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# **Paving Blocks Made from Plastic Waste: Environmental Solutions & Business Potential**

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## ***Abstract***

*The research in this thesis aims to find out the process of developing plastic waste products into paving blocks, to find out the business prospects of paving blocks from plastic waste in the city of Palopo and to find out the business implications of paving blocks from plastic waste in the city of Palopo. The type of research data uses research and development methods and descriptive quantitative methods. This research was conducted by conducting product-making experiments and interviews. The development techniques used by researchers are the previous research stage, the initial product development stage, the expert validation stage, and the compressive strength test stage. Analysis of the data used by the author is an analysis of the compressive strength of paving blocks, analysis of economic value, and analysis of contribution to the environment. The results showed that Sample B with a composition of 1.5 kg of plastic waste and 1.5 kg of sand, sample C with a composition of 2.25 kg of plastic waste and 0.79 kg of sand, sample D with a composition of 1.5 kg of plastic waste and 1.9 kg meets the eligibility standard for paving block quality based on SNI 030691 1996 quality standard. Paving block products made from plastic waste have the potential to be developed into a business with a Break Event Point occurring in the 1st month. The profit by producing 1,500 paving blocks has already benefited from the business with the first month's R/C Ratio of 1.1 and the first year's R/C Ratio of 1.4. Paving block products have implications for reducing the amount of plastic waste in the city of Palopo by making plastic waste a raw material for making paving block products. 25 Kg of plastic waste and 0.79 Kg of Sand, sample D with a composition of 1.5 Kg of plastic waste and 1.9 Kg met the eligibility standards for paving block quality based on SNI 030691 1996 quality standards. Paving block products made from plastic waste have the potential to be developed into business with a Break Event Point occurring in the 1st month. The profit by producing 1,500 paving blocks has already benefited from the business with the first month's R/C Ratio of 1.1 and the first year's R/C Ratio of 1.4. 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**Keywords:** *Paving Blocks, Business Prospects, Plastic Waste, and Environmental Solutions.*

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## INTRODUCTION

Yuliesti et al. (2020) the most difficult type of waste to digest in the soil is plastic waste. Plastic waste discarded now will not biodegrade in the next 80 years. Plastic wrap is used on almost all household items.(Yuliesti et al., 2020)Plastic waste is very durable in the environment after disposal and is able to withstand physical, chemical and biological degradation for decades or even longer.

Alhazmi et al. (2021) Plastics are easy to use in a variety of applications used in everyday life, because they are lightweight, tough and cost effective. Large quantities of plastics are used for packaging and container materials as these applications take full advantage of the unique properties of plastics, the use of other materials for these applications would lead to a threefold increase in weight resulting in increased transport and disposal weights, and a further burden on the environment due to increased energy use. higher levels involved in its production and disposal.(Alhazmi et al., 2021)

Subagiyo & Rahayu (2019) Day by day there is more and more waste on earth, while the people themselves are still unfamiliar with environmental education which should be one of the first efforts to tackle the impact of waste. As a result, the quality of the earth has decreased and humans are still indifferent to environmental conditions.(Subagiyo & Rahayu, 2019)

Diana & Fansuri (2020) several cities in Indonesia have implemented a business for processing plastic waste into paving block products. One of the cities that has paving block entrepreneurs from plastic waste is Jakarta. The business built by Ovy Sabrina and Novita Tan spends 88,000 packs of plastic waste every day which pollutes the environment and has produced 100,000 paving blocks in 2021. 4 The company founded by Ovy Sabrina and Novita Tan is called Rebricks Indonesia, the paving blocks they produce have been used in various large projects such as the Santiago District De Latinos BSD parking lot which uses 73,100 paving blocks, the parking lot at McDonald's Parung uses 136,400 paving blocks,(Diana & Fansuri, 2020)

Kutai Kartanegara Regency, East Kalimantan Province also has a waste bank that is developing a paving block business to be precise in Sukamaju Village. His business has been established since June 2019. Paving blocks are made in the shape of a hexagon and are sold for Rp. 10,000 each. In a day, the Sukamaju village waste bank prints around 50 paving blocks, the number and number of products made depends on the amount of plastic waste raw material available. The search for waste has spread to other areas because the area around the plastic waste bank has run out.

Palopo City has a total area of 247.52 square kilometers, which consists of 9 districts and 48 urban settlements or kelurahans. Palopo City is a city with a population that produces waste which is increasing every day, reaching 80 tons per day. As a result of the increasing quantity of various types of composition which are increasingly varied, limited sources of funds for public services in big cities, the impact of technological developments, and limitations that arise in terms of energy and raw materials, the problem of waste management in today's society is very complex/complex.

Table 1. Waste Data of TPS 3R KSM Lagaligo City of Palopo in 2021

No.	Month	Trash Type					
		organic	Inorganic				
			Plastic	paperboard	Metal/ Iron	Glass	Residue
kg	kg	Kg	kg	kg	kg		
1	January	370	54	44.5	9	51	9363
2	February	289	62	47	13	57.5	7950
3	March	355	37.5	30.5	18	28	10255
4	April	402	51	41	13	18.5	10540
5	May	417	44	29	7.5	40	9790
6	June	421	43	23.5	5.5	15	10585
7	July	439	50	25.5	6	24	10930
8	August	0	48	30.5	4	21	10515
9	September	0	54	35.5	12	27	11055
10	October	0	53	43.5	8	79.5	9053
11	November	177	82.5	54	16	67.5	9075
12	December	0	61	52	22.5	49	12850
Total		2870	640	456.5	134.5	459.5	121961

Source. TPS 3R KSM Lagaligo City of Palopo, 2021

Based on the table above, the amount of waste in the city of Palopo, especially plastic waste, reaches 640 kg based on 2021 data and the waste that goes to TPS 3R is only 15% of the total waste in the city of Palopo, therefore the city of Palopo has the potential to implement business development paving blocks as well as a solution to reduce plastic waste that pollutes the environment.

