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Applying Lean Six Sigma Methodology to Improve Productivity: Case Study at a Mooncake Production Enterprise

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Abstract
This study aims to apply the Lean Six Sigma methodology to reduce defect rates at a mooncake production company. The study reveals that the highest defect rate, recorded at 3.78%, occurred during the semi-finished product shaping stage. The research uses the Pareto chart to analyse the causes of the defects, while the Delphi method and cause-and-effect diagrams are applied to identify the root causes of the primary defects. To enhance the process, the research team adjust the technical specifications of the shaping mould and employ a *t*-test to evaluate the statistical significance of the improvement results. As a result, the defect rate was significantly reduced from 3.78% to 3.12%. This improvement leads to an increase in the Sigma level from 3.28 to 3.36, resulting in annual cost savings of USD 6,018 for the company. Looking ahead, the DMAIC methodology can be further applied to address other defect rates within the mooncake production process.

Keywords
Lean Six Sigma; DMAIC; Delphi method; process capacity analysis; *t*-test; mooncake.

Introduction

In the era of Industry 4.0, enterprises are required to strengthen their competitive advantage through innovation and effective quality management practices (Nguyen et al., 2023). Manufacturing firms, in particular, must continuously reduce operational costs while enhancing productivity and service quality to remain competitive and ensure long-term viability (Pekarcikova et al., 2023). To achieve this, companies must improve their quality management systems, modify production processes, innovate product designs, and add value to existing offerings (Nguyen et al., 2021; Sekarwardani, 2022). One effective methodology for achieving these objectives is Six Sigma's DMAIC framework (Define, Measure, Analyse, Improve, and Control), which supports organizations in optimizing processes, minimizing defect rates, enhancing product quality, and ultimately increasing customer satisfaction (Patel et al., 2019; Condé et al., 2023).

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The modern food industry has undergone significant transformation, expanding from the mere acquisition of raw materials to encompass complex processes such as food processing, distribution, and consumption. In parallel with these developments, consumer expectations for product quality have risen substantially, necessitating stricter control over defect rates to maintain competitive standards (Widiwati et al., 2024). Defects occurring during production can adversely affect food quality, leading to diminished consumer satisfaction. Consequently, ensuring high food quality has become a critical priority in the twenty-first century (Yusof & Lee, 2022). Recently, there has been a marked increase in the emphasis placed on quality by food technologists and manufacturers. This increase is largely driven by stringent consumer demands, government regulations, and intense market competition. In response, the food industry has adopted effective quality control and improvement methodologies to meet these challenges. More precisely, food quality management (FQM) practices encompassing production and personnel-based systems that manage quality and delivery expectations and are guided by specific objectives (Nandakumar et al., 2020; Radu et al., 2023). FQM can improve customer satisfaction and loyalty (Naini et al., 2022).

According to (Antony et al., 2017), Bill Smith developed Six Sigma at Motorola in the mid-1980s. Different from Six Sigma, Lean relies on principles rather than statistical data. Both Six Sigma and Lean have great results, yet they also have some limitations. Lean and Six Sigma were integrated to form Lean Six Sigma, a methodology designed to overcome the limitations of each approach while leveraging their combined strengths (Anthony & Antony, 2022).

The Lean Six Sigma methodology has been applied in many companies to help them optimise processes and minimise production costs (Williams et al., 2020; Adeodu et al., 2021; Duc & Nguyen, 2022; Kar & Pal, 2024). For example, (Sharma et al., 2022) applied LLS to improve the manufacturing process in India. The result showed that defect rates were reduced by 53%, and the sigma value increased from 3.78 to 3.89. Daniyan et al. (2022) concluded that the project applying the LLS method using the DMAIC approach has significantly improved the railcar industry's bogie assembly process. The process cycle efficiency improved significantly, rising from 19.9% to 66.7%, while the lead time was reduced by 27.9%. To exemplify further, (Ly et al., 2022) demonstrated improved quality and productivity of the machining process of precision mechanical products. The yearly cost reduction is 6000 USD, and the yearly profit increase is 7,636 USD. (Srinivasan et al., 2023) used the DMAIC method to improve the productivity and quality of the galvanising process line in the steel industry. The results show that implementing Six Sigma increased the process cycle efficiency from 22.82% to 61.87% and reduced the lead time by 62%.

