

# Analysis of Quality Control of Chocolate Production Process at CAU Chocolates Bali

I Kadek Dwi Wahyu Saputra and Ni Ketut Purnawati

## ABSTRACT

The products produced by the company must comply with the quality standards expected by the customer, for that a strict quality control system is needed. This study aims to analyze the quality control activities of the chocolate production process at PT. CAU Chocolates Bali is already optimal. This research was conducted at PT. CAU Chocolates Bali is located at Jalan Marga-Apuan, Cau, Marga, Tabanan Regency, Bali. This research uses descriptive research method with saturated sampling technique in sampling the product to be tested. The data used in this study is data on the number of chocolate product defects in the period May to June 2022. The data analysis technique used in this study is Statistical Quality Control, namely with p control chart diagrams and cause-and-effect diagrams as well as quality cost analysis. The results of the quality cost analysis show that the production process quality control activities carried out by PT. CAU Chocolates Bali is still not optimal, because even though the level of damage that occurs is still within the control limit or is still between the upper limit (UCL) and the lower limit (LCL), the actual total cost of quality charged to the company is still greater than total cost of optimal quality.

**Keywords:** Quality, Quality Control, Statistical Quality Control.

**Submitted:** December 26, 2022

**Published:** January 24, 2023

**ISSN:** 2507-1076

**DOI:** 10.24018/ejbmr.2023.8.1.1800

**I. K. D. W. Saputra\***

Management, Faculty of Economics and Business, Udayana University, Indonesia  
(e-mail: saputraw231@gmail.com)

**N. K. Purnawati**

Management, Faculty of Economics and Business, Udayana University, Indonesia  
(e-mail: m\_purnawati@yahoo.com)

\*Corresponding Author

## I. INTRODUCTION

Cocoa are an important ingredient in the chocolate-making industry. there are several cocoa beans which are the main raw material for making chocolate. Good quality cocoa beans can be processed into various types of products such as chocolate, cocoa powder, cocoa butter, and so on. Processed foods from cocoa beans are often found in many flavors. Most chocolate lovers are always looking for quality chocolate to consume. The quality of chocolate is determined based on the percentage of cocoa and cocoa butter used, for the pleasure of chocolate connoisseurs. A large number of chocolate fans in the world and every country make chocolate a lot of processed products and is one of the superior products with various flavors.

Competition in the chocolate industry is not only on the selling price of the product but also on the quality of the product produced. Quality is an important factor in determining the satisfaction that consumers get after buying and using a product because a good quality product will be able to fulfill the wants and needs of consumers, so companies need to maintain the quality of their products so they can compete with other companies in maintaining satisfaction. consumers. Companies carry out various methods by focusing on various aspects including technology, management, raw materials, and others to improve the quality of the products (Kartini & Syarief, 2018). a company's success is seen from the level of product acceptance accompanied by a high level of customer satisfaction. Therefore, quality control is needed by

companies to maintain and improve the quality of product production, because quality is an important factor in increasing customer satisfaction and loyalty

There are different definitions of the concept and opinions about quality, and what quality should include in a product. The quality of a product is the ability of a product to satisfy exceeding customer desires and expectations (Girmanova *et al.*, 2017). Quality is the overall features and characteristics of an item or service that uses its ability to fulfill stated or implied needs. To be able to produce quality products, companies must plan and control the product production process properly (Heizer & Render, 2015). Quality control activities will help companies produce good quality products, improve product quality continuously, and can reduce production costs (Kemit *et al.*, 2016).

Quality control of the production process is an activity of planning and supervising the production process, starting from raw materials that have not been processed at all, until these materials turn into finished products according to standards set by the company. If the product produced by the company is not by the standards set, then the product is included in the defective product group. The company will later analyze the defective product for the cause of the defect, and the results of this analysis will be used as a guide as well as learning so that the company does not make the same mistakes in the future and as much as possible avoids these mistakes so that the production process runs better and of course has higher quality. Minimizing defects is an effort that must be carried out continuously in terms of improving the quality of a product (Rachman, 2017).

