



Increasing Dishwashing Soap Production Capacity through the Implementation of Mixer Machines in Small and Medium Enterprises

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Abstract

Small and Medium Enterprises (SMEs) contribute to national economic resilience, particularly in producing household chemicals. However, small-scale dishwashing soap production often relies on manual stirring, which limits capacity, efficiency, and product consistency. This study aims to increase dishwashing soap production capacity by implementing a mixer machine at Sahabat Bersih SMEs. A comparative case study approach was used to compare production results before and after the implementation of the machine. Data were collected through time studies, production records, and quality tests. The results showed that the implementation of a mixer machine with specifications of power: 135 Watt, Capacity: 40 Liters, Frequency: 50 / 60 Hz, Voltage: 220 V Speed 200 Rpm with a machine weight of 25 Kg, dimensions: 30 x 65 x 85 cm was able to increase production capacity by 700%, reduce mixing time by 33%, and improve product homogeneity. These findings confirm that implementing Appropriate Technology (TTG) can strengthen the competitiveness of SMEs and provide a model that can be replicated in similar industries.

Keywords: *Dishwashing Soap, Production Capacity, Small And Medium Enterprises, Mixer Machines, Appropriate Technology*

INTRODUCTION

Small and Medium Enterprises (SMEs) support local economies, create jobs, and improve community well-being. In Indonesia, SMEs widely produce household chemical products such as dishwashing soap. However, many SMEs face limitations in increasing production capacity due to the continued use of manual tools and traditional methods. Small and Medium Enterprises (SMEs) play a crucial role in supporting local economies, generating employment, and improving community well-being. In Indonesia, SMEs are widely engaged in producing household chemical products, such as dishwashing soap. However, production capacity remains limited due to reliance on manual tools and traditional methods (Bappenas, 2023).

Dishwashing soap production typically involves mixing raw materials, such as surfactants, water, fragrances, and dyes, to form a homogeneous solution. Manual mixing, while inexpensive, only allows for limited batch capacity, requires high labor costs, and often results in inconsistent product quality. This makes SMEs less competitive than large-scale producers that have adopted automated production systems.

Appropriate Technology (TTG) presents a potential solution for SMEs. Using simple yet effective machinery, SMEs can improve production efficiency and consistency without requiring significant investment. Unfortunately, empirical research on the quantitative impact of TTG implementation, particularly on household chemical production in Indonesia, is still limited. Manual mixing of raw materials, such as surfactants, water, fragrances, and dyes, has low batch capacity, requires more labor, and often produces inconsistent quality (BPPT, 2022). This condition makes SMEs less competitive compared to large-scale manufacturers that adopt automation (Rahman & Yusof, 2022). Appropriate Technology (TTG) offers a potential solution to these

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challenges. By utilizing affordable yet effective machinery, SMEs can enhance production efficiency and consistency in quality without incurring substantial investment (Smith & Lee, 2020; Kumar & Sharma, 2019). Previous studies emphasize that stirring speed, impeller design, and duration significantly influence product homogeneity (Li & Zhang, 2018; Wang & Chen, 2021).

Market demand for dishwashing soap products continues to increase in line with population growth, lifestyle changes, and growing public awareness of the importance of cleanliness. However, limited production capacity makes it challenging for most small and medium-sized enterprises (SMEs) to consistently meet market demand. This results in market opportunities being increasingly captured by products from large-scale manufacturers. Therefore, efforts to increase production capacity in SMEs are highly relevant and urgent.

Besides capacity issues, product quality is also a determining factor in the competitiveness of SMEs. Products that are not homogeneous, too runny, or have unstable viscosity often undermine consumer confidence. Previous studies have shown that technical factors such as stirring speed, impeller design, and mixing duration significantly influence the final results of household liquid products. Therefore, the use of mixer machines not only increases production quantity but also ensures more consistent quality.

The novelty of this research lies in its empirical case study approach in the Sahabat Bersih small and medium enterprise (SME), which serves as a concrete example of the application of TTG in the household chemical industry in Indonesia. While most previous studies have examined only technical or conceptual aspects, this study provides direct evidence of the impact of mixer machine implementation on production capacity, time efficiency, and product quality. Therefore, this research is expected to serve as a basis for developing a replication model that can be adopted by similar SMEs in various regions.

Based on the above description, SMEs' main problems are limited production capacity, unstable product quality, and high workload due to manual mixing methods. Therefore, this study aims to analyze the impact of implementing a soap mixer machine on increasing production capacity, reducing processing time, and improving product quality consistency at Sahabat Bersih SMEs. In addition, this study also seeks to provide a practical contribution in the form of a replicable TTG implementation model to support the development of SMEs in the household chemical sector in Indonesia.