There have been many studies related to the theory and implementation of Lean Six Sigma in various industries (Brown et al., 2021; Nurprihatin et al., 2023; Srinivasan et al., 2023; Pereira et al., 2019) However, there remains a significant need for additional case studies on the implementation of Six Sigma in emerging economies such as Vietnam, especially within the food industry. Hence, this study aims to apply LSS to improve the manufacturing process at a food company that specialises in mooncake manufacturing in Vietnam. Mooncakes are famous in Asian countries such as China, Korea, Japan, and Vietnam. The product is not manufactured year-round; instead, it is produced and consumed exclusively during the Mid-Autumn Festival. This study is one of the first researches applying LSS to improve the production process of mooncakes in a company in Vietnam.

Statistical data provided by the quality management department indicate that, between July and August 2023, the shaping stage of semi-finished products exhibited the highest defect rate, recorded at 3.78% (756 defects out of 20,000 units). In response, the company established a target to reduce the defect rate to below 3.2%. To investigate the underlying causes of this elevated defect rate, a structured methodological approach was adopted, incorporating brainstorming sessions, Pareto analysis, the Delphi method, and cause-and-effect diagrams. The analysis identified the primary contributing factor as the poor performance of the shaping machine. To solve the problem, we have adjusted the technical specifications on the height of the two stainless steel needles and the height of the shaping mould. Stainless steel needles will create two small holes above the cake to release air while baking, thereby reducing the defect rate of mooncakes. This project helped the company minimise defects, increase production process efficiency, improve Six Sigma level, and reduce manufacturing costs.

The rest of the paper is organized as follows. The literature review provides a comprehensive examination of the implementation of Lean Six Sigma (LSS), with a particular focus on its application within the food production industry. Methodology explains the DMAIC approach and the tools used in the study. Next, the findings of the study and a detailed discussion of the results are presented. Finally, we conclude the paper by summarising the key issues addressed and outlining the study's limitations.

Literature review

The Lean Six Sigma (LSS) methodology improves process output quality by identifying and eliminating the root causes of defects and minimising variations in production and business processes (Pereira et al., 2019; Singh et al., 2020). LSS has transformed into a methodology that relies on principles of statistical analysis and focuses on projects to enhance the quality of products and processes (Antony et al., 2017; Gupta, 2020). Subsequently, LSS has been applied in many fields as a breakthrough strategy for improving production and processes, allowing companies to use simple but effective principles and statistical methods to complete and maintain activities in the best way (Nandakumar et al., 2020).

For example, Guerrero et al. (2017) investigated the implementation of Six Sigma within a small furniture company. The DMAIC process was implemented to quantify opportunities, provide evidence for improvement, and illustrate potential gains. The outcomes indicate that implementing Six Sigma can yield the following benefits for the organisation in the initial year: a 25% reduction in defects, a 13% decrease in waste, and an approximate 14% increase in sales productivity (Guerrero et al., 2017). These results indicate that implementing a Six Sigma strategy can benefit small wood furniture manufacturers.

Pereira et al. (2019) applied Lean Six Sigma principles and the DMAIC framework to optimise mould design and manufacturing processes. Various Lean Six Sigma methodologies were implemented at each stage, including OEE, value stream mapping, continuous improvement, and Pareto analysis. As demonstrated by the findings of this study, numerous aspects of the mould industry achieved tremendous success. By conducting a Pareto analysis, it was possible to determine which events have the most significant impact on pauses. The increasing outcomes were the unavailability of the operator (16.4%), machine programming (14.4%), and tool exchange (12.4%). A 20% increase in global OEE was achieved through implementing LSS tools, as evidenced by the mould industry study obtained for the CNC machines.

