

Improvement of the business processes with Kaizen techniques

Master Thesis

Study programme: N6208 Economics and Management
Studybranch: Business Administration

Author: Şenel Etingü Özkaptan
Thesis Supervisors: Ing. Eva Šírová, Ph.D.
Department of Business Administration and Management





Master Thesis Assignment Form

Improvement of the business processes with Kaizen techniques

Name and surname: **Şenel Etingü Özkaptan**
Identification number: E18000608
Study programme: N6208 Economics and Management
Study branch: Business Administration
Assigning department: Department of Business Administration and Management
Academic year: **2019/2020**

Rules for Elaboration:

1. Theoretical background connected with the issue of improving business processes using Kaizen techniques.
2. Analysis in the selected company and selected processes.
3. Results, measures and recommendations for the company.
4. Summary of final thesis results.

Scope of Graphic Work:
Scope of Report: 65 normostran
Thesis Form: printed/electronic
Thesis Language: Czech



List of Specialised Literature:

BENNETT, Jason a Jennifer BOWEN. 2018. *Lean: 8-in-1 book ultimate collection*. England: Independently published. ISBN 978-1-720-21629-2.
GARCÍA-ALCARAZ, Jorge Luis, Aidé Aracely MALDONADO-MACÍAS a Midiala OROPESA-VENTO. 2017. *Kaizen Planning, Implementing and Controlling*. Cham: Springer. ISBN 978-3-319-47746-6.
MILLER, Jon, Mike WROBLEWSKI and Jaime, VILLAFUERTE. 2014. *Creating a kaizen culture: Align the organization, achieve breakthrough results, and sustain the gains*. Berkshire, UK: McGraw-Hill. ISBN 978-0-071-92685-3.
ROTHER, Mike. *Toyota kata*. 2009. New York: McGraw-Hill Professional Publishing. ISBN 978-0-07-163985-9.
PROQUEST. 2019. Databased of articles ProQuest [online]. Ann Arbor, MI, USA: ProQuest. Available at: <http://knihovna.tul.cz/>
Consultant: Ali Nurman, Quality Assurance Engineer, StarGroup Cam A.S.

Thesis Supervisors: Ing. Eva Šírová, Ph.D.
Department of Business Administration and Management

Date of Thesis Assignment: October 31, 2019
Date of Thesis Submission: August 31, 2021

L.S.

prof. Ing. Miroslav Žižka, Ph.D.
Head of Department

Liberec October 31, 2019

Declaration

I hereby certify, I, myself, have written my master thesis as an original and primary work using the literature listed below and consulting it with my thesis supervisor and my thesis counsellor.

I acknowledge that my bachelor master thesis is fully governed by Act No. 121/2000 Coll., the Copyright Act, in particular Article 60 - School Work.

I acknowledge that the Technical University of Liberec does not infringe my copyrights by using my master thesis for internal purposes of the Technical University of Liberec.

I am aware of my obligation to inform the Technical University of Liberec on having used or granted license to use the results of my master thesis; in such a case the Technical University of Liberec may require reimbursement of the costs incurred for creating the result up to their actual amount.

At the same time, I honestly declare that the text of the printed version of my master thesis is identical with the text of the electronic version uploaded into the IS/STAG.

I acknowledge that the Technical University of Liberec will make my master thesis public in accordance with paragraph 47b of Act No. 111/1998 Coll., on Higher Education Institutions and on Amendment to Other Acts (the Higher Education Act), as amended.

I am aware of the consequences which may under the Higher Education Act result from a breach of this declaration.

August 29, 2020

Şenel Etingü Özkaptan

Acknowledgment

I would like to thank my dear consultant, Ing. Eva Šírová, Ph.D., all of my teachers who contributed to my development of academic and personal during my master education in Technical University of Liberec, my mother Serda Demir, and father Mustafa Demir who contributed to my coming to these days, and my dear husband Mustafa Halis Özkaptan who have supported me for my thesis process.