## METHODS

Octaviany et al. (2020) said the type of research conducted for product development is Research and Development. Research and development methods, known as R&D in English, are research procedures used to design and test goods. To be able to develop certain items, needs analysis research is used, and research is needed to assess the effectiveness of these products so that they can function in the wider community.(Octaviany et al., 2020)

The product being developed is paving blocks made from plastic waste. Sugiyono (2019) at the product analysis stage uses a descriptive qualitative research method.

Descriptive qualitative is a research method based on the philosophy of postpositivism. The development stages used in product development use Prof.'s theory. Dr. Sugiyono which consists of the previous research stage, the initial product development stage, the expert validation stage, and the compressive strength test stage used in this product development model.(Sugiyono, 2019)

## RESULTS AND DISCUSSION

The results of this study are paving blocks made from plastic waste as an environmental solution and business potential, the researchers conducted experiments by making paving block products directly using plastic waste mixed with sand, besides that the researchers also conducted interviews with the environmental service lives to find out waste data and how to process plastic waste to reduce environmental pollution.

This compressive strength test is the process of developing plastic waste products into paving blocks by determining the raw material composition of plastic waste and sand. Answering the formulation of the problem, the researcher conducted an experiment to make paving block products directly by making five kinds of samples with different compositions. Of the five samples that have been tested, there are two samples that do not meet the quality requirements for paving blocks.

Zainuri (2021) shows that the results of this study are in line with research conducted by Zainuri entitled "Plastic Waste Management in Paving Block Production" with the results of a 70% plastic:30% sand variation which is recommended for production because it absorbs the most plastic waste.(Zainuri, 2021)

The sample composition that meets the requirements is sample B with a composition of 1.5 kg of plastic waste and 1.5 kg of sand, sample C with a composition of 2.25 kg of plastic waste and 0.79 kg of sand and sample D with a composition of 1.5 kg of waste plastic and 1.9 kg of sand.

Sample B with a compressive strength of 8,553 Mpa fulfills the class D paving block category which is used in parks, sample C with a compressive strength of 14,474 Mpa fulfills the class C paving block category which is usually used for pedestrian areas, and sample D with a strength of 9,056 MPa also includes in the class D paving block category.

Researchers conducted an economic value analysis by determining the Break Even Point. To determine the break-even point for making paving block products, you must first determine the variable cost, fix cost, price, and total variable cost. After that, the breakeven point of the paving block product can be determined, namely after calculating the results of the financial analysis, the Break Event Point occurs in the 1st month by producing 1,500 paving blocks, already benefiting from the business with the first month's R/C Ratio of 1.1 and R/C Ratio the first year 1.4. From the economic value analysis above, it can be concluded that paving block products have the potential to be developed into a business.

The market share in the paving block business is the government, because the government's contribution in using this product as a recommendation for environmentally

friendly materials for city projects will be a contribution in helping to reduce plastic waste. Apart from the government, market share can also spread to communities, communities, or constructions that are members of the earthly use of environmentally friendly products.

The limitation in developing the paving block business is that the production tools are very simple so that making products requires more human resources but with limited production results. Limitations in developing the paving block business are also related to the reintroduction of paving blocks made from plastic waste to the market.

Dieningrum et al. (2020) said the paving block business is a solution to reduce plastic waste. Answering this formulation of the problem, researchers use plastic waste as a substitute for cement in paving block products. Plastic waste serves as a raw material for making paving block products. The use of plastic waste as a raw material will directly reduce the amount of plastic waste that is difficult to decompose. This is also in line with research conducted by Alifan Nurin Ananti Dieningrum, Muslihudin, Edy Suyanto entitled "The Process of Managing Plastic Waste into Paving Blocks in Jetis Village, Kemangkong District, Purbalingga Regency" with the results of research on the process of managing plastic waste is an innovation to solve plastic waste problem by turning plastic waste into paving blocks. (Dieningrum et al., 2020)

Paving blocks produced by the Daeng Rudi concrete business in a month are approximately 150-500 paving blocks. If paving blocks with plastic waste raw materials are produced as much as 150-500 paving blocks in a month, this business will contribute to reducing plastic waste by 263 – 875 Kg of plastic waste in Palopo City.

## CONCLUSIONS

This study aims to explain paving blocks made from plastic waste as an environmental solution and business potential. This study used experiments and interviews in collecting research data and testing the compressive strength of paving blocks using a compressive strength machine. The conclusions of this study are sample B with a composition of 1.5 kg of plastic waste and 1.5 kg of sand, sample C with a composition of 2.25 kg of plastic waste and 0.79 kg of sand, sample D with a composition of 1.5 kg of plastic waste and 1.9 Kg meets the eligibility standard for paving block quality based on the SNI 030691 1996 quality standard.

Paving block products made from plastic waste have the potential to be developed into a business with a Break Event Point occurring in the 1st month. The profit by producing 1,500 paving blocks has already benefited from the business with the first month's R/C Ratio of 1.1 and the first year's R/C Ratio of 1.4. Paving block products contribute to reducing the amount of plastic waste in the city of Palopo by making plastic waste a raw material for making paving block products.

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