Quantitative analysis of Kaizen philosophy on productivity improvement

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ABSTRACT

Due to rising global competition and major changes in consumer demands, preferences, and tastes, many businesses today use the Japanese management technique known as Kaizen to adjust their production processes to meet these expectations. The sole goal of this study was to improve the overall productivity of medium-scale industries by integrating the kaizen philosophy into the production process. Most learning exercises carried out as part of kaizen initiatives were designed to improve social outcomes regarding employees’ problem-solving skills and attitudes. In particular, Kaizen coordinators are concerned with employees’ understanding of continuous improvement and their communication and problem-solving abilities. The pilot project was carried out in the production lines where vanilla extracts were being produced. The Plan-Do-Check-Act (PDCA) cycle technique was used in this study to improve productivity in the production process. The pitch diagram was used as a supportive tool. The two prominent techniques that mainly contributed to the increase in productivity were the PDCA cycle and the pitch diagram. Kaizen implementation led to a 37% increase in the company's total productivity. To increase productivity even further, water tapping and measurement were merged. As a result, it took just 2 minutes instead of 5 to fill a bottle with 20 liters of water. This study concludes that the Kaizen philosophy and elimination of non-value-adding tasks from the production process improve output.

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Introduction

After World War II, Japan developed kaizen Masaki Imai popularized the idea of Kaizen and helped it spread like a revolution throughout the world (Suárez-Barraza, Ramis-Pujol, & Kerbache, 2011). The origin of Kaizen can be traced back to the Quality Guru Dr. W. Edwards Deming. Kaizen, which is made up of the Japanese terms “kai” and "zen," literally translates as “Change for the Better.” Its meaning is a combination of the notions of Kai (change) and Zen (for the better) (Suárez-Barraza et al., 2013). The term “Kaizen” refers to a method of continuous improvement in the traditional way of working (Berhe, 2022). The Kaizen philosophy is centered on optimizing processes and reducing waste in an organization’s workplace (Dimitrescu et al., 2018). Everyone is involved in the Kaizen approach, from high management to the cleaning staff (Shrivastava & Jain, 2018). Everyone is urged to regularly offer tiny suggestions for improvement. Kaizen is based on implementing adjustments wherever there is room for improvement (Rosak-Szyrocka, 2019).

Due to rising global competition and major changes in consumer demands, preferences, and tastes, many businesses today are using the Japanese management technique known as Kaizen to make adjustments in their production processes in order to meet these expectations (Shan et al., 2016). The dynamic kaizen technique combines a continuous cycle of Plan, Do, Check, and Act (PDCA) with a focus on customer-driven operations to improve productivity and the standard of goods and services by making a series of modest adjustments over time (Kumar, 2019). With this kind of continuous improvement waste and losses in every part of business can be completely eliminated while achieving the ideal level of organization (Leksic et al., 2020). In both the industrial and service
sectors, kaizen management theories are today the most popular and dominant. The key factor in its success is how easily it can be put into practice (Rewers et al., 2016).

The Tanzania development plan 2021/22 - 2025/26 anticipates that the manufacturing sector will operate as the growth and transformation engine for the creation of a semi-industrialized economy. By 2025, it is predicted that the manufacturing sector will have contributed 31.1% of the GDP, meeting the goal. As of the now, the industrial sector contributes 29.6% of the GDP (Tanzania Development plan, 2021).

In order to achieve this vision, the Tanzanian government has taken steps to implement the Kaizen concept to established and recently developed industries in an effort to improve quality and productivity. These continuing initiatives anticipate that 1,475 enterprises will adopt this philosophy by 2030 (TKU report, 2020).

In Tanzania, numerous studies on kaizen and the performance of SME's have been carried out. For instance, Bwemelo (2017) studied whether kaizen was acceptable as a tool for enhancing the performance of Small-Scale Manufacturing Enterprises (SSME), with an emphasis on the 5S-Kaizen methodology. Margaret (2019) examined the factors Small and Medium Enterprises (SME's) should take into account while implementing kaizen to boost performance and efficiency, placing a focus on 5S and Total Quality Management. To the best of the author's knowledge, there are few studies on productivity improvement in medium manufacturing industries that employ a PDCA cycle technique during kaizen implementation. The PDCA cycle has been shown to be useful in productivity improvement through optimization of the production process (Isniah et al., 2020). Therefore, this study aims at using PDCA cycle technique during kaizen implementation to improve productivity and reduce the length of the production cycle at Natural Extract Industries (NEI) Limited.

