PRODUCT DESIGN AND EXPERIMENT ON ESPRESSO MACHINE PORTAFILTER USING REVERSE ENGINEERING AND VDI 2221 METHODS

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Abstract

In the industrial era 4.0, it is easy for companies to meet consumer needs quickly. One of the industries affected is the food and beverage industry, especially the coffee industry. To produce espresso quickly, companies need a tool, namely an espresso machine. However, the capacity of the existing portafilter is not enough to produce large amounts of espresso. The solution to this problem is to increase the capacity of the existing portafilter. The design of this portafilter uses the VDI 2221 and Reverse Engineering methods. This research uses a 1:2 scale as a standard. The espresso obtained increases as the mass of the powder increases. As the capacity increases, the pressure needs to be increased. The resulting waiting time in making espresso is roughly the same between the two portafilters. However, the total output produced is more than the portafilter before modification.

Keywords:
Portafilter, Espresso Machine, Reverse Engineering, VDI 2221

1. Introduction

Indonesia is one of the largest coffee-producing countries in the world. Indonesia is the third-largest coffee producing country after Brazil and Vietnam. in 2015, the coffee plantation area in Indonesia reached more than 1.24 million hectares, whereas 933 hectares is robusta plantations and 307 hectares is arabica plantations. By increasing the area of plantations, Indonesian coffee production in the next ten years is targeted to reach between

900 thousand tons to 1.2 million tons per year. Various kinds of coffee are produced in Indonesia. Starting from coffee beans to instant sachet coffee. The development of coffee in Indonesia makes companies willing to compete in this food and beverage business. Brewing was first improved by separating the water used for brewing, best hot but not boiling, from the heating water. The lever has now been replaced by an electric pump, simpler and more regular to operate.

Espresso machines often used in restaurants and cafes are semi-automatic espresso machines because they can produce maximum espresso characteristics. However, the problem with this machine lies in its portafilter, which can only produce two cups of espresso in one brewing. This problem can be overcome by using an espresso machine with more than one brewing station. However, the more stations an espresso machine has, the more expensive the machine will be. From the problems mentioned above, the main focus of this research is to design a new portafilter with a larger capacity to produce more espresso. The design of this portafilter uses reverse engineering and VDI 2221 methods.

2. Methods

Research begins by determining the topic and title first. Determination of the theme is based on the problems observed in a product. Then the research is continued by identifying the problem of the product. At this stage, the boundaries of the problem contained in the product under study are determined. After determining the boundaries of the problem, the next step is to formulate the problem. From the problems that have been formulated, the research objectives will also be determined. The next stage is the literature study. At this stage, a study search will be carried out to answer the problems contained in the research. The literature study was conducted to compare this research with existing research. After the literature study, the next stage is data collection. The data taken must be based on the purpose of the study. If the data taken is sufficient, it will proceed to the next stage. If the data taken is still lacking, return to the previous stage.

Furthermore, the data is processed based on a predetermined theory. The data is processed to find out the lacking results and improvisation is carried out. The data processing results will refer to the feasibility of a prototype. The data that has been processed will be made an initial design or a new product design. The design will be developed until it is declared feasible to realize the product. Products that have been declared eligible will be made into product realizations to analyze the development of these products.

Furthermore, the product that has been realized will be analyzed and researched for changes in data and improvisations from the previous product. Product comparisons were then recorded to conclude the results of the study. The research methodology can be seen in the following Figure 1.

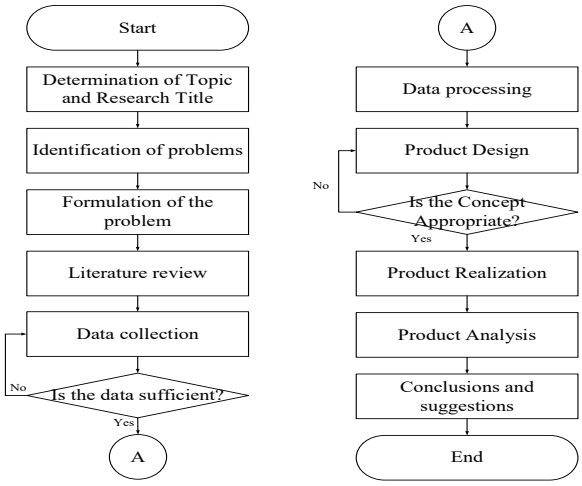


Figure 1 Research Methodology

3. Literature Review

3.1 Reverse Engineer

Reverse engineering is extracting knowledge or design blueprints from anything man-made production. Reverse engineering is usually conducted to obtain missing knowledge, ideas, and design philosophy when such information is unavailable (Eilam, 2011). So, by doing reverse engineering, we can find out and update the existing design into a new idea or idea. There are four stages in reverse engineering:

a. Disassembly Product

This activity is carried out to determine the components of a design. The disassembly results will be examined to determine the function of each component.