One method that can help companies to control the quality of their production processes is to use Statistical Quality Control (SQC). Statistical Quality Control (SQC) or Statistical Process Control (SPC) is a process control tool that is often used to determine process variability on control charts along with process capability analysis (Lestari, 2018). Statistical methods are needed to understand the variability in product and process variables. In addition, the use of statistical methods can also minimize the variability that directly affects product quality (Alkubaisi, 2013). Statistical Quality Control (SQC) is a technique developed based on a conception of process variability, which is widely applied not only in manufacturing processes but also in service operations (Halim-Lim *et al.*, 2017). SQC is an effective tool for quality control in all types of industries, both manufacturing and other industries (Harpreet *et al.*, 2016). If the company can apply the SQC method correctly, the company will be able to prevent problems, control the production process, and ultimately increase profits and customer satisfaction (Madanhire & Mbohwa, 2016)

The use of statistical quality control has been carried out by several previous researchers to see if the quality control system implemented in several companies is under control by looking at the level of product damage that occurs. Empirical research conducted by Sari and Purnawati (2018) states that the quality control of the production process at the Pie Susu Barong Company has not run optimally, because even though the number of defective products produced is still within reasonable limits, which is located between the upper limit (UCL) and the lower limit (LCL), but at the actual damage level, the total quality costs incurred are more significant than the total quality costs produced at the optimal damage level. Sari and Sudiarta (2019) shows that the quality control carried out in the companies studied is still not optimal because even though the number of defective products produced is still within reasonable limits, namely between the upper limit (UCL) and lower limit (LCL), however at the actual damage level, the total quality cost incurred is greater than the total quality cost produced at the optimal damage level. Research conducted by Elmas (2017) states that quality control in the company under study has been going well because the number of defective products that occur is still within reasonable limits, which is located between the upper limit (UCL) and lower limit (LCL). Analysis of the cause-and-effect diagram shows that the main factor in the occurrence of defective products is caused by human negligence or human resource factors. Research conducted by Busyairi (2017) shows that the quality control of the production process in the company studied has been running optimally because the damage that occurs is still within control limits. Research by Godina *et al.* (2016) showed that the quality control of the production process carried out in the companies studied was running optimally.

To maintain the quality of a product, the company must pay a fee, which is called the cost of quality. Quality costs are costs that arise because there may be or have been products that are of poor quality. Quality Costs or in other words called Quality Costs are costs incurred in handling quality problems, both in the context of improving quality and costs incurred due to poor quality (Erdhianto, 2021). Sari and Purnawati (2018) states that quality costs consist of 3 main categories,

namely Prevention Costs, Appraisal Costs, and Failure Costs. Failure costs are divided into 2 types: Internal Failure Costs and External Failure Costs.

Based on the results of interviews and direct observations conducted at PT. CAU Chocolates Bali shows that the company has carried out quality control activities every day, but it is known that out of 350 chocolate bars produced per day, or as many as 8750 chocolate bars for one month, 1005 chocolate bars are damaged with average daily damage of 40 chocolate bar or equal to 11.5% per. day. The criteria for damage to chocolate bar products include cracks in the chocolate after the molding process, the color of the chocolate being cloudy and not shiny, and there is still fat left in the mouth when the chocolate is consumed. If defective products continue to occur, it will be able to affect the profits earned by the company. Damaged products affect the company's profits because the costs incurred will increase. Defective products can affect profits because in production defective products have cost production and cannot be repaired. That is, if the number of defective products continues to increase, it can have an impact on increasing the cost of production, thereby reducing the profit or profitability earned by the company. Then the purpose of conducting this research is to analyze the quality control of the production process carried out by PT. CAU Chocolates Bali.

## II. LITERATURE REVIEW

### A. Quality

Quality according to Heizer and Render (2015) is the overall features and characteristics of an item or service that uses its ability to fulfill stated or implied needs. Quality is the characteristic of a product in its ability to meet predetermined and latent needs. The dimensions of quality are Performance, Durability, Conformance to Specification, Features, Reliability, Aesthetics, Perceived quality, and Serviceability. In addition to being an essential element in operations, quality has implications for corporate reputation, product liability, and global implications

### B. Quality Control

Quality control is a process of arranging raw materials to become the final product by examining or checking and comparing with expected standards, if there is a deviation from the standard, it is recorded and analyzed to determine where the deviation occurs, as well as the factors that cause the deviation. Tools used in quality control are Pareto Diagrams, Cause and Effect Diagrams, Stratification, Check Sheets, Histograms, Scatter Diagrams, and Control Charts (Erdhianto, 2021)

### C. Quality Costs

Quality Costs are costs incurred in handling quality problems, both to improve quality and costs incurred due to poor quality. Quality costs consist of 3 main categories, namely Prevention Cost, Appraisal Cost, and Failure Cost. Failure costs are divided into 2 types: Internal Failure Costs and External Failure Costs (Erdhianto, 2021).