Annotation

This thesis defines the Kaizen methodology, gives information about the purpose and philosophy of Kaizen, and sheds light on the infrastructure to be created and the culture to be gained in order to implement Kaizen in enterprises. In the thesis, seven main components of Kaizen, problem-solving tools, and checklists used in Kaizen applications were examined in detail. Information about the advantages and disadvantages of Kaizen applications is given. In order to increase the comprehensibility of the subject, various examples are used in the processes of a company serving in the packaging industry, using the Kobetsu Kaizen and Before-After Kaizen methods. In sample applications, gains in quality, cost, and additional workmanship were evaluated.

Keywords: Before-After Kaizen, Continuous Improvement, Kobetsu, Profit, Waste.

Anotace

Tato diplomová práce definuje Kaizenovu metodologii, poskytuje informace o účelu a filozofii Kaizenu a vrhá světlo na infrastrukturu, která má být vytvořena, a na kulturu, která má být získána za účelem implementace Kaizenu v podnicích. V diplomové práci bylo podrobně prozkoumáno sedm hlavních komponent Kaizen, nástroje pro řešení problémů a kontrolní seznamy používané v aplikacích Kaizen. Jsou uvedeny informace o výhodách a nevýhodách aplikací Kaizen. Za účelem zvýšení efektivity v procesech společnosti působící v obalovém průmyslu byly použity různé příklady pomocí metod Kobetsu Kaizen a Before-After Kaizen. Ve vzorových aplikacích byly vyhodnoceny přírůstky v kvalitě, nákladech a dodatečném zpracování.

Klíčová slova: Kobetsu, Neustálé zlepšování, Plýtvání, Zisk, Před po Kaizen.

Content

List of Figures.....	9
List of Tables	10
List of Abbreviations.....	11
Introduction	12
1 Kaizen Concept.....	12
1.1 History of Kaizen.....	15
1.2 Benefits Of Kaizen Methodology	15
1.3 Advantages And Disadvantages Of Kaizen.....	17
1.4 Cost Effect Of Kaizen	18
2 Kaizen Theoretical Background	20
2.1 Participation in the Kaizen.....	20
2.1.1 Management Priority Kaizen	24
2.1.2 Group Priority Kaizen	24
2.1.3 Individual Priority Kaizen	30
2.2 7 Problem-Solving Tools In Kaizen Implementation.....	32
2.3 3-Mu Control System In Kaizen Works.....	37
2.4 Main Components Of Kaizen.....	38
3 Kaizen Implementation In Crown Cork&Seal.....	46
3.1 Kobetsu Kaizen Implementation	47
3.2 Before-After Kaizen Implementations	51
3.3 Evaluation Of Kaizen Implementation.....	59
3.4 Suggestion	61
Conclusion.....	63
References	64

List of Figures

Figure 1 Kaizen Umbrella.....	13
Figure 2 PDCA Cycle	25
Figure 3 Pareto Chart	33
Figure 4 Fishbone Diagram.....	34
Figure 5 Histogram Examples.....	35
Figure 6 Scatter Chart Reflecting Positive Correlations	35
Figure 7 Control Chart Example	36
Figure 8 Process Map Example.....	37
Figure 10 Crown Holing Product Picture.....	46
Figure 11 Air Booster.....	50
Figure 12 Ink Agitator.....	50
Figure 13 Implementation 3 Before-After Pictures.....	54
Figure 14 Implementation 4 Before-After Picture	55
Figure 15 Implementation 5 Before-After Pictures.....	56
Figure 16 Implementation 6 Before-After Pictures.....	58
Figure 17 Implementation 7 Before-After Pictures.....	59

List of Tables

Table 1 Management Hierarchy of Kaizen	20
Table 2 Three pillars of Kaizen.....	22
Table 3 5W 1H Questions Technique	28
Table 4 3-MU Control System	37
Table 5 Topic Selection Table	47
Table 6 Activity Plan	48
Table 7 Evaluation	51
Table 8 Monetary Saving per month for Plants	61

List of Abbreviations

3-MU	Muda, Muri, Mura
5S	Seiri, Seiton, Seiso, Seiketsu, Shitsuke
5W1H	Who, What, Where, When, Why, How
CEO	Chief Executive Officer
CP	Control Panel
JIT	Just in Time
PDCA	Plan, Do, Check, Act

Introduction

In today's world, rapid changes are experienced in technology, economy, and politics. However, as a result of the effects of globalization on all sectors and government administrations, the concept of competition comes to the fore.