b. Benchmarking
Benchmarking is a product comparison stage. Similar products will be compared based on their advantages and disadvantages.
c. Planning New Design
The results of this research are calculated in the previous stage. The new proposed design emerges from the new idea.
d. Prototyping
From the results of the design made, a prototype will be made to find out the work of the new product design. Prototyping is done to find out the product's advantages compared to the previous product.

3.2 Verein Deutcher Ingenieure 2221 (VDI 2221)

VDI Guideline 2221 proposes a generic approach to the design of technical systems and products, emphasizing the general applicability of the approach in the fields of mechanical, precision, control, software, and process engineering (Pahl, W. Beitz, Jörg Feldhusen, Lucienne T. M. Blessing, & Karl-Heinrich Grote, 2007).
There are four stages in the VDI 2221 method. The following is an explanation of the stages contained in the VDI 2221 method:
a. Clarification of The Task
At this stage, information or data is collected regarding the requirements met by the product design. This stage produces the requirements or product specifications. The tools used are in the form of a checklist.
b. Conceptual Design
At this stage, discuss the problem, the research structure, and then find the problem-solving. This stage solves the basic problem or concept.
c. Embodiment Design
This stage is a continuation of determining the product concept. The sketch of the solution that has been obtained from the initial problem is selected based on the conditions by the specifications. This sketch will be made an embodiment of the design (standard layout).
d. Detail Design
This stage produces a detailed design in the form of a file that includes detailed product drawings, component lists, material specifications, tolerances and other files where a file is a single unit. From these results, a re-evaluation of the product will be carried out.

3.3 Product Development and Design

Design is an attempt to compile, get, and create new things useful for human life. While development is a series of activities starting from analyzing market perceptions and opportunities, then ending with production, sales and delivery of products to consumers (Irawan, 2017).
From the above understanding, it can be concluded that product development and design are a series of activities to create new things by considering market perceptions and opportunities to be produced and sold to consumers.

3.4 Bill of Materials (BOM)

BOM is a complete, formal, structured list of components that lists the hierarchical membership and quantity relationships from raw materials to parts, components up to the end product (Zhang, 2017). BOM contains information about the components of a product. The amount and materials needed to make a product are contained in the BOM. By using BOM, companies can determine the number of component requirements and products. In the BOM, there are levels as a basis, including:
a. Level 0: is a finished product. Does not contain the information required for assembly
b. Level 1: is the component that forms level 0. At this level, some finished components and components must be assembled first. However, at this level, it is not a ready-to-use product.
c. Level 2: is a direct component of one of the components at level 1.
d. Level 3: is a level 2 support component. Usually, there are more finished components than assembled components at this level.

3.5 Espresso Making

Espresso is a method that differs from others in that the hot water is under pressure and percolates rapidly (for between 20 and 30 seconds) through the grounds to extract the oils and other aromatic compounds from the coffee. (Racineux & Chung-Leng Tran, 2019). Espresso is usually used as the basis for other beverage concoctions, such as cappuccino, café latte, affogato, etc. Espresso has a characteristic strong taste and aroma and a thick body so that connoisseurs can feel the true taste of coffee. In making espresso using a machine, there are three stages, namely:

a. Grinding

Grinding or grinding is intended to smooth the coffee beans to dissolve in water easily. This process occurs due to collisions, cuts, and friction with coffee beans (Coffee and Cocoa Training Center, 2018). The ground coffee beans will be put into the portafilter at this stage.

b. Tamping

After the coffee grounds are collected into the portafilter, the powder will be compacted using tamping. Tamping is a way to compact coffee grounds to blend into the portafilter (Yuliandari, 2015). The purpose of tamping is so that water can seep thoroughly into the solid so that the coffee is extracted optimally.