Nandakumar et al. (2020) applied DMAIC, SIPOC (Suppliers, Inputs, Process, Outputs, Customers), VSM (Value Stream Mapping), ANOVA (Analysis of Variance) and 5S methods to identify and eliminate the bottlenecks in the food production process in south India. The analysis revealed that 60% of non-value-added activities stemmed from VSM, including the overproduction of cattle-feed products and an escalation in faulty packets throughout the consumer packing process. According to the study's findings, recommendations were provided to enhance overall equipment efficiency and mitigate production variability using the LSS methodology.

Araman and Saleh (2023) explored the implementation of LSS's DMAIC in an aluminium extrusion process in Palestine. By focusing on a specific product dimension's critical-to-quality (CTQ) characteristic, the study used tools like Pareto charts, cause-and-effect analysis, and statistical analysis to identify and mitigate defects. Results show significant process improvements, such as a reduction in defect per million opportunities (DPMO) from 89,649 to 15,659, an increase in the sigma level from 2.84 to 3.65, and a cost savings of $62,721.

Methodology

According to Kosina (2015) and Park et al. (2020), the Lean Six Sigma methodology offers a systematic approach to managing improvement activities. The DMAIC framework is utilised in process improvement to represent the primary structure. A different framework is DMADV (Define–Measure–Analyse–Design–Verify), which enhances product or service design. In this study, the authors followed the DMAIC framework instead of DMAIV to improve the product quality at a food company.

Define phase is the initial and most critical phase in the process of improvement. In the Define phase, the intended outcome of implementing improvements is ascertained (Hien et al., 2024). Furthermore, the process researcher must clearly define the objectives and challenges of the project precisely. These challenges must be closely aligned with customer product requirements and strategically connected to the organisation's broader business goals to ensure the relevance and effectiveness of the improvement initiative. The "backbone" of the Six Sigma initiative is identifying improvement-required problems (Patel & Patel, 2021). In this stage, the authors employ the Brainstorming method and statistical data of defects to identify the project's problem and objectives.

Measure phase is critical at every project lifecycle stage. In this phase, the purpose of the measurement is to assess the process's performance. They are evaluating and measuring process performance precisely and comprehensively using data collected regarding the capacity of the entire production process. Numerous support tools are necessary during this phase, including process charts for activity recording, control charts, and Pareto charts. In this study, the authors employed the Pareto chart in this investigation to identify the issue's primary cause and frequency of occurrence. According to (Ranade et al., 2021), the Pareto chart is a valuable tool used to arrange problems from severe to less serious, from which you can focus on understanding and using resources suitable for solving problems according to priority order. The Pareto chart emphasises which factors are causing the most significant problems.

Analyse phase evaluates all the parameters measured in the measure phase to find the root causes. During this phase, the Delphi technique and cause-and-effect diagrams were used to find the root causes of mooncake shaping defects. Once the defects were identified from the measure phase, the authors employed the Delphi method to determine the causes by surveying twelve company experts. Then, the Delphi method's outcomes are shown in a cause-and-effect diagram. The Delphi method is a consensus strategy that systematically gathers the perspectives of a group of experts regarding a specific problem, as stated by (Nguyen et al., 2023). According to (Yadav et al., 2019), cause-and-effect diagrams help managers analyse processes to determine the root causes of variation and poor performance (defects) and make appropriate improvements. A cause-and-effect diagram visually represents the causes of a particular problem or outcome. This tool can classify the problem's potential causes in detail, explicitly identifying the root causes.

In improve phase, the solutions were implemented based on the analysis results and evaluate the solutions' effectiveness by comparing before and after improvements. According to Kosina (2015) and Rifqi et at. (2021), activities in the Improve phase include proposing solutions, conducting pilot studies, designing experiments, assessing the efficacy of proposed solutions, developing an implementation plan, executing changes, and validating their effectiveness.