Organizations of different sizes and sectors; while trying to be strong in terms of capital, knowledge, technology, and quality in the face of competition, it is looking for new methods and tools to sustain its existence. Businesses need to be better, different, cheaper, more efficient, and faster in order to survive and compete. Businesses can set the "quality," "cost," and "delivery" goals and reach these goals and take the key to success. One of the ways to make it easier to achieve these goals is continuous improvement.

Kaizen techniques are seen as one of the attractive performance improvement methods within the companies since their application costs are low. Today, the relationship between manager and employee is significant. Kaizen believes that the success of a company is the result of the total efforts of all employees. This method brings together all the employees of the company by improving the communication process and strengthening the sense of belonging.

1 Kaizen Concept

Kaizen is a combination of the words kai (change) and zen (better) in Japanese. It means change for the better, continuous improvement. It covers the activities of senior executives, managers, and employees in work environments. Kaizen aims to solve existing problems and to see possible problems instead of being content with the current situation. (Çetinay, 2016)

Kaizen Philosophy; It is based on logical foundations such as 'the best is the enemy of the good' and 'good enough is not enough.' This is not only the current situation but also all of the practices that make small improvements in the areas in which people are responsible, both administratively, team, and individually. Continuous improvement is the result of an effort to seek better by sharing information in small steps.

In order to improve the results according to Kaizen, root causes of the problems should be found, and then improvement and development studies should be carried out. In this way,

by contributing to the reduction of costs, appropriate infrastructures are formed in order to create innovations as a result of continuous improvements in processes. (Gerger, 2010)

After World War II, most Japanese firms had to be restructured. Managers and employees face new challenges every day, and it is aimed to make progress every day. As a result of this; Continuing has meant continuous development. Thus, Kaizen has become a way of life. The tools that help the Kaizen concept reach new heights were introduced by experts such as Deming and Juran in Japan in the late 50s and early 60s. Today, Kaizen philosophy is applied in many sectors and companies. (Çetinay, 2016)

Masaaki Imai, who first put forward this philosophy, explains Kaizen as 'Kaizen is an umbrella that covers many management practices that developed in Japan and then spread all over the world, including total quality, quality control studies, productivity increase or relations with workers' (Imai, 2012). This definition supporting the expression of the Kaizen philosophy is shown in Figure 1.



Figure 1 Kaizen Umbrella

Source: Imai, 2012

While Western societies have always focused their attention on inventions, breakthroughs, and results, Japan has obtained more positive results by directing its attention towards progress and processes through small steps. Although almost no major technology

(computer, electronics, atom, genetics, etc.) was developed in Japan, the best practitioners of these technologies were again the Japanese. The Japanese took these technologies from the West and took them forward with small but confident steps. Two main elements of management in Japan; protection and improvement. Management primarily determines the necessary company policies, rules, and procedures for all primary operations. It then tries to ensure that everyone complies with these standards. So the Japanese understanding of management can be summed up in one rule: "Maintaining and improving standards." It is perceived as improvement, Kaizen, and innovation. Kaizen; it points to minor improvements that are currently seen as a result of continuous efforts. Innovation is radically changing the current situation as a result of significant investments in new technology and tools. The starting point for improvement is to realize the need for improvement. If there is no problem noticed, there is no need for improvement. With the problem resolved, the improvement reaches a higher level each time. The improvement provided should be standardized to raise further the new level achieved. In order to realize continuous improvement, it is necessary to provide three primary conditions: (Ulukanoğlu, 2001)

- 1) Finding the current situation insufficient: Even if a system seems to be working flawlessly, methods to improve it can be found. Besides, developments in science and technology and customer expectations require that the efficiency criterion be carried forward every day.
- 2) Developing the human factor: It is the person who does everything. It is the most valuable resource for a human organization. The use of this resource in the usual form of management is wholly insufficient. However, it is necessary to make every employee a member of these development activities.
- 3) Using problem-solving techniques widely: The biggest mistake in solving problems is to focus on symptoms and not see the underlying causes of problems. In order to solve the problems well, it is necessary to monitor each problem for the most extreme reason and to solve the underlying problem in a way that will not occur again. Asking for five reasons when investigating the source of the problem usually gives good results and makes it easier to find the root cause, rather than the apparent cause of the problem.