### III. RESEARCH METHOD

This research is a case study regarding the quality control of the chocolate production process at PT. CAU Chocolates Bali which is descriptive research with a quantitative approach analyzes the company's problems regarding the quality control of the production process.

Product Quality Standards in this study are product quality characteristics set by PT. CAU Chocolates Bali according to the wishes of consumers, consists of soft and no fat attached when the chocolate is consumed which is checked before the chocolate is put into the mold, is shiny in color, has no cracks, and is soft when consumed. Total Production is the number of products produced by PT. CAU Chocolate Bali in 1 day of production, namely 350 chocolate bars, or 8,750 chocolate bars in 1 (month) of production. The number of Products Damaged in the Production Process is the number of products produced in one day of production that does not comply with the established product quality standards. Quality costs are costs incurred, either in the form of prevention costs, monitoring costs, or quality assurance costs, which the company per unit of defective product bears.

The population in this study was all chocolate bar products produced by PT. CAU Chocolates Bali in 1 day of production, which consists of several variants such as original, sea salt, and vegan series. In 1 day of production, PT. CAU Chocolates can produce approximately 350 bars of chocolate or 8,750 bars of chocolate in 1 month or 25 working days. Sampling used a saturated sampling technique. Data collection in this study was obtained by observation and interviews. Data analysis techniques use statistical quality control techniques by making check sheets and making P-charts.

### IV. RESULTS AND DISCUSSION

#### A. Determination of Quality Standards for Chocolate Products

Based on an interview with Adi who is a production supervisor, it can be seen that the quality standards for chocolate bar products (bars) set by the company are based on consumer wishes which will be divided into two categories, namely quality standards that are checked before the printing process and after the printing process are not cracked. (checked after the printing process), shiny color

(checked after the printing process) and soft when consumed, and does not leave fat marks in the mouth when finished. (checked just before the printing process is done). If the resulting chocolate product does not meet one or all of the desired chocolate criteria, then the chocolate product is declared damaged.

#### B. Chocolate Bar Production Check Sheet

Of the 350 chocolate bar samples taken per day or as many as 8750 chocolate bars for one month, 1005 chocolate bars were damaged with an average of 40 chocolate bars per day. There are 3 (three) categories of damage that occur due to cracks in the chocolate during molding, fat is still attached when consumed, and the color of the chocolate is not shiny. The highest number of defective products per day during May - June occurred on day 22, namely 52 chocolate bars, while the lowest number of defective products per day occurred on day 14, namely 32 chocolate bars.

#### C. CAU Chocolate Bar Production Damage Control Limits

Based on Fig. 1, There are no points outside the control limits (UCL and LCL). All 25 points are within the control limits, so it can be said that the quality control of the chocolate product production process at PT. CAU Chocolates Bali is still under control. However, from 25 From the existing points, it can be seen that the points on days 12 and 22 are almost close to the control limits, so these points appear to fluctuate and are irregular, which means the quality control of the production process is carried out by PT. CAU Chocolates Bali still has high variations. , it still needs further analysis to find out the cause of the high variation that occurs by using a cause-and-effect diagram (fishbone diagram).

#### D. Analysis of Factors Causing Damage to CAU Chocolate Bar Products with Fishbone Diagrams

Based on Fig. 2, cracks in the chocolate during printing are caused by the raw material for chocolate, namely the lack of fermentation period for the cocoa beans before being sent to the factory. In addition, too much water content in the chocolate dough can also cause the printed chocolate to crack. When the chocolate enters the printing process, the workers are not careful when removing the chocolate from the molds and move the chocolate to the packaging area which causes the chocolate to crack.