The paper is structured as follows: introduction, theoretical and literature review of various kaizen tools used, discussion of various steps employed during implementation of Kaizen philosophy, data analysis, empirical results and interpretations and the final part concludes and gives proposed recommendations to the responsible stakeholders.

Theoretical Literature Review

Theoretical and Empirical Review

Lean management theory served as the foundation for this study. According to the theory, manufacturing businesses should use kaizen, one of the lean manufacturing tool, to remove non-value-adding operations from their production processes in order to increase the productivity and quality of their goods. (Rosak-Szyrocka, 2019). Kaizen is a Japanese word which refers to small, regular changes that are made to improve productivity, efficiency, and safety. Each small development requires numerous stages of growth and is mostly utilized to improve production processes (Antony et al., 2017). Despite the fact that lean was a developed strategy, various experts who interacted with lean-practicing found and exposed numerous shortcomings of this theory. It was noted that lack of implementation expertise, organizational pressure to revert to old behaviors, poor management commitment to the implementation program, inadequate stakeholder education and training, and a lack of financial, intellectual, and human resources all contribute to lean implementation failure. (Nithia et al., 2015).

Accordingly, this study contends that eliminating non-value-adding tasks from the production process will increase output. On the other hand, the theory helped the authors to come up with tactical options for enhancing production of vanilla extracts.

Kaizen is the practice of making continuous improvements in different fields including but not limited to engineering, production, assembly, and quality (Kumar, 2019). Jagusiak-Kocik (2017) presented a case study of the actual application of the Deming cycle in a manufacturing company from the small- and medium-sized enterprises (SME) sector of the plastics processing industry. His paper examined the literature in the area of continuous improvement and was based on the Deming cycle, also known as the PDCA cycle, which is a continuous improvement cycle. This PDCA cycle was used to address productivity issues that emerged during the production of photo frames, including scorches and discolorations on the frame's surface. There was a more than 60% decrease in non-conformities after the introduction of steps to eliminate them. Shrivastava & Jain (2018) applied MUDA elimination technique in bulk coal handling (coal unloading) at a CHP of a thermal power station. As part of a study on the use of MUDA elimination in CHP on the coal unloading process, he was able to eliminate unnecessary activities in order to optimize the current unloading process and improve production by reducing various types of Muda. Margaret (2019) examined the factors that influence the adoption of kaizen by Small and Medium Enterprises (SMEs) in African nations. It carefully evaluated the factors that influence SMEs in African nations to embrace kaizen. A thorough analysis of twelve pieces of relevant empirical research on the use of kaizen in African nations was conducted. According to the study's findings, African nations that practice kaizen should concentrate on the commitment and support of top management, training and education, teamwork, employee participation, and empowerment as the key significant determinants of kaizen to quicken its implementation and improve the performance and productivity of SMEs. Additionally, Bwemelo (2019) examined the acceptance and viability of KAIZEN among SSMEs in Tanzania's Dar es Salaam region. Questionnaire, interviews, and observations were used to survey 500 stakeholders and 23 pilot enterprises during the sensitization seminars and on-site trainings. The use 5S-KAIZEN methodology to identify some barriers to the success, such as employee resistance and failure to reward hardworking employees.
Research Methodology

Research Design

A case study design offers a complete approach for looking at and researching a specific instance (Rashid et al., 2019). Utilizing case studies in research enables the researcher to become fully immersed in the situation and gain in-depth understanding of a phenomenon (Takahashi & Araujo, 2019). Confirming the effectiveness of the research approach can be done by replicating the findings under comparable conditions (Rashid et al., 2019). This study has been performed in a medium-scale industry that processes vanilla in Moshi, Tanzania. Given the nature of the project and the related costs, consultants visited the business twice a week. As a result, the consultants may rapidly acquire information by visiting the process or asking workers questions. The case study has been underway since the project’s inception. The amount of time spent on it changed as the project did; initially, only a few observations were made to understand the process; later, more time was invested to delve further into the process and gather data. Finally, additional observations were taken to help the improvement analysis produce its best results.