c. Extraction

The compressed coffee grounds will be fed into the espresso machine by attaching a portafilter. Extraction is carried out for 20 to 30 seconds. There are three categories of Extraction, namely (Omden, 2020):

i. Under Extraction

Under Extraction is coffee extraction that is carried out in a short time. In this Extraction, the coffee is not maximally extracted.

ii. Perfect Shot

Perfect Shot is a coffee extraction carried out at an optimal time. In this Extraction, the coffee is extracted to the maximum level, then the oil and fragrance in the coffee mix evenly.

iii. Over Extraction

Over Extraction is coffee extraction that is carried out for a long time. This Extraction causes the coffee to lose its consistency, making it run.

3.6 Market Research

Market research is the process of determining the feasibility of a new service or product through research conducted directly with potential customers. Market research allows companies to find target markets and get opinions and other feedback from consumers about their interest in products or services (Twin, 2021). Market research is carried out before product development. Market research aims to discover consumer feedback on the product to be developed.

3.7 Validity and Reliability

Validity and reliability are an instrument to prove a questionnaire can be trusted or not. Factors that affect the validity and reliability of a measuring instrument (instrument) other than the instrument are the user of the measuring instrument who performs the measurement and the subject being measured. However, these factors can be overcome by testing the instrument with appropriate validity and reliability tests (Sugiyono, 2017).

3.8 Fusion 360

Fusion 360 is an application to create images of a product prototype. This application creates an overview of the product before processing it into physical form. This application aims to make various product proposals and find the best product proposals before being designed into their original form.

4. Results and Discussion

The questionnaire data results can be seen in the following Table 1.

Table 1 Questionnaire Data Results

Respondent	Material	Capacity	Spout	Display	cost	Total
1	5	5	4	4	2	20
2	5	4	4	4	5	22
3	5	5	1	3	3	17
4	4	4	4	4	4	20
5	5	4	4	4	4	21
6	4	5	4	5	4	22
7	3	4	5	4	3	19
8	5	4	3	3	5	20
9	4	4	4	2	4	18
10	5	3	3	2	4	17
. .	. .	. .	. .	. .	. .	. .
131	4	4	3	5	5	21

4.1 Validity Test

A validity test is carried out to determine whether the data that has been obtained is valid or not by comparing the r count with the r table. The calculation begins by entering the numbers that the respondents have filled in. Then from the five questions, each respondent will add up. Calculations were performed using Microsoft Excel software. R calculated is obtained through a variable in excel, namely correlation. While the r table is obtained through the number of respondents, namely 131 respondents with a two-way test significance level of 5%, then the r table is 0.1703. The results of the calculations can be seen in the following table.

The calculation results show that the calculated r for the value 1 is 0.597, the value 2 is 0.564, the value 3 is 0.633, the value 4 is 0.697, and the value 5 is 0.719. The resulting value of r arithmetic is greater than the r table, where the r table is 0.1703, then the questionnaire results are considered valid for all questions.

4.2 Reliability Test

The reliability test aims to determine how much the questionnaire can be trusted. This reliability test, performed using the Microsoft Excel application. The test is carried out by calculating the item variance of each variable and the total using the VAR formula in Excel. Then, these results will be entered into the reliability formula to get the value of r11. The calculation results can be seen in the following table.
The calculation results show the total variance of items is 4.299, the total variance is 8.867, and r11 is 0.64397. The above calculations show that the value of r11 is 0.64397, where the value is above >=0.6, the reliability is high.

4.3 Benchmarking

The benchmark of the portafilters circulating in the market can be seen in Table 2.