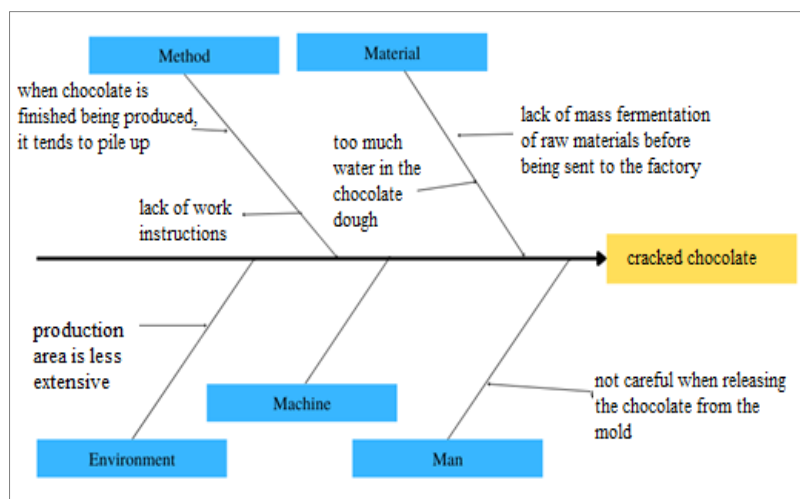


Fig. 1. Fishbone Diagram of Cracked Chocolate Products.

In addition to the raw material and human resource factors, it is also caused by the method factor, where when the chocolate is removed from the mold, the chocolate tends to be piled up causing some of the chocolate at the bottom to crack.

The next factor is the environmental factor, where the space available is not wide enough, this is due to the arrangement of work equipment that is not neat so the space available for workers to place chocolate that is ready to be packaged tends to be narrow so that chocolate is piled up causing cracks to form chocolate.

The second damage is the form of fat that remains in the oral cavity when consumed with chocolate. Fig. 2 is a cause-and-effect diagram of the presence of fat left in the oral cavity when chocolate is consumed.

Based on Fig. 2, the damage was caused by careless labor when mixing chocolate-making ingredients in which too much vegetable oil was added. In addition to raw materials and labor, damage to chocolate products in the form of fat remaining in the mouth when chocolate is consumed is also caused by a lack of work instructions before and during production. Hence, workers become less careful or careless during the production process.

The third damage is a brown color that is dull and not shiny. Fig. 3 gives the cause-and-effect diagram of matte browns.

Based on Fig. 3, Chocolate damage is due to the lack of fermentation period of the chocolate material used, besides that the high temperature of the chocolate in the tempering process also causes the brown color to become cloudy and not shiny. In addition to raw materials, another factor that causes brown damage in the form of a cloudy and dull brown color is caused by the labor factor, where the workforce is considered to be less thorough in the production process so that damage occurs. In addition to raw materials and labor, damage to chocolate products in the form of a cloudy and dull brown color is also caused by a lack of work instructions before and during the production process so workers become less careful or careless during the production process.

*E. Quality Cost Analysis*

Based on the P control chart, it can be seen that the quality control activities for the production process of chocolate bar products are carried out by PT. CAU Chocolates Bali is still within the control limits. Still, to find out whether the quality control that has been carried out is optimal or not, a quality cost analysis is needed. First, determine the lowest number of product defects, then proceed to find the total cost of quality control, quality assurance costs, and the lowest total cost of quality so as to achieve optimum quality costs.

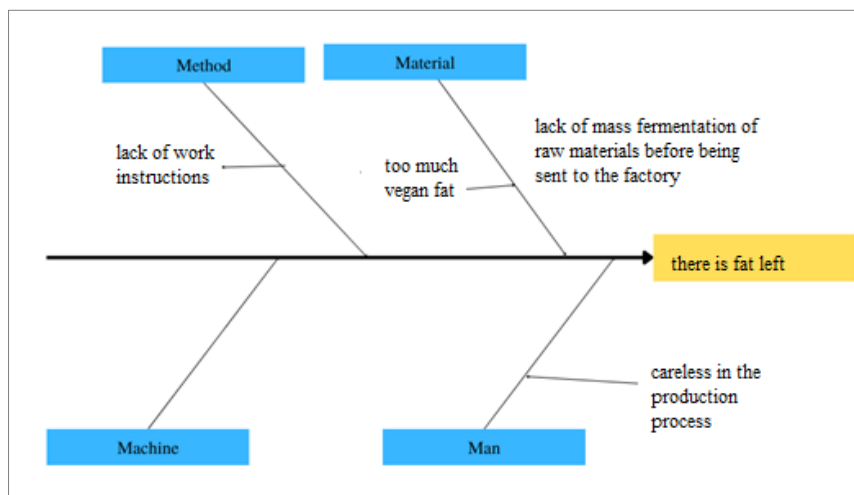


Fig. 2. Fishbone Diagram of Damaged Products with Fat Left Behind.