After the results of evaluating the improvement solution are appropriate in the Improve phase. In the control phase, the company standardised and promulgated the application of these improvements and continued to evaluate performance statistically. To evaluate the solution's effectiveness before and after implementation, the binominal proportion t-test procedure proposed by Bowerman et al. (2003) was used to test the difference. Utilising the binomial distribution to model the incidence of defectives is often justifiable when the binomial parameter p denotes the proportion of defective products manufactured. Thus, hypothesis testing about p value is choose. One-tailed hypothesis t-test is proposed as following.

$$H_0 : p \geq p_0, \quad H_a : p < p_0 \tag{1}$$

One-tailed t-test rejects domain

$$W = (-\infty; -Z\alpha) \text{ with } \theta_0(Z\alpha) = 1 - \alpha \tag{2}$$

To test $H_0 : p \geq p_0$, calculate the test statistic:

$$Z = \frac{\overline{p} - p_0}{\delta_{\overline{p}}} \text{ with } \delta_{\overline{p}} = \sqrt{\frac{p_0(1-p_0)}{n}} \tag{3}$$

After testing the significance of the results, documenting the critical points to maintaining an improved process is essential to monitor process improvement and evaluate future process performance quickly. Authors create control plans that include control procedures, guidance documents, standards, and control activities.

Results

Define

In this study, we investigate the defect rates at the mooncake production process, which has six steps: preparing materials, forming, shaping, grilling, metal detecting, and packaging. According to statistical data obtained from the quality management department between July and August 2023, it is evident that the highest defect rate, 3.78% (756/20,000), occurred in the stage of shaping semi-finished products (Tab. 1). Moreover, during this step, the company attempts to control the defect rate below 3.2%. Consequently, the authors intend to implement the DMAIC process to concentrate on handling the root causes and managing redundant defects during this step, with the ultimate objective of reducing the defects rate below 3.2%.

Table 1
Defect rates at the mooncake production process

No	Defects	Defect rates
1	Preparing baking materials	0.072%
2	Forming semi-finished products	0.135%
3	Shaping semi-finished products	3.782%
4	Grilling semi-finished products	3.554%
5	Metal detecting semi-finished products	0.001%
6	Packing finished products	0.659%

Source: Quality Management department

Then, the authors apply the brainstorming method to discuss and get opinions from the heads of the Quality Management, Quality Assurance (QA), and Quality Control (QC) departments to identify different types of defects in the shaping process. At the end of this phase, we identify six major types of defects in the shaping process, which include revealing cake filling, sagging and distorted cake, trimming the base, separating the crust, denting the top of the cake, sticking tightly to the mould, and lack of mass.

Measure

In this phase, the study collected data on the defect rate at the Shaping of the semi-finished products process. The data shows the defect rate is 3.78% and the sigma level is 3.28. Then, the research utilise Pareto charts to analyse and prioritise the most frequently occurring defects identified in the previous phase. The research use Minitab software to create the Pareto chart in Figure 1 using the statistical data from the production process. From the results, defects "Revealing cake filling", "Sagging and distorted cake", and "Trim the base" are the three critical defects as indicated by the Pareto chart. These defects need to be improved to reduce the error rate of the process. In order to identify the root causes of the mentioned defects, the authors continue to use the fishbone diagram and Delphi method to analyse the root cause in the next phase.

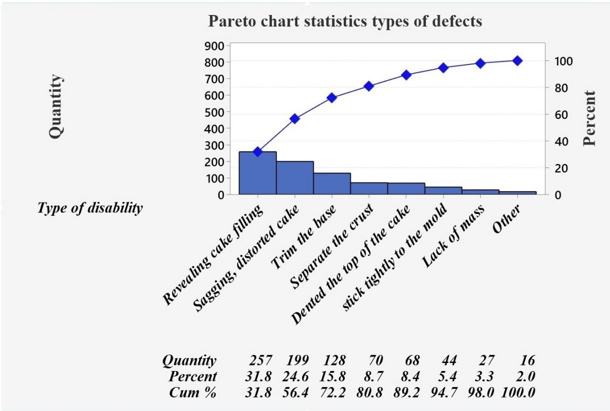

Fig. 1. Pareto chart of defects in the cake shaping. Source: Author's own calculation

