out orderly and systematic way. Each procedure is started by using the guiding EDP model researchers to develop products. Begin by analyzing the problem for this study then expand to result of this product. Each step involved requires careful observation to ensure the product development can be produced well. Therefore, the procedure made can be a reflection of implementation during product production.

2. Methodology

In the methodology carried out for this study, the Engineering Design Process MODEL (EDP) has been followed. This model is used to be able to carry out work systematically by following the phases in this model. Methodology is an important matter in product development so that the product developed has followed the set standards so that the objectives can be achieved. The use of this model has also been repeated and the steps used also vary according to the project itself. The use of this model often improves the developed project. The location of the study is at a workshop in Perlis, which is workshop A. Research continues to be done with the mechanics at the workshop B, C, D and E. A study was conducted to see the product's ability to support the weight of a motorcycle engine. In addition to its function as a motorcycle engine supporter so that it is easy to maintain. The material used to produce this product is steel which has a stronger steel capacity than other materials. This is not only to give grip in hanging the motorcycle engine but can even repair the engine by using this product. Data was collected in Kangar Perlis, Kedah & around Parit Raja Johor. by observing and interviewing the staff in the workshop. The big challenge to the workshop is not having many people who are experienced in motorcycle maintenance, with the employee with the longest experience being only 7 years in the field. This has caused business profits to be disrupted, making it difficult to find a motorcycle workshop that reaches the required level.

2.1 Research Design

In product design, there are three sketches made by the researcher. Each sketch developed by the researcher. There are sketches 1, 2 and 3. The researcher has done improvement methods from sketches 1, 2 and 3. According to the fish burn method which is the easiest method to solve design problems. So using some features like costing, quality and design view. Also, the function is based on how the accessory has been used is the function and the view is based the use of materials is it worth the cost as well. With the matrix that has been given the researcher can easily compare good design to move the development process. (venkata r., 2007) this method is used for easy choose designs with the same look and it's hard to choose.

Table 1 Scale Development of Product

Scale	Score
Strongly Disagree	1
Do Not Agree	2
Disagree	3
Agree	4
Totally Agree	5

Table 1 is a development scale for the product that will be evaluated by each workshop. Each workshop has given encouraging suggestions for the products developed. After giving suggestions to the researcher to do a matrix in selecting the variable angle stand engine motorcycle design. Such as Table 2 matrix of choosing design variable angle stand engine motorcycle is a score given by each workshop. Most of them agree about the proposal in enlarging the area of the product base to give stability in holding the load. The second is that this product needs to be at the height of the motorcycle, which is the same level as the engine to withstand the load of the motorcycle engine. In addition, this product also needs to be at low gravity to make it more stable

Table 2 Matrix of Choosing Design Variable Angle Stand Engine Motorcycle

Type of Suggestion / Name of Workshop	A	B	C	D	E	Total Score
Recommends that this product have a large site	4	4	5	3	4	20
States that this product should have a low height so that the motorcycle engine is easy to maintain	5	4	3	4	5	21
This product should have a low point of gravity	3	5	5	5	3	21

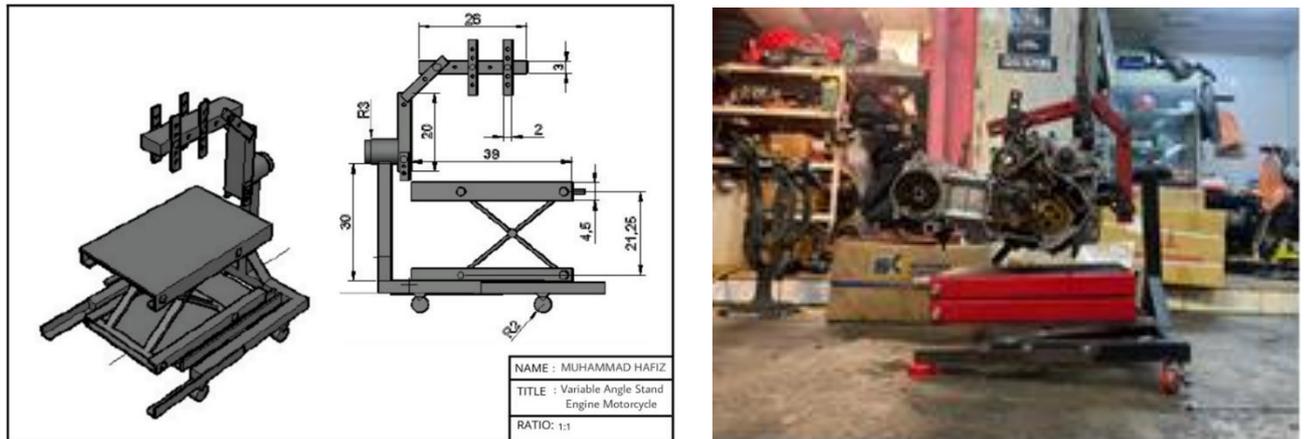


Fig.1 Variable Angle Stands Engine Motorcycle

Fig. 1 is a sketch of C that got approval from 5 workshops the researcher has conducted product research. For the selection for figure 4.1 this is stronger and has some additional accessories that have been added by following the recommendations of the motorcycle workshop. So, the mini jack added to the product aims to withstand the load of the motorcycle engine. The type of motorcycle model used by the researcher is a model that many people use. For the use of a stand engine that functions as a motorcycle engine mounting. This mounting works as a motorcycle engine mount. The researcher has also defined how the position of the motorcycle engine is as the engine is on the motorcycle. For option C this is also accompanied by a heavy-duty wheel that works to move this tool anywhere. This product was successfully built by researchers and can be used well by users.