Table 2 Benchmarking

No.	Name	Specification	Strengths and weaknesses
1	*Portafilter Single*  (Source: https://www.etsy.com/listing/633442930/the-original-portakeeper-tm-portafilter)	*Compatible Brand*: Rocket 58 mm *Straight Tab*	Strengths: - Maximum coffee extraction - Does not require excessive tamping - It's easier to increase the number of shots Weakness: - It can only be used to make one glass
2	*Portafilter Double*  (Source: https://www.bluestarcoffee.eu/isomac--portafilter-double-10376-p.asp)	*Compatible Brand*: La Pavoni 51mm *Size*: 200 x 30 x 55mm	Strengths: - Can make a maximum of 2 cups -Can make smaller coffee extract Weakness: - Easy to be channeling - Requires proper tamping process
3	*Naked Portafilter/Bottomless*  (Source: https://www.amazon.com/Bottomless-Portafilter-Machine-Compatible-Delonghi/dp/B08N56L6PP)	*Compatible Brand*: Delonghi EC155M La Pavoni 51mm *Size*: 218 x 36 x 51 mm	Strengths: - Maximum coffee extraction - -Easily improve coffee extraction - No channeling occurs Weakness: - If the tamping process does not fit, dilution will occur - Can only make 1 cup

5. Design

5.1 VDI 2221 Method

The VDI 2221 method is carried out to obtain the optimal solution of the material to be used. Initial specifications of the portafilter can be seen in the following Table 3.

Table 3 Initial specifications

Parameter	Specification	Demand (D) / Wish (W)
Geometry	Diameter	D
	Width	D
	Height	D
Material	Heat Resistance	D
	Light	D
	Durable	W
	Easy to get	D
	Safe for Food and Beverage	D
Production cost	Affordable Cost	D
Operation	Easy to use	W
	Easy to clean	W
Assembly	Easily removable	D

Information:
D: Demand is a specification that must be met
W: Wish is the expected specification

The initial specifications will be used to determine the principle of the solution / sub-function of the portafilter component to be designed. The principles that have been determined can be used as alternative solutions. The principal solution / sub-function of the portafilter can be seen in the following Table 4.

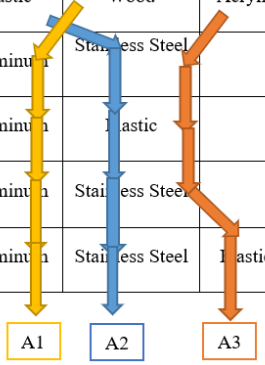
Table 4 The Principal of Solutions / Sub-Functions in Portafilter Components

No.	Solution/Sub-Function Principle	Information	1	2	3
1	*Handle*	Made	Plastic	Wood	Acrylic
2	*Head*	Made	Aluminium	Stainless Steel	
3	*Handle Joint*	Buy	Aluminium	Plastic	
4	*Basket*	Made	Aluminium	Stainless Steel	
5	*Spout*	Made	Aluminium	Stainless Steel	Plastic

The alternatives obtained from the solution principle / sub-function above are as many as (3x2x2x2x3) 72 alternatives. Of the 72 alternatives, three were chosen as alternatives as to the best solution. The solution principle/sub-function alternative can be seen in Table 5.

Table 5 Selection of Alternative Principal Solutions / Sub-Functions

No.	Solution/Sub-Function Principle	Information	1	2	3
1	*Handle*	Made	Plastic	Wood	Acrylic
2	*Head*	Made	Aluminum	Stainless Steel	
3	*Handle Joint*	Buy	Aluminum	Plastic	
4	*Basket*	Made	Aluminum	Stainless Steel	
5	*Spout*	Made	Aluminum	Stainless Steel	Plastic



Description:

-  = Alternative 1
-  = Alternative 2
-  = Alternative 3

The following are the alternatives that have been selected:

- Alternative 1 = 1-2, 2-1, 3-1, 4-1
- Alternative 2 = 1-1, 2-2, 3-2, 4-2
- Alternative 3 = 1-3, 2-2, 3-2, 4-3

From the three alternatives that have been selected, a re-selection will be carried out to determine the best solution. The tools used in making the selection are selection diagrams. The selection diagram can be seen in the following Table 6.

Table 6 Selection Diagram

Selection Diagram for Coffee Machine								
	Variant Principle Solution Selection Criteria					Decision Sign Solution Variant		
	(+) Yes					(+) Yes		
	(-) No					(-) No		
	(?) Less Information					(?) Less Information		
	(!) Check Spesification					(!) Check Spesification		
	According to the overall function							
		According to wish list						
			Within production cost limits					
				Knowledge of the concept is sufficient				
					According to the designer's wishes			
						Meet safety requirements		
	A	B	C	D	E	F	Description	SV
A1	+	+	+	+	+	+	As expected	+
A2	+	-	+	-	-	+	Not As expected	-
A3	+	-	+	-	-	-	Not as expected	-

Based on the selection diagram in Table 6, the concept that meets the criteria in designing a portafilter is the first concept (A1). Pictures of the selected concepts and the espresso machine can be seen in Figure 2 and Figure 3.