Analyse

In this phase, the authors employ the Delphi technique and cause-and-effect diagrams to identify the root causes of significant defects. Following Nguyen et al. (2024), the authors apply the Delphi method to identify the causes of primary defects via a survey of 12 experts who are QC leaders, production leaders and QC employees. In the first round, the authors interview the experts to identify the causes of the primary defects. The results show that 19 causes were divided into six groups: Men, Material, Machine, Method, Measure, and Environment. Then, we implement the second round to ask the experts about the importance of causes via a Likert scale from 1 to 5 (1: strongly disagree, 5: strongly agree). The data

Table 2
The results of Delphi method

Factors	Indicators	Mean	CVR	Result
Men	QC staff lack experience and cannot control the process.	4.21	0.86	Accept
	Workers do not accept opinions from superiors.	3.43	0.14	Reject
	Workers do not pay attention to quality assurance.	4.07	0.57	Accept
	Workers talk during working hours, losing concentration.	3.21	-0.14	Reject
	QC staff discriminate and belittle workers.	1.36	-1.00	Reject
	Due to the company's strategy of hiring seasonal workers.	4.21	0.71	Accept
Materials	Poor quality cake crust dough.	1.57	-1.00	Reject
	The filling is not tight at the correct Brix level.	4.07	0.71	Accept
	Raw materials are not stored properly.	1.64	-1.00	Reject
Machines	The shaping machine has poor performance.	4.86	1.00	Accept
	The crust-making machine is not consistent in volume.	4.14	0.86	Accept
	Automatic machinery is not invested much and often breaks down.	4.50	1.00	Accept
Methods	The way to control cake filling has not been standardised.	3.00	-0.29	Reject
	Semi-finished cake products are not rolled properly.	4.09	0.82	Accept
	Semi-finished cake products are placed incorrectly or off-centre on the forming line.	4.14	0.71	Accept
	Acceptance criteria are unclear.	4.43	1.00	Accept
	Picking semi-finished cakes by hand causes the cakes to distort and sag.	4.07	0.71	Accept
Measures	The distance is wrong to place semi-finished products on the conveyor line.	3.79	0.14	Reject
	Wrong weight of crust.	4.07	0.86	Accept
	Wrong weight of cake filling.	4.14	0.71	Accept
Environment	Noisy working environment.	4.14	0.71	Accept
	The working environment lacks light.	1.71	-1.00	Reject
	The working environment lacks dynamism.	2.21	-1.00	Reject
	Messy working environment.	3.29	-0.14	Reject

Source: Author's own calculation

are analysed by calculating all variables' Mean and CVR values. Following (Lawshe, 1975), the variables with Mean values greater than 3.5 and CVR greater than 0.56 are accepted with the sample size of 12 experts. The details of two rounds of Delphi analysis are presented in Tab. 2.

After the Delphi analysis, the authors discuss and confirm the results with two experts who are QC leaders, finally determining the defects' root causes, which are drawn as a fishbone diagram in Figure 2. The diagram highlights the cause of "The shaping machine has poor performance" which is the highest score in the Delphi analysis.

Improve

Through the analysis phase, the authors determine that the root cause that needs to be prioritised for treatment is that "The shaping machine has poor performance". In this phase, solutions for shaping machine improvements are proposed. After group discussion information, the study design the shaping mould using 2D images through the AutoCAD tool. In more detail, we have adjusted the technical specifications on the height of the two stainless steel needles and the height of the shaping mould. Stainless steel needles will create two small holes above the cake to release air while baking, thereby reducing the defect rate of mooncakes. The image of the mould after improvement is presented in Figure 3.