1.1 History of Kaizen

Kaizen is the first after World War II, it began to be implemented in several Japanese businesses during the country's recovery and has since spread to businesses worldwide. The visit to Japan by American businesspeople and quality management teachers positively affected the quality approach in Japan.

Following the Korean conflict, the industry in Japan began to be rebuilt, with Japan serving as an essential supply line for the United States army. In the early 1950s, W. Edwards Deming helped Japanese business managers develop quality systems using statistical quality control methods, with the United States helping industry revitalize in Japan.

Kaizen was first handled as a method to increase product quality in the "Toyota Production System" as a method involving the entire workforce. Then it was widely used in all Japanese companies. Kaizen has since become one of the critical factors for the country's success. In Japanese companies, Kaizen is a lifestyle that starts with the CEO and goes down to all employees.

The Kaizen methodology has become famous all over the world with Masaaki Imai's book "Kaizen: The Key to Japan's Competitive Success.

1.2 Benefits Of Kaizen Methodology

The primary purpose of the Kaizen is to achieve excellence in quality, cost and delivery.

Quality: It is the quality of the finished product, intermediate product, the process used for production. Low quality should not go to the next step.

Cost: It is the sum of all reduced quality costs, not just production costs, but also service, sales and design.

Delivery: It always means ensuring the delivery of the requested quantity, just in time. (Moore, 2006)

These three factors contribute to quality-enhancing issues such as reduced production costs, reduced cycle time, customer orientation and process. Gradual, continuous improvements at a lower cost are more advantageous and attractive for many companies in the long term. Furthermore, as a result, momentum continues. However, evaluating the results in a very

short time can lead to incorrect evaluations. If employees work consciously aware of the importance of quality and quick resolution of problems, errors are prevented, and losses are reduced; All negativities such as scrap, time loss, second quality product, loss of time, unnecessary stock are eliminated, and production costs decrease. All other functions within the company, such as planning, sales, and design, must be separated from the production unit. (Wittenberg, 1994)

Since Kaizen activities are carried out with employees from top to bottom, the sense of belonging increases, and the communication environment improves as the employees adopt their workplaces more. All employees become eager to solve problems, and their awareness about quality problems increases day by day. During Kaizen studies, applications such as training, teamwork, motivation-enhancing incentive, board, presentation, and reward should be actively applied according to the requirement and time. (Eskin, 2011)

However, if the method to be used is an award, this should be designed very well. Because when it comes to big rewards, behaviours such as stealing ideas or storing how much the idea is clear can occur to prevent the system. Accordingly, the most effective reward is the implementation of the idea. In this way, trust can be created against the system. For an efficient system of ideas, the following principles should be adapted to employees:

Ideas are everyone's regular job.

Opinions are easy to report. Ideas and impact are reviewed to those who have direct knowledge of the job, and suggestions for improvement can be added to make it work.

- ◆ Decision making should be fast, effective, and efficient.
- ◆ There should be a quick return to all suggestions.
- ◆ The application should be carried out quickly.
- ◆ People should be understood and congratulated.
- ◆ System and results should be actively measured, managed, and improved.
- ◆ Top management should provide a system and leadership for success.
- ◆ Innovation and improvement should be free at all levels of the organization. (Moore, 2006)

1.3 Advantages And Disadvantages Of Kaizen

The Kaizen model provides a company with a holistic gain by providing the opportunity of change, development and transformation in many ways. The Kaizen implementation includes the following benefits, but not all benefits are limited to the following.

Use of Resources: Kaizen focuses on improving products through the use of existing resources to achieve increased and continuous improvement. Kaizen aims to make small changes instead of relying on significant changes or expensive equipment investments to make improvements.