Figure 2 Selected Design Results

Figure 3 Espresso Machine with Selected Design Portafilter

The basketball and head dimensions are added to the height in the selected design. The design of the head and basket is increased by approximately 10 mm in height. By increasing the height by 10 mm, the amount of ground coffee that can be accommodated increases by 10 grams from the maximum total before modification.

5.2 Assembly Reverse Engineering After Modification

After knowing each component of the portafilter, the next step is to combine these components. After modification, the assembly process is different from before it was modified. This condition is reflected in the OPC, BOM, and assembly maps. The OPC, BOM, and assembly map of the portafilter after modification can be seen in Figures 4, 5, and 6.

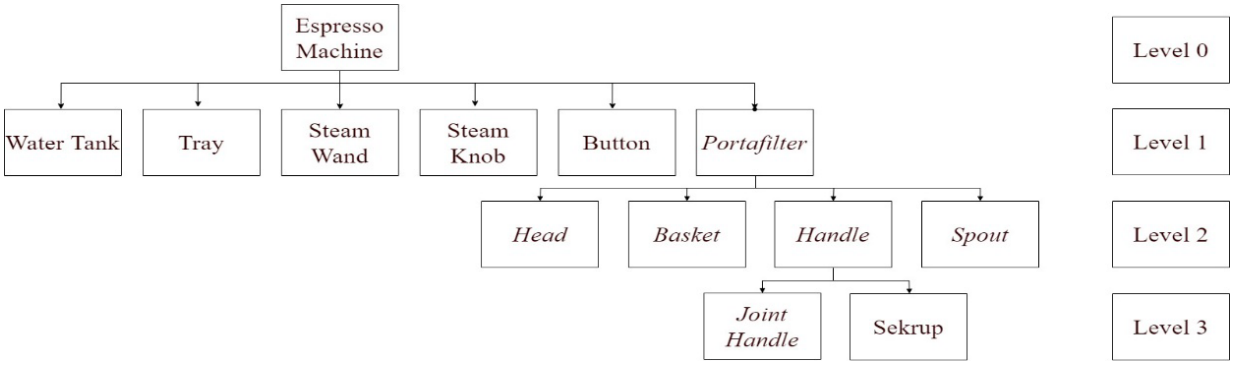


Figure 4 Bill of Material Espresso Machine

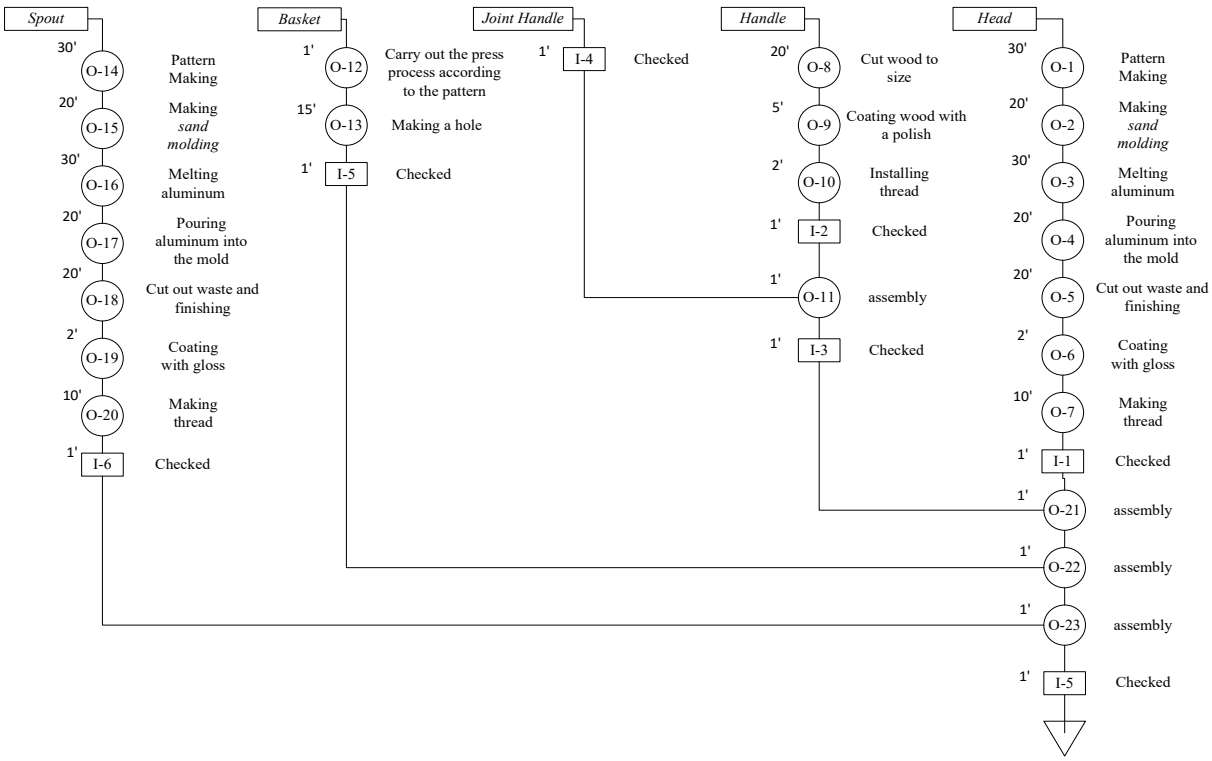


Figure 5 Operation Process Chart Portafilter after Modification

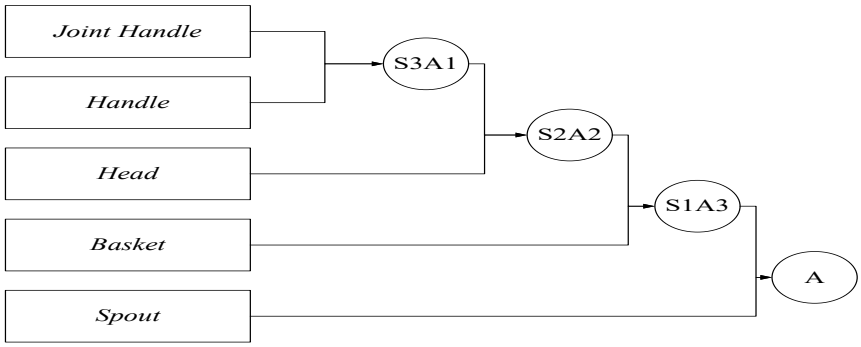


Figure 6 Assembly Map

5.3 Portafilter Performance Test

In the portafilter performance test, the modified design is tested to make coffee with the amount scale of 1:2, which is a 20-gram powder that can make espresso up to 40 grams. The variables to be tested are the time of first flow, brewing time, and total output of espresso. The espresso machine test results before modification can be seen in Table 7.

Table 7 The Test Results of The Espresso Machine Before Modified

Powder Mass	Pressure	First Flow Time	Brewing Time	Total Output per Portafilter	Total Mass Output
18.5	9	6	18	2	36
		6	20	2	34
		6	25	2	36
		6	21	2	35
		6	18	2	34
20	9	7	23	2	38
		7	22	2	35

Powder Mass	Pressure	First Flow Time	Brewing Time	Total Output per Portafilter	Total Mass Output
		7	20	2	36
		7	25	2	40
		7	24	2	34

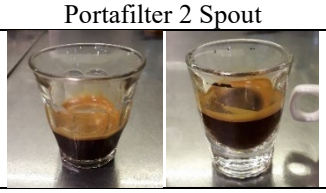
After the portafilter test gained before being modified, the test continued on the portafilter after being modified. The amount scaled to test the portafilter is still the same. The result of the test can be seen in the following Table 8.