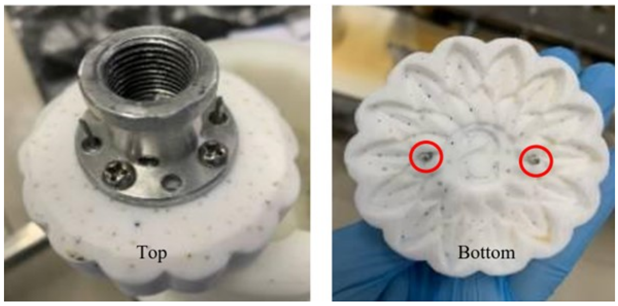

Fig. 3. Shaping mould after improvement

To evaluate the effectiveness of improvements, we measure the process capabilities before improvement. The shaping characteristic is evaluated by the cake's

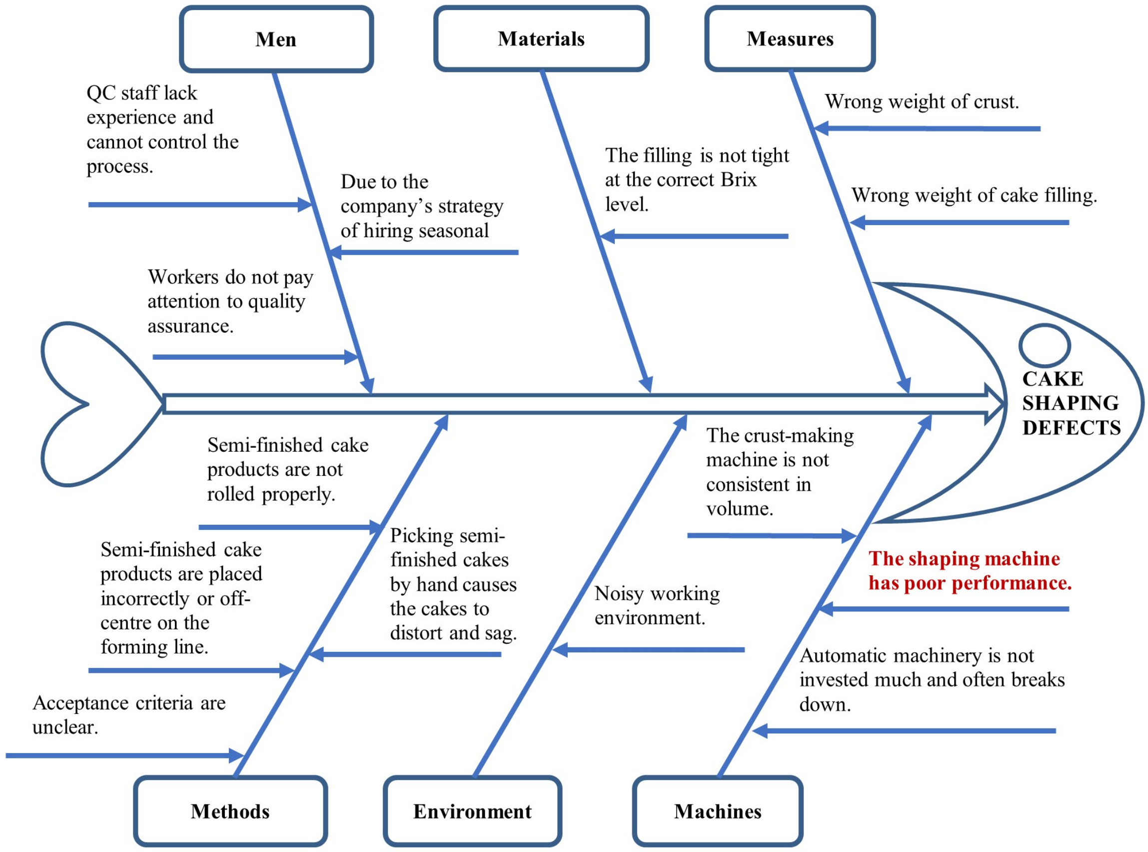

Fig. 2. Cause-and-effect diagram

diameter, controlled with a lower specification limit (LSL) of 7.6 cm and an upper specification limit (USL) of 7.8 cm. A sample of ten observations was collected each day, resulting in a total of 50 observations over the course of five days. Minitab software is used to draw the process capacity, as shown in Figure 4. Based on the Cp (0.5) and Cpk (0.4) indexes, the authors found that these indexes are still low. This process is still unstable, and it needs to be improved to enhance its capacity.