Increased Productivity: Increased efficiency in Kaizen methodology, providing a well-planned work area, eliminating unnecessary movements or operations, and providing appropriate training for all employees.

Employee Satisfaction: Kaizen is concerned with creating an atmosphere of teamwork and change where new ideas are encouraged. Team members are expected to review the processes and make suggestions for improvement.

Security Improvements: A safer working environment is another advantage of Kaizen. Security improvements occur when cleaning and organizing workspace when new ideas are developed and implemented.

Repetitive Development: Instead of planning and trying to get everything right during this critical planning period, the Kaizen model allows for rapid and incremental improvements.

Continuous Integration: All team members combine all development efforts in one central location, better analyzing and discovering areas for further improvement.

Waste Reduction: With continuous improvements made several times a week or daily, the Kaizen model tries to eliminate waste.

Multi-Headed Decision-Making Structure: Since the majority of improvements and iterations made throughout the life cycle are handled by the team as a whole, the Kaizen model leads to the majority of critical design decisions made by more than one person.

Since the Kaizen model is open-ended and mostly a change of mentality rather than a methodology, it can be difficult to eliminate any disadvantages in this method. The disadvantages of Kaizen are as follows:

Internal Communication of Company: Many organizations may have difficulty adapting to the open communication style of the Kaizen model. Proper implementation of Kaizen requires the organization to use inputs and allow monitoring and dissemination of potential developments. Excellent communication is needed for this.

Organizational Structure: Although the implementation of the Kaizen model does not require a direct change in authority or administrative structures, it emphasizes the need to reduce the importance of these dynamics in the team. It supports developers and other team members not to be afraid of top managers; otherwise, potentially significant improvements may be left halfway (Morse, 2017).

1.4 Cost Effect Of Kaizen

In order for businesses not to encounter high-cost problems, firstly, high costs caused by poorly designed and poorly managed processes should be taken under control, and these costs should be reduced. Accordingly, when the processes are improved, the following change occurs: (Gürdal, 2007)

- ◆ The cost of transactions is reduced.
- ◆ The goods and services offered to customers are offered at a higher quality.
- ◆ Producing the same volume of output at a lower cost provides the opportunity to reduce the sales price, thereby increasing the competitiveness of the enterprise in the market.

In this way, while the costs of the existing products are reduced, the quality of the products is increased, and the security of the production processes is increased.

In order to manufacture a product at a foldable cost, engineers try to exclude all the activities that are not necessary for the production process. Accordingly, reductions in activities also reduce costs. Cost reduction efforts help increase quality by eliminating problems such as production losses, delivery delays, surplus stocks that may arise during the production of the product. (Gürdal, 2007)

We can briefly summarize the benefits of continuous development as follows;

- ◆ There is a vitality in all activities.
- ◆ Unity of aim and goal is provided with the company.

- ◆ The level of knowledge and skills of employees is continuously improving.
- ◆ The motivation of the employees increases.
- ◆ Common problems of the units in interaction are solved.
- ◆ Production and other competitive elements develop faster.

2 Kaizen Theoretical Background

In this chapter, kaizen participation, problem solving tools, control systems and components of Kaizen which is responsible for the technical functioning of kaizen are mentioned.

2.1 Participation in the Kaizen

Another part of kaizen is the kaizen participation issue, which includes employees from all levels of an enterprise. Kaizen participation is a holistic work approach that all employees aim to realize Kaizen works in communication. The most critical factor for Kaizen is human. Because if there is no human, everything else will be meaningless. Therefore, the Kaizen strategy has a structure that includes everyone from senior management to the worker. However, its application to each level and participation of each level are separate. Senior managers should be determined to make Kaizen operational as the primary strategy of the business, establish company policies, and carry out audits to achieve the goals. Mid-level managers should ensure that activities are carried out in line with the goals determined by senior management and raise awareness about Kaizen. Supervisors should ensure that the exchange of information between workers and mid-level managers is stronger. It should also ensure that the improvement is more effective by creating quality circles. Workers should always work to improve activities and strive to be more useful.