Interviews and Discussions

The interview is a fundamental method of data collection that involves verbal discussions between the researcher and the respondent (Alamri, 2019). When the project first started, a significant amount of time was spent talking with the quality manager to better understand the production processes. It was more about open discussions and explanations about various aspects of the process or the company than formal interviews. The production manager and several employees were involved in similar discussions later on in the project to gain a deeper understanding of the production process.

Data Collection and Analysis

Both primary and secondary data were used in this research. By interviewing and observing the operator, team manager, sub section head, and section head in the field, primary data were acquired directly from the topic under study to determine the real happenings. The historical records of production were the secondary data used in this study. The secondary data on production were analyzed before and after the project by using excel in order to get a deeper understanding on the obtained data.

Observations

Observation is one of the most essential and versatile research methods in the social sciences, the choice of this method depends on the research topic and the surrounding environment (Ciesielska et al., 2018). A lot of time was spent on the work floor to watch what was happening in general; every week, roughly eight to ten hours were devoted to this task. It provided the chance to fully comprehend the process by learning something new virtually. It was also an excellent opportunity to discuss about kaizen with employees and spread some awareness about it.

Pdca Cycle

Plan, Do, Check, and Act (PDCA) cycle is a four-step iterative management approach that is employed in business for process and product control and continuous improvement (Realyvásquez-Vargas et al., 2018). As depicted in Figure 3, it is also known as the Deming Cycle (Moen & Norman, 2019).

Figure 1: PDCA Cycle

Plan: The goal is to anticipate changes and plan accordingly (Realyvásquez-Vargas et al., 2018). Do: The strategy is carried out by making small, deliberate moves. Check: results are now been studied. Act: the company takes step to improve the process.
Results & Discussion

Problem Detection Phase

The big and minor issues that actually affected the productivity of the products were identified after a brief overview of the production process.

Problem Analysis and Target Setting

In this phase, the problems identified from the production process were analyzed, and a pitch diagram was made, in order to pinpoint the bottleneck process in the production process. As can be seen in the pitch diagram below, once the bottleneck process was identified, the aim was to increase the loading capacity by 50%.

![Pitch Diagram](image)

**Figure 2: Pitch Diagram**

Figure 2 indicates that the extraction process, which has a 2 kg/hour capacity, is the bottleneck process. In order to increase production without affecting quality parameters, it was planned to increase this capacity to 4 kg/hour.

Recommendation Phase

Certain improvements and practices were recommended following a brainstorming session on the aspects affecting the productivity of the extraction process and those required for the company's effective adoption of Kaizen. The following suggestions were put forward.

i. Combining the process of tapping and measuring water

ii. Loading more black pods and reducing the cycle time for circulation and mascellation in the extraction process

Implementation Phase

The kaizen team considered a number of options before deciding on the best ones to implement. The numerous suggestions were put into practice during this stage in order to increase productivity in the extraction process. With these suggestions Kaizen is implemented in the extraction process as follows.

i. Water tapping and measurement were merged.

ii. There was a 250 percent rise in the number of black pods put on the first manufacturing line and a 200 percent increase on the second production line.

iii. In the circulation and mascellation process, the circle time was cut from 12 to 5 hours while the number of circles was increased to 6.
Results

Process Improvement

When all of the aforementioned recommendations were implemented, production rose by 37%. This conclusion align with the one made in one of the studies carried out by (Jagusiak-Kocik, 2017). Fig 3 shows that Kaizen application enhanced the bottleneck process, which improved the company's production.

![Figure 3: Capacity Before & After Kaizen](image)

Improvement in The Water Taping and Measurement Process

The extraction process was more productive since the time it took to measure 20 liters of water had been reduced by half by integrating the water taping and measurement processes during kaizen implementation. This outcome is consistent with that reached in one of the studies conducted by (Shrivastava & Jain, 2018)

Conclusion

This study concludes that the Kaizen philosophy and elimination of non-value-adding tasks from the production process improve output. Kaizen practices were implemented in the company as part of the kaizen project to improve productivity, work environment and financial performance of the company. According to the study's findings, kaizen implementation was successful. We suggest that other departments, including the service departments, consider implementing kaizen, particularly 5S. On the manufacturing floor, there is a chance to establish a disciplined and supportive work atmosphere. To boost productivity and decrease the time spent on non-value-adding activities while work is still being done, a good material handling system can also be put into place.

The primary conclusions of the study cannot be generalized to all medium scale industries. This will be achieved in the future by conducting research to a number of medium-sized manufacturing firms.

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