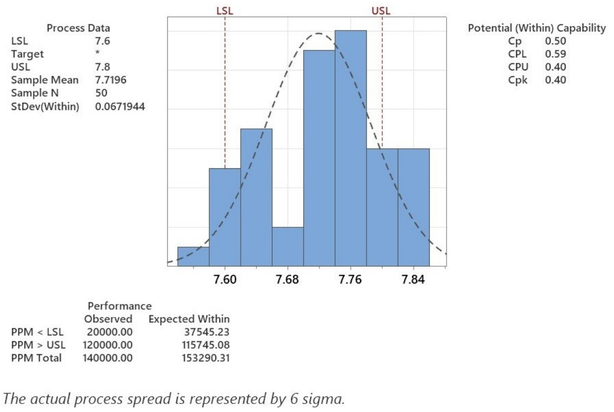

Fig. 4. Process capacity analysis before improvement. Source: Author's own calculation

After improvement, we re-evaluate process capacity by taking a sample of 50 observations. The indicators in Figure 5 reflect that process capacity Cp (0.83) and Cpk (0.74) have increased compared to before improvement. The results indicate that the average process values no longer exceed the control limit boundaries. Although the Cp and Cpk indexes have increased, these indexes are still less than 1, so the process needs to have further improvements in the future to make it more stable.

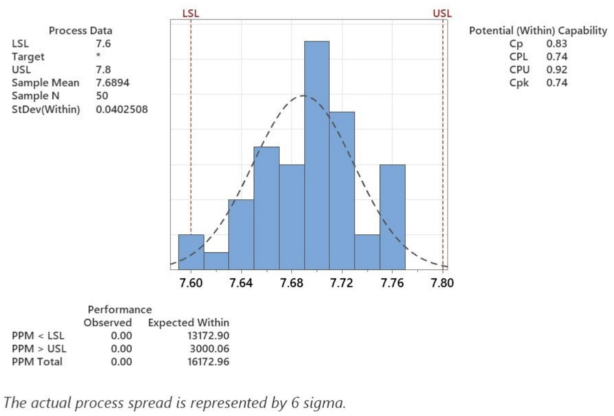

Fig. 5. Process capacity analysis after improvement. Source: Author's own calculation

Data on the number of defects are continuously collected over seven consecutive working days to calculate the post-improvement defect rate. We record a total of 628 defects in a total of 20,115 products produced during this period. The defect rate after improvement was calculated to be 3.12% (628/20,115). The improvement has achieved the objective in the define phase, where the defect rate is less than 3.2%. Compared to the period before improvement, the defect rate has decreased by 0.66%.

Then, we test the significance of the difference in defect rate before and after implementing the solution and following the one-tailed hypothesis t-test as proposed in the methodology section.

$$H_0 : p \geq 0.0378, \quad H_a : p < 0.0378 \tag{4}$$

with the significant level $\alpha = 0.05$, look up the z-distribution table, we have

$$Z\alpha = 1.645 \tag{5}$$

Reject domain:

$$W = (-\infty; -1.645) \tag{6}$$

We calculate the Z value

$$Z = \frac{0.0312 - 0.0378}{0.00135} = -4.89 \tag{7}$$

$$\text{with } \delta_{\overline{p}} = \sqrt{\frac{0.0378(1 - 0.0378)}{20,000}} = 0.00135 \tag{8}$$

H_0 is rejected because $Z \in W$ (reject domain). This result means that the defective rate decreased significantly after implementing the solution. Then, we estimate the cost and benefit of the improvement, summarise some results after the improvement and propose a control plan to monitor the process to prevent shaping defects from recurring in the future.

In the cost and benefit analysis, we first estimate improvement costs, which are labour and material costs. Labour costs are recorded as eight working days for QC and maintenance staff to design and manufacture testing moulds. The labour cost is estimated at 400 USD. The cost of raw materials to produce the testing mould is estimated to be 230 USD. Therefore, the total cost of the improvement is USD 630.