Table 1 Management Hierarchy of Kaizen

Senior management	Middle-Level Management	Supervisors	Workers
Adopts Kaizen system as company strategy	Announces the goals, objectives and policies determined by the top management to other employees and ensures that they are realized	In terms of communication between mid-level managers and workers acts as a step.	It is included in Kaizen activities with group works.

Provides resource support and enables Kaizen to be developed.	Uses Kaizen in functional activity	It prepares plans for Kaizen and guides workers.	To improve itself continuously in problem-solving engages in activities.
It establishes company policies, goals and objectives.	It plays an active role in establishing, maintaining and improving company standards.	It supports group work with few individuals, such as quality circles.	By participating in cross-training activities, he improves his abilities.
Enables the company to be audited to achieve goals.	Gives information about the Kaizen concept to employees within the educational programs	It aims to keep the morale of the employees high	By participating in cross-training activities, he improves his abilities.
Creates systems and structures for the development of Kaizen	It helps employees to develop talents and problem-solving.	Uses Kaizen in functional roles. It provides discipline within the company. Suggestions for Kaizen are created.	It complies with all rules and Disciplinary regulations.

Source: Pyzdek, 2013

Kaizen Strategy for Senior Management

- ◆ All employees should be told that Kaizen is everyone's strategy,
- ◆ Support should be provided for Kaizen by allocating the necessary resources,
- ◆ Auxiliary systems, methods, and structures should be created for Kaizen.

Kaizen Strategy for Mid-Level Managers

- ◆ The goals set by the top management should be followed and spread to other units,
- ◆ Standards should be created, implemented, and developed.
- ◆ With intensive training programs, workers should gain Kaizen awareness,

- ◆ Workers should be assisted in developing new methods and tools to solve problems.

Kaizen Strategy for Supervisors

- ◆ Communication with workers should be increased, and morale should be kept high,
- ◆ Small group work and personal suggestion systems should be supported,
- ◆ Required discipline should be explained to employees.

Kaizen Strategy for Workers

- ◆ Discipline should be provided in the workplace,
- ◆ It should continuously improve itself in order to find solutions to the problems,
- ◆ Cross-training activities should improve his talent and experience.

Kaizen participation is divided into three separate parts. These;

1. Management Priority Kaizen,
2. Group Priority Kaizen,
3. It is Individual Priority Kaizen.

The primary task of management-priority Kaizen is to direct efforts to improve the system. In other words, it concerns important administrative areas such as system improvement, planning, decision making, and control. Group priority Kaizen is represented by small group activities, such as quality circles, which use a variety of tools to solve problems. The individual-priority Kaizen uses the suggestion system as a tool. Thus, employees are allowed to express themselves. It also has a motivating effect on employees (Charantimath, 2011).

Table 2 Three pillars of Kaizen

	Management Priority Kaizen	Group Priority Kaizen	Individual Priority Kaizen
Tools	*Seven tools *Professional ability	*Seven Tools	*Common sense *Seven Tools

Concept	*Management and Professionals	* Quality Circle Members	*All
Goal	*Focuses on system and processes	*Within the same field	*Everyone in their field
Cycle	*Continues throughout the project	*Four or five months to complete	*Any time
Gain	*Management chooses how much	*2-3 per year	*Numerous
Supporting System	*Line and staff project team	*Small group activities *Quality Control circles Suggestion system	*Suggestion System
Realization Cost	*Sometimes it decides to make small investments	*It is mostly not expensive.	*It is not expensive.
Result	* The new system and facility improvement.	*Advanced business management *Renewal of the standard	*On-site improvement
Additional Contribution	*Improved management performance	*High morale *Participation *Gaining experience	*High morale KAIZEN sensitivity *Self-development

Direction	*Gradual and visible improvement *Significant improvement in the current situation	*Gradual and visible improvement	*Gradual and visible improvement
------------------	---	----------------------------------	----------------------------------

Source: Imai, 2012

As can be understood from here, these methods allow them to specialize in problem-solving, enable employees to participate in group activities, communicate more with each other, and develop employees' skills.