2.2 Research Procedure

Research procedures are made to ensure that this product development process can be carried out in an orderly and systematic manner. Each procedure should be initiated by using the EDP model that guides researchers to develop products. starting with analysing the problem for the study then developing until the formation of this product. Every step of the steps involved requires careful observation to form a good product development. Therefore, the procedure created can make a picture of the implementation during the production of the product. The research procedure for the observations carried out in 5 motor workshops. This also follows with the objective that has been done by the researcher. The researcher is looking for a motorcycle workshop that services and repairs motorcycle engines. Developers also put limits on the selection of motorcycle workshops. For the first objective is to design a product that can withstand the heavy load of the motorcycle engine for workers to do any maintenance on the engine. The researcher went to each workshop and asked about the design that needed to be developed. In addition, this limitation is to achieve the objective of the product. This study was done to determine the time in doing the activity of lowering the motorcycle engine. The second objective is to develop a tool to provide support to accommodate the weight of the motorcycle engine. Observations were made at 5 motorcycle workshops that only service motorcycle engines. So, this observation is indeed done by a researcher who can build a product that can withstand a motorcycle engine. Therefore, a procedure was developed to see its effectiveness.

2.3 Research instrument

The researcher uses several instruments according to the study procedure. The use of this instrument is important to determine how project problems are sought so that problem solving can be solved easily. The researcher only used two important instruments throughout the project. Observation and interviewing have been used by the researcher because the instrument is easy to use to analyze this product. The researcher has been explaining in more detail the use of the instrument and prove that this instrument is suitable for the study.

Observation is the first instrument; the researcher looks for the problem and evaluates himself how the process has been being done. Comparisons are also made at each motorcycle workshop. Researchers have been to study locations around Johor and Kedah. Among the main motor workshops, Workshop A and several other workshops were used as a field study site to obtain various data by using this instrument. This instrument allows researchers to get data in terms of product testing. There are also some experiments by looking at the period of time of using the product before and after.

3. Results and Discussion

This product has been tested to experts and users by using before and after this development product. After that, the product was evaluated in terms of the product evaluation process produced with appropriate and safe use. Product evaluation is carried out by experts to determine products according to the prescribed standards and to repair some defects in the product and design. Tests were done to compare before and after product development to see how satisfactory it was objective. Experts have seen the problem of notifying defects so that development has been redesign products to meet customer needs.