The benefits of the solution include saving time for production workers after improvement. Based on statistical data, the process can save 2.4 seconds of shaping time and 4.4 seconds of setup and QC check for each cake produced. So, the total time saving per cake is 6.8 seconds. In one production season (from June to August), the total number of cakes produced is 150,000. So, the total saving time is 283 hours

(6.8*150,000/3600). Workers are paid an average of $2.5 per hour in the company. So, the total benefit due to saving working time is 708 USD (283*2.5). In addition, the defect rate decreased from 3.78% to 3.12% after improvement. With a total production of 150,000 cakes, the number of defective cakes will be reduced by 990 (150,000*(3.78%-3.12%)). With a production cost of 6 USD per cake, the total savings due to the reduced defect rate is 5940 USD. Finally, the total benefit of improvement is 6648 USD, including 708 USD in savings from labour and 5940 USD from production costs.

In order to see the results after improvement, we summarise some of the primary indicators presented in Tab. 3. The results show that the defect rate decreased by 17% from 3.78% to 3.12%, and the sigma level increased by 3% from 3.28 to 3.36. The Sigma level is calculated based on the defect rate using the Excel function. Besides, Cp and Cpk indexes increased by 66% and 85% respectively. Although these indexes are still less than 1, this is a significant improvement in the process.

Table 3
Comparison of process results before and after improvement

No	Indicators	Before	After	Change
1	Defect rate	3.78%	3.12%	-17%
2	Sigma level	3.28	3.36	3%
3	Cp	0.50	0.83	66%
4	Cpk	0.40	0.74	85%

Source: Author's own calculation

Control

To ensure the effectiveness of improvements is maintained in the future, we have undertaken several process standardisations. Firstly, we propose using a control chart to control the shaping process. For more detail, five semi-finished products are randomly taken from the process every day to measure the diameter. After that, we calculate the average value and compare it with the upper and lower limits of the control chart. We re-evaluate process capacity every ten days by calculating the Cp and Cpk indexes. Secondly, we recommend a procedure in which workers must check steam pipes before starting their shift based on the daily inspection list for the shaping machine. This procedure can minimise the probability of shaping machine breakdown. Finally, we propose a procedure in which quality staff inspect production areas randomly twice daily to ensure the workers follow the instructions and procedures to minimise defective products.

Conclusions and limitations

This study is a successful example of an LSS project in a manufacturing enterprise that significantly improved efficiency. The mooncake shaping defect improvement project is carried out according to LSS's DMAIC process. In the define phase, we have identified the project's objective: to improve the defect rate at the shaping process, which has the highest rate. In the measure phase, we used a Pareto chart to present the frequency of defects. In the analysis phase, we applied the Delphi method and fishbone diagram to identify the root causes of defects. In improve phase, we propose an improvement in shaping mould to solve the root cause of defects and estimate the cost and benefit of the solution. The study also uses a t-test to evaluate the difference in the results before and after improvement. Finally, in the control phase, the study proposes some procedures to prevent defects from happening in the future. The project results show that the defect rate decreased from 3.78% to 3.12%, and the Sigma level increased from 3.28 to 3.36. The estimated cost and benefit of the project are 630 USD and 6648 USD, respectively. So, the estimated profit of the improvement project is 6018 USD.

From an economic perspective, this DMAIC project can reduce the number of defective mooncakes, thereby reducing the company's production costs. When production costs are reduced, the company's profits will increase. To ensure the effectiveness of the project in the future, the company should use a control chart to control the shaping process. Besides, the study recommends a procedure in which workers must check steam pipes before starting their shift based on the daily inspection list for the shaping machine. Finally, the research proposes a procedure in which quality staff inspect production areas randomly twice daily to ensure the workers follow the instructions and procedures to minimise defective products.

Although the project achieved the results of reducing the defect rate of the production process and saving production costs, the project only focused on major defects. Defects with lower frequencies remain unresolved. In addition, the Cp and Cpk indexes after improvement are still less than 1. These indicators show that the process must continuously improve to meet the company's specifications. Therefore, in the future, the company can continue to carry out new projects, applying the DMAIC method to identify new problems and propose solutions to solve these problems to help the company's production process reduce defect rates and bring financial benefits to the company.

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