Table 8 The Test Results of The Espresso Machine After Modified

Powder Mass	Pressure	First Flow Time	Brewing Time	Total Output per Portafilter	Total Mass Output
21	10	5	20	4	40
		5	22	4	42
		5	21	4	39
		5	23	4	40
		5	23	4	41
24	10	6	24	4	45
		6	23	4	46
		6	25	4	43
		6	22	4	47
		6	24	4	46
27	11	5	26	4	52
		5	24	4	50
		5	25	4	48
		5	23	4	53
		5	25	4	55
30	11	6	24	4	57
		6	25	4	58
		6	26	4	56
		6	23	4	60
		6	24	4	58

The difference between the two results is the pressure, the total output per portafilter, and the total mass produced in the table above. The pressure bar is increased due to the mass increase. When the pressure is increased, the flow time becomes faster. It causes the brewing time to have almost no difference as the powder mass increases. However, the espresso's mass output increases. Therefore, increasing the capacity and number of spouts can reduce wait times and increase espresso machine productivity. Several factors can cause some errors that occur during testing. Some errors are the tamping that is too weak or hard, an excessive amount of powder mass due to inaccurate weighing, and the wrong grind size. The portafilter test results can be seen in the following Table 9.

Table 9 Portafilter Test Results Comparison

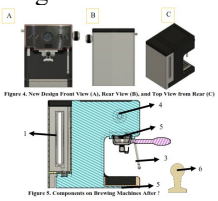
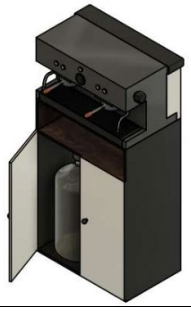
Portafilter 2 Spout	Portafilter 4 Spout
	

As you can see from the results above, the number of espressos produced increased after the new design. The color of the espresso produced is the same by looking at the similarity of the results. However, in this test, the optimal taste of espresso and the concentration level were not taken into consideration because there was no tool to test the accuracy of the taste and concentration.

5.4 Literature Review

The literature review can be seen in the following Table 10.

Table 10 Literature Review

References	Discovery	Research Study
Claudia Jessica Atmadja, Frans Jusuf Daywin, Lina Gozali, Carla Olyvia Doaly, Agustinus Purna Irawan. 2021. *Improving the Capacity of Espresso Machine Using Reverse Engineering Method and VDI 2221 Method. Proceedings of the 11th Annual International Conference on Industrial Engineering and Operations Management Singapore, March 7-11, 2021*	The results showed that the machine's performance could be increased by adding the water capacity, from a total production of 8 cups to 14 cups. Pictures of the designed designs can be seen as follows: 	The use of reverse engineering and VDI 2221 methods in improvising the capacity of the espresso machine.
Marco Marconi, Michele Germani, Marco Mandolini, dan Claudio Favi. 2018. *Applying Data Mining Technique to Disassembly Sequence Planning: A Method to Assess Effective Disassembly Time of Industrial Products. International Journal of Production Research. 1-25*	The results show that the deviations between the estimated and actual disassembly times for a single operation range from 13% to 15% for washing machines and 8% to 2% for coffee machines.	Effectiveness in disassembling products in the form of washing machines and coffee machines.
W. Andreas, "Modifikasi Mesin Seduh Kopi Dual Group Head dengan Menggunakan Metode Reverse Engineering dan VDI 2221," Universitas Tarumanagara, Jakarta, 2021.	This study resulted in a modified espresso machine with more water capacity and a gallon storage area with a time efficiency percentage of 21.28% and a percentage increase in output of 1271.43%. Here is the design of the final modification. 	In making modifications, the method used are reverse engineering and VDI 2221, which involve assembling and disassembling the machine before redesigning it.

6. Conclusions and Suggestions

6.1 Conclusion

From the results of the research above, it can be concluded as follows:

1. From the questions of importance survey results, it can be concluded that each question of validity test results is valid. Through the reliability test, the confidence level of this survey is in the high category.
2. The selected design was modified by increasing the head and basket height by 10 mm. The total capacity increased by 10 grams.
3. From the results of the application of the VDI 2221 method, a portafilter design is obtained using aluminium and a wooden handle. This result was chosen because it has ingredients that are safe for making coffee, durable, and low prices.
4. By increasing the capacity of the portafilter, the espresso machine's pressure must be increased to obtain a balanced flow time.
5. By using a 1:2 scale as a standard, the espresso output increases due to the powder mass.
6. The resulting waiting time in making espresso is roughly the same between the two portafilters. However, the total output produced is more than the portafilter before being modified.