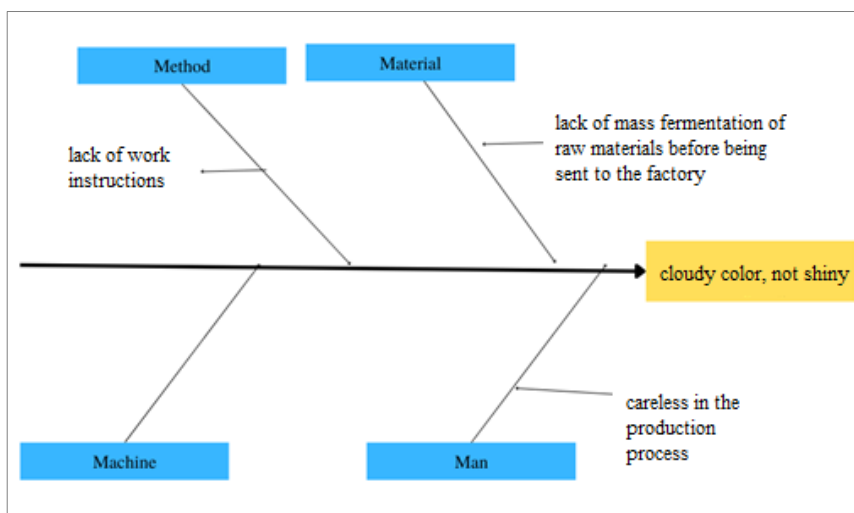


Fig. 3. Fishbone Diagram of a Cloudy and Not Shiny Product.

The first cost is the cost of maintaining production machines, which is estimated at IDR 200,000 per month, which consists of checking and maintaining the machine. The next cost is the cost of inspection of the production process. Inspection at PT. CAU Chocolates Bali is carried out by the production supervisor, so the costs incurred by the company to carry out inspections are the same as the production supervisor's salary, which is IDR 2,500,000. The cost of quality assurance for each chocolate bar borne by the company is equal to the production cost of each damaged chocolate product, which is IDR 11,500 per chocolate bar, but the damaged chocolate is used by the company as a raw material for making food in restaurants that are available at locations pays the factory 40% of the cost of production, which is IDR 4,600. Therefore, the quality assurance costs incurred by the company are IDR 11,500 – IDR 4,600 = IDR 6,900. Total production for 1 (one) year (R) is 105,000 chocolate bars. The inspection officer's fee is IDR 2,500,000 / month, so for 1 year the costs are IDR 2,500,000 × 12 = IDR 30,000,000; Machine maintenance costs IDR 200,000 / month, so the machine maintenance costs for 1 year are: IDR 200,000 × 12 = IDR 2,400,000; Quality control activities are carried out every working day. The average normal number of working days for 1 month is 25 days. So, in 1-year quality control activities are carried out 25 × 12 = 300 times. So that the cost of testing (o) is IDR 108,000. So that the Quality Control Cost (QCC) is IDR 940,300. The quality Assurance Fee (QAC) is IDR 83,214,000. The total Cost of Quality (TQC) is IDR 84,154,300.

#### F. Optimal Quality Cost Calculation

Based on the calculation of quality control costs, it can be determined that the number of damaged chocolate bars (bars) that bear the minimum cost ( $q^*$ ) is 1,282. Quality Control Fee (QCC) of IDR 8,845,600. Quality Assurance Fee (QAC) of IDR 8,845,800. The total Cost of Quality (TQC) is IDR 17,691,400

The optimum amount of damage is 1,282 products, which is smaller than the actual damage amounting to 12,060 products. In addition, the actual quality control cost, which is IDR 940,300, which is less than the optimum quality control cost, which is IDR. 8,845,600. However, the actual total cost of quality, which is IDR 84,154,300, which is greater than the total cost of optimum quality, which is only IDR. 17,691,400. This is due to the actual quality assurance fee of IDR. 83,214,000 which is greater than the optimum quality assurance fee which is only IDR 8,845,800 indicates that the production process quality control activities carried out by the company have not run optimally.