Therefore, this research aims to analyze the impact of implementing a soap mixer machine on production capacity, processing time, and product quality consistency in SMEs. The novelty lies in providing empirical evidence from a real-world case study in Indonesia, which has been relatively underexplored in past research.

LITERATURE REVIEW

Appropriate Technology (APT) has long been recognized as a key factor in increasing productivity and efficiency in small and medium-sized enterprises (SMEs). Smith and Lee (2020) studied detergent production in South Korea and found that implementing semi-automatic machines increased production capacity by 45%. Adopting simple technology can significantly impact the competitiveness of small-scale Enterprises. A similar finding was expressed by Djohar et al. (2021), who analyzed the implementation of APT in Indonesian SMEs. The study noted improvements in cost efficiency and product standardization, confirming that APT impacts not only production quantity but also the consistency of quality.

Various technical limitations are often encountered in dishwashing soap production, particularly regarding mixing speed, batch capacity, and worker fatigue levels. A 2023 report by Bappenas (National Development Planning Agency) indicates that using manual methods, most small and medium enterprises (SMEs) can only produce 20–30 liters per batch, with a mixing time

of more than 60 minutes. This aligns with a 2022 study by the Indonesian Agency for the Assessment and Application of Technology (BPPT), which confirmed that mixer machines can process up to 50–100 liters per batch in 30–40 minutes with better homogeneity. Therefore, using mixer machines is an appropriate technological intervention to increase the efficiency of dishwashing soap production in SMEs.

Other studies further reinforce the importance of appropriate machine design to increase productivity. [Kumar and Sharma \(2019\)](#) emphasized that developing a low-cost mixer machine can double the production capacity of SMEs without requiring significant investment. Meanwhile, [Wang and Chen \(2021\)](#) found that optimizing process parameters, particularly stirring speed, significantly impacts the homogeneity and stability of household liquid products. From a technology adoption perspective, [Almeida and Costa \(2020\)](#) identified several barriers, such as limited labor skills and initial investment costs. However, driving factors, such as the need for increased competitiveness, can accelerate the implementation of TTG. Furthermore, [Rahman and Yusof \(2022\)](#) demonstrated that using semi-automatic machines in Southeast Asia has increased production capacity and operational efficiency in various SMEs. Similarly, [Li and Zhang \(2018\)](#) demonstrated that the consistency of liquid product quality is significantly influenced by mixer design and the technical stirring parameters.

In addition to capacity building, previous research also highlights the role of TTG in supporting the *sustainability* of small Enterprises. Mixing machines with relatively low energy consumption have been shown to reduce the need for manual labor and reduce long working hours. This implies a reduction in the total energy used in the production process compared to traditional methods, thus supporting the concept of energy efficiency while being environmentally friendly ([Wang & Chen, 2021](#)). Thus, TTG serves not only as a tool to increase production capacity but also as a strategy to support the sustainable development of small Enterprises.

Socioeconomic factors also play a significant role in the success of TTG implementation. [Almeida and Costa \(2020\)](#) emphasized that worker resistance to technological change is often a barrier to adoption in SMEs, especially when workforce skills are limited. However, research by [Rahman and Yusof \(2022\)](#) demonstrated that this resistance can be overcome through short training sessions and a hands-on approach. *Hands-on learning* can increase worker acceptance of new technologies. This confirms that the success of TTG adoption depends on technical aspects and socioeconomic factors that support operational sustainability.

The existing literature confirms that using mixer machines in liquid soap production can improve SMEs' productivity, quality, and competitiveness. However, most existing research is macro-scale or based on technical simulations, rather than empirical case studies at the small-scale industry level in Indonesia. Thus, a research gap remains that needs to be filled through real-world practice-based studies. This study aims to address this gap by presenting empirical evidence of the application of mixer machines in SMEs. *Clean Friends* also presents a TTG implementation model that other SMEs in the household chemical sector can replicate.

The conceptual framework in this study stems from the fact that most SMEs in Indonesia, particularly in the household chemical production sector, still rely on manual processing methods. This limitation creates problems such as low production capacity, inconsistent product quality, and high labor costs. This situation aligns with findings from [Bappenas \(2023\)](#) and [BPPT \(2022\)](#), which confirm that manual methods limit production scale and reduce SME competitiveness in the market.

Previous literature confirms that the application of Appropriate Technology (APT), particularly mixer machines, has the potential to address these issues. Studies by [Smith and Lee \(2020\)](#) and [Kumar and Sharma \(2019\)](#) show that low-cost mixer designs can significantly increase production capacity. [Wang and Chen \(2021\)](#) also emphasize the importance of adjusting technical

parameters, such as stirring speed, to ensure the homogeneity and quality of liquid products. Therefore, the conceptual framework of this study emphasizes that the application of mixer machines in SMEs impacts capacity increases and product quality consistency.