6.2. Suggestions

The suggestions from this portafilter development research are as follows:

1. Research can be done to find the most effective time to make espresso.
2. Can modify the number of existing spouts and their impact.
3. Increase the capacity of the portafilter by increasing the diameter of the portafilter and designing a new tamper according to the size of the portafilter.
4. Examine the handle of the portafilter and its impact when tamping.
5. Increase the number of holes in the basket or reduce them to find out the impact.
6. Next research can be used to find the optimal SOP for taste and concentration with the addition of portafilter capacity.

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Biographies

Alvan Nathanael was born in Jakarta**,** 3rd June 1997, he was graduated from St. James High School, Kelapa Gading in 2015. He has work experience as a high school tutor for 3 years, and ever opened a beverage shop called Me-Nom at 2020. He is currently a last year student at Tarumanagara University, majoring in Industrial Engineering. He was a chief executive for event IMADUTA CUP 2019. In 2021, he was intern at PT. Asaba Industry.

Lina Gozali has been a lecturer at the Industrial Engineering Department of Universitas Tarumangara since 2006 and a freelance lecturer at Universitas Trisakti since 1995. She graduated with her Bachelor's degree at Trisakti University, Jakarta, Indonesia, then she got her Master's Degree at STIE IBII, Jakarta, Indonesia, and she recently got her Ph.D. at Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia in 2018. Her apprentice college experience was in the paper industry at Kertas Bekasi Teguh, the shoe industry at PT Jaya Harapan Barutama, and the automotive chain drive industry at Federal Superior Chain Manufacturing. She teaches production systems and supply chain management subjects. She did research about Indonesian business incubators for her Ph.D. She has written almost 70 publications since 2008 in the industrial engineering research sector, such as Production

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Frans Jusuf Daywin was born in Makasar, Indonesia on 24th November 1942. is a lecturer in the Department of Agricultural Engineering at Faculty of Agricultural Technology Bogor Agricultural University since 1964 conducted teaching, research, and extension work in the field of farm power and machinery and become a professor in Internal Combustion Engine and Farm Power directing and supervising undergraduate and graduate students thesis and dissertation and retired as a professor in 2007. In 1994 up to present as a professor in Internal Combustion Engine and Farm Power at Mechanical Engineering Program Study and Industrial Engineering Program Study Universitas Tarumanagara, directing and supervising undergraduate student's theses in Agricultural Engineering and Food Engineering Desain. In 2016 up to present teaching undergraduate courses of the introduction of concept technology, research methodology, and seminar, writing a scientific paper and scientific communication, and directing and supervising undergraduate student's theses in Industrial Engineering Program Study at the Faculty of Engineering Universitas Tarumanagara. He got his Ir degree in Agricultural Engineering, Bogor Agricultural University Indonesia in 1966, and finished the Master of Science in Agricultural Engineering at the University of Philippines, Los Banos, the Philippines 1981, and got the Doctor in Agricultural Engineering, Bogor Agricultural University Indonesia in 1991. He joined 4-month farm machinery training at ISEKI CO, AOTS, Japan in 1969 and 14 days agricultural engineering training at IRRI, Los Banos the Philippines, in March 1980. He received the honors "SATYA LANCANA KARYA SATYA XXX TAHUN" from the President of the Republic of Indonesia, April 22nd, 2006, and received appreciation as Team Jury from the Government of Indonesia Minister of Industry in Industry Start-Up 2008. He did several research and survey in the field of farm machinery, farm mechanization, agricultural engineering feasibility study in-field performance and cost analysis, land clearing and soil preparation in secondary forest and alang-alang field farm 1966 up to 1998. Up till now he is still doing research in designing food processing engineering in agriculture products. Up to the present he already elaborated as a conceptor of about 20 Indonesia National Standard (SNI) in the field of machinery and equipment. He joins the Professional Societies as a member: Indonesia Society of Agricultural Engineers (PERTETA); Indonesia Society of Engineers (PII); member of BKM-PII, and member of Majelis Penilai Insinyur Profesional BKM-PII.

Evera Olivia was born in Jakarta, 30th October 2002, she is an Industrial Engineering student at Tarumanagara University. She graduated from SMAN 5 Karawang, and she was a modern dancer here. She is a dance teacher for children if there is any event. She loves dogs, and she has had dogs since she was a child until now. During her free time, she likes to read fiction books and likes to work as a dress designer to learn something new.