Sari and Purnawati (2018) state that between QCC and the amount of damage have a negative relationship, namely QCC will increase if the number of damaged products decreases, and vice versa QCC will decrease if the number of damaged products increases. In contrast to the relationship between QAC and the amount of damage which has a positive relationship, where QAC will increase if the number of damaged products also increases, conversely QAC will decrease if the number of damaged products decreases.

#### G. Recommendations for Improvements that can be given to Companies

After the cause of product damage is known, the next step is to make a general action proposal to reduce the level of product damage. The improvements that can be made by the company to overcome damage caused by raw material factors are 1) Conducting directions to cocoa farmers to carry out the fermentation process during the processing of cocoa fruit before the cocoa beans are sent to the factory according to the time needed, 2) Carry out control quality of raw materials before the production process is carried out. In addition to raw material factors, damage to chocolate products is also caused by labor factors. The improvements that can be made are as follows: 1) Install clear regulations, prohibitions, and sanctions at production sites so that workers can be more careful and maintain good behavior during the production process, 2) Conducting briefings or briefings before the production process takes place, 3) Recording, documenting and analyzing every time a defective product occurs, finding out the causes and finding ways to overcome them, 4) Companies need to conduct continuous training for employees so that resources are created quality human resources, 5) Establish a special team to supervise and evaluate the performance of production employees to reduce the occurrence of errors caused by human error.

The method factor also causes product damage that occurs. The improvements that the company can make to overcome product damage caused by method factors are as follows: 1) Provide clear work instructions to employees, both before the production process begins and during the production process, 2) Install a special board in the production area to record product damage that occurs per day, so that it is easy for supervisors to find out, or make a special report for the production department regarding product damage that occurs per day, to be used as evaluation material in the future, 3) Maintain cleanliness and tidiness of the work environment so that workers are more comfortable while working.

In addition to human factors and methods, product damage that occurs is also caused by environmental factors. The improvement that can be made by the company to overcome product damage caused by environmental factors is to always maintain the tidiness of the work environment by arranging production equipment neatly so that there is a broader place to put chocolate that is ready to be packed.

#### H. Implications of Research Results

The theoretical implications of this research are analyzing the quality control of the chocolate production process at PT. CAU Chocolates Bali. The results of this study indicate that the production process quality control activities carried out by PT. CAU Chocolates Bali has not run optimally because even though the level of damage that occurs is still within control limits, the actual cost of quality incurred by the company is still greater than the cost of optimal quality.

This means that companies need to carry out quality control activities for their production processes to reduce the level of product damage that occurs, as well as the quality costs incurred by the company.

The practical implication of this research is that the results of this research can be used as material for consideration by companies in making decisions to reduce the level of damage

to chocolate products that occur during the production process and the quality costs incurred by the company.

## V. CONCLUSION

PT. CAU Chocolates Bali is still not optimal because even though the level of damage is still within the control limits of the P-Chart or still between the upper limit (UCL) and lower limit (LCL), the results of the analysis of production quality costs in the 2022 period show quality costs for actual damage. more significant than the cost of optimal quality. Actual damage amounted to 12,060 chocolate bars, quality control costs (QCC) incurred amounted to IDR 940,300 and quality assurance costs (QAC) amounted to IDR 83,214,000 so the actual total quality costs (TQC) incurred by the company amounted to IDR 84,154,300. Meanwhile, at the optimum damage limit of 1,282 chocolate bars, the optimum total quality cost (QTC) is IDR 17,691,400 consisting of quality control costs (QCC) of IDR 8,845,600 and quality assurance costs (QAC) of IDR 8,845,800. This shows that if the company carries out stricter production process quality control activities, the quality costs incurred by the company can be reduced and can increase the company's profits.

To overcome the causes of damage from raw material factors, companies need to guide farmers to carry out the process of processing cocoa pods into cocoa beans better, before the cocoa beans are sent to the factory. In addition, companies also need to control the quality of raw materials before the production process is carried out to reassure that the raw materials used for the production process are of good quality.

To overcome product damage caused by labor factors, companies must conduct training and development for employees, especially new employees, to create better human resources. In addition, the company also needs to make regulations that contain what can and cannot be done during the production process along with the sanctions.

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