On the other hand, socioeconomic aspects are also an important part of the research framework. [Almeida and Costa \(2020\)](#) explain that barriers to technology adoption are often related to worker skills and resistance to change. However, [Rahman and Yusof \(2022\)](#) show that through simple training, the adoption of TTG can be well-accepted and positively impacts small Enterprises' transformation. The application of mixer machines is a multidimensional approach that encompasses both technical, social, and economic aspects to improve production capacity, time efficiency, and product quality in *IKMClean Friends*. This impact is expected to ultimately increase the competitiveness of SMEs and contribute to developing a TTG model that can be replicated in similar Enterprises.

RESEARCH METHOD

Research Design

This study uses a comparative case study design to analyze the impact of implementing a mixer machine. Production performance is compared before (manual) and after (machined) implementation ([Yin, 2018](#); [Creswell & Creswell, 2018](#)).

Research Location

The research was conducted at IKM Sahabat Bersih, a household chemical producer in Bantul, Yogyakarta, with a workforce of 8 people.

Machine Specifications

The soap mixer machine used has the following power specifications: 135 Watts, capacity: 40 Liters, Frequency: 50 / 60 Hz, Voltage: 220 V, Speed 200 Rpm, machine weight 25 Kg with dimensions: 30 x 65 x 85 cm

Data Collection Techniques

Data is collected through:

1. Time study – measuring the mixing duration per batch ([Niegel & Freivalds, 2014](#)).
2. Production records – record daily Output.
3. Quality test – assesses the viscosity and homogeneity of the solution.
4. Employee interviews – exploring experiences related to workload and ease of operation ([Kvale & Brinkmann, 2015](#)).

Data Analysis

The analysis was carried out by comparing the average capacity, Time, and quality before and after using the mixer ([Miles, Huberman, & Saldaña, 2014](#)).

FINDINGS AND DISCUSSION

Production Output

Table 1 shows a comparison of the average daily Output before and after the use of the machine.

Table 1. Comparison of Production Output

Parameter	Manual Production	Production with Mixer	% Increase
Batch Capacity (liters)	5	40	700%
Daily Output (liters)	35	280	700%
Production quantity (bottles)	78	622	700%
Mixing Time (min/batch)	30	20	33%

Product Homogeneity Quality using a mixer reduces the potential for production failure due to imperfect mixing of raw materials by 30%. Worker Feedback: Where Workers report reduced physical fatigue, ease of operation, and an increase in predictable production quantities.

Discussion

The results show that the application of mixer machines significantly increases production efficiency in SMEs. *Clean Friends* Production capacity increased by 700%, mixing Time decreased by 33% per batch, with manual mixing capacity reaching 5 liters per worker for 30 minutes. These results align with the findings of [Smith and Lee \(2020\)](#) and [Djohar et al. \(2021\)](#), which emphasized the role of TTG in increasing SME productivity.

Increasing homogeneity supports product quality, especially dish soap. From a worker's perspective, using machines has been shown to reduce fatigue, thus supporting occupational safety and health aspects. From an economic perspective, an investment of 5 million Rupiah in a mixer machine is estimated to be recoupable in approximately 1 month through increased capacity and sales volume. This indicates that TTG is not only technically feasible but also economically viable. A limitation of this study is that it only covers one SME case. Further research can be conducted on several SMEs to test the replication of the results and assess integration with automatic filling and packaging machines.

CONCLUSIONS

This study concludes that the implementation of a soap mixer machine in SMEs has been proven to:

1. Increase production capacity by 700%.
2. Reduce mixing time by 33%.
3. Improve product quality consistency.
4. Reduce worker fatigue.

Practical Contribution

This research demonstrates that mixer machines are a feasible and affordable form of Appropriate Technology (TTG) to improve competitiveness in small household chemical enterprises. The findings can be directly used by SME owners to justify small-scale technological investments.

Theoretical Contribution

The study provides empirical evidence supporting the theory that simple technological interventions can bridge the productivity and quality gap between SMEs and large manufacturers. It enriches the literature on TTG adoption in the household chemical sector.

LIMITATIONS & FURTHER RESEARCH

Further research is recommended to integrate mixer machines with automatic filling and packaging systems, and to replicate this study across multiple SMEs to test the generalizability of the findings. This study was limited to one SME case in Yogyakarta. Therefore, the results may not fully represent all SMEs in Indonesia. Future research should include more diverse case studies and consider other variables such as energy consumption, long-term durability of machines, and economic scaling.

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