3.1 Results The Operation Before and After Using Product

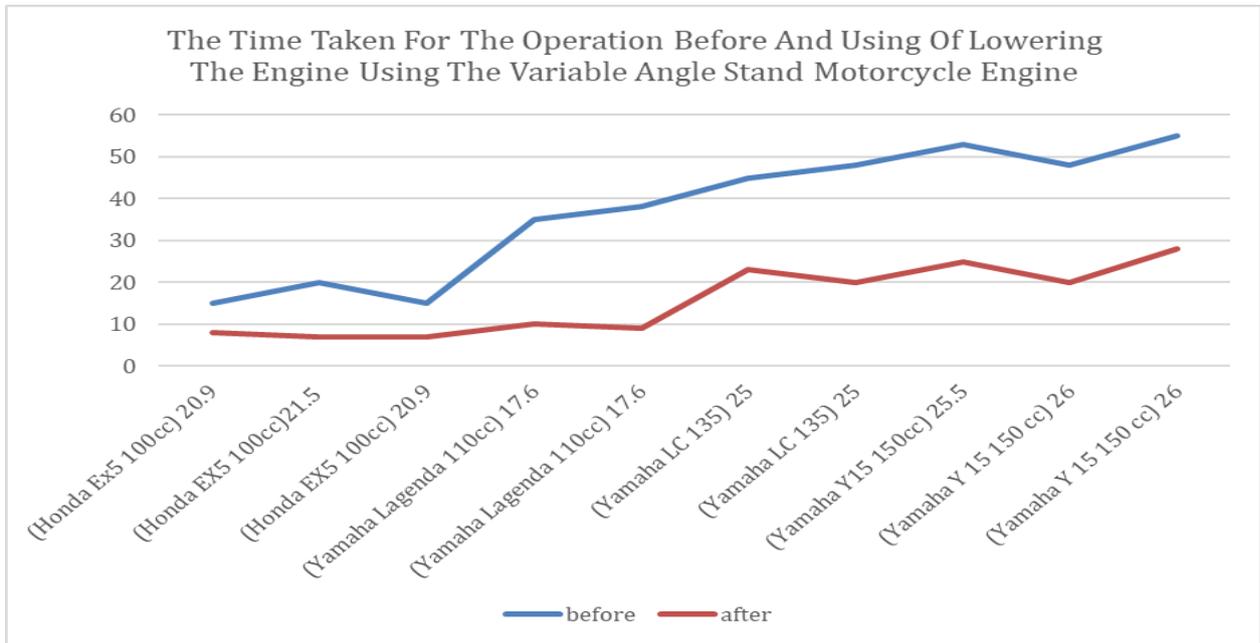


Fig. 2 Before and After Using Product

Based on the Fig. 2 the graph is directly proportional between time and weight. The research conducted is also related to the weight of each type of motorcycle engine capacity. So every data obtained is made the difference between before and after using the product. From the graph we see that the Honda EX5 engine which before using the product takes almost 15 minutes' period of maintenance. Compared to after using the product the period is only 8 minutes. So the use of the product turns out to save time. For the maximum time for operation is Yamaha Y15 150 cc takes at least 56 minutes without product. When using the product, the time taken is only 28 minutes. In addition, the minimum weight of a motorcycle engine is 17.6kg which is from the Yamaha Legend 110 cc. Weight is also used as the main point of this experiment because weight is used as resistance for the product developed. Maximum engine weight is 26 kg for the Yamaha y15 150cc model so can be concluded that the heavier an engine is; the more time it takes to operate.

3.2 Product Efficiency Analysis

Table 3 Product Efficiency Analysis for Horizontal Engine

Workshop	Time Taken Maintained Engine Before Using Product (Minute)	Time Taken Maintained Engine After Using Product (Minute)	Inferences of Time Saving (Minute)
A	20	7	13
B	15	8	7
C	38	9	29
D	35	10	25
E	15	7	8
Total average	24.6	8.2	16.4
Percentage of saving time %			66.67

Table 4 Product Efficiency Analysis for Vertical Engine

Workshop	Time Taken Maintained Engine Before Using Product (Minute)	Time Taken Maintained Engine After Using Product (Minute)	Inferences of Time Saving (Minute)
A	53	32	21
B	45	23	22
C	55	30	25
D	56	28	28
E	48	28	20
Total average	51.4	28.2	23.2
Percentage of saving time %			45.13

Based on Table 4 product efficiency analysis for vertical engine, the data collected in the data shows that this product saves from its use. the average time using this product is 23.2 minutes. In addition, before the product was developed the average time was only taken for 51.4 minutes for all types of vertical engines. so, the percentage of time saved when using this product is 45.13% Including the motorcycle model that uses a horizontal type engine in figure 3 has proven before the average product consumption is 24.6 min. after using the product is 16.4 minutes. so the percentage that has saved if using this product is 66.67%. The application of this product is also the same on every motorcycle. But for the vertical model it takes a long time because it has a coolant connection on the radiator that works as an engine coolant. So motorcycle workshop workers also need to take time to do maintenance before doing the activity of taking down the motorcycle engine. The development of these tools also helps to some extent in doing daily activities in the motorcycle workshop.

4. Conclusion

The development of the product must be studied about its advantages and disadvantages. The researcher has been make a summary covering all aspects of the development of this product. The researcher has been make a discussion in terms of product improvement. If product development is given more time, researchers has been improving product development to meet the needs of customers who use this product. Although some studies have proven the effectiveness of the product but there are also problems and records of the product. Therefore, in this chapter the developer has been explain the shortcomings of the product from a professional point of view.

In conclusion, each product has its own potential. Some even have advantages and disadvantages. This product is an idea that helps SME workshops to some extent improve their economic standards in line with the improvement of living standards. This product can also help SMEs from various aspects. Motorcycle workshops that specialize in pouring ideas are also the people closest to the success of the product being developed. They have also provided comments, suggestions and advice that are very helpful for the development of this product. An important part of the development is using the mini jack on the product. The sketched size is a size that does

not match the application on the actual material. So the researcher used a slider application placed on the bottom of the mini jack to make it easier for the slider to accommodate the weight of a motorcycle engine. This slider also serves as an adjuster for the mini jack to hold the motorcycle engine. Goodness is the main factor that needs to be emphasized during this manufacturing. Starting from the cutting process to testing. This product also aims to maintain ergonomics in doing the daily work of employees. So this product can also keep time safe as well as ergonomic and practical when doing work activities. Convergence of the manufacturing process is a complicated matter in all existing processes. so, every objective that has been set by the researcher was successfully achieved by developing the product and refining the product that can be used with the analysis that is done at each location of the motorcycle workshop.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** *Muhammad Hafiz Osman, Badaruddin Ibrahim, Norlida Shaari*; **data collection:** *Muhammad Hafiz Osman*; **analysis and interpretation of results:** *Muhammad Hafiz Osman, Badaruddin Ibrahim*; **draft manuscript preparation:** *Muhammad Hafiz Osman, Badaruddin Ibrahim, Norlida Shaari*. All authors reviewed the results and approved the final version of the manuscript.

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