2.1.1 Management Priority Kaizen

Kaizen, the first pillar of Kaizen, is management priority; It focuses primarily on logistics and strategic issues, ensures progress, and gives strength that keeps morale alive. Since everyone who works in Kaizen has a business, the manager should also be interested in developing his own business. Kaizen believes in general that an administrator should devote at least half of his working time to improve.

Kaizen topics that management is working on; although it requires professional knowledge and complex problem-solving ability, it can sometimes be solved with the help of simple Statistical Tools. These are the primary duties of management and often include people from different departments working together on common problems, as in project groups.

Management-priority Kaizen; Kaizen teams also use group approaches such as work teams and project teams. However, these groups are quite different from the quality control circles; because they consist of management and support staff and are considered as a routine part of the activity management task (Imai, 2012).

2.1.2 Group Priority Kaizen

Group priority Kaizen is conducted through quality control circles, volunteer management groups, and small group activities that use various statistical tools to solve problems. This approach requires a complete PDCA cycle. Not just members of the team identify problems;

they include identifying and analyzing causes, developing and testing measures against these problems, and as a result, creating new standards and procedures.

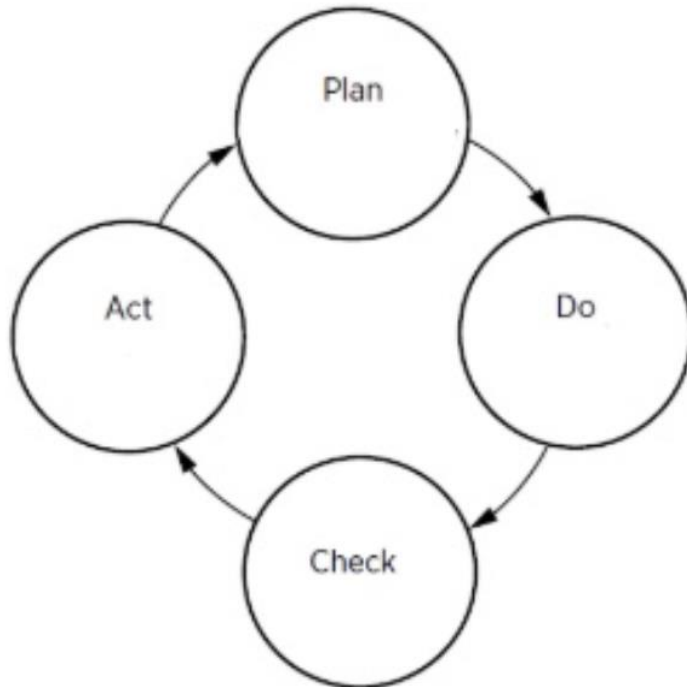


Figure 2 PDCA Cycle

Source: Imai, 2012

The steps of the PDCA cycle are given below:

Plan

1. Determination of the goal (what we want to achieve, where, when),
2. Determination of targets,
3. Detailed plan preparation (implementation plan).

Do

1. Informing every person concerned (What, Who, When),
2. Monitoring and realization of the activity plan,
3. Application results are strictly followed.

Check

1. Checking whether the targets are reached,
2. Detecting and recording possible deviations,

3. It is informing the related people.

Act

1. Standardization of effective act,
2. Providing the necessary training and guidance,
3. Establishment of a permanent monitoring system,
4. It is standardization and control to ensure continuity of improvement.

Small group activities play a significant role in the Kaizen strategy. These small groups are often created to support mutual development among members. Caring, sharing, and devotion have an essential place in Kaizen. The advantages of small group activities, starting Kaizen studies can be observed in a short time. We can list these advantages as follows (Imai, 2012):

- ◆ Determining the group goals and working to achieve them strengthens the team spirit.
- ◆ Group members better share and coordinate their tasks.
- ◆ Communication between workers, supervisors, and senior management is strengthened, as well as among employees of different generations.
- ◆ Morale rises significantly.
- ◆ Employees gain new knowledge and skills.
- ◆ Worker-supervisor-senior management relations develop.
- ◆ The group aims to find its solutions without leaving the solution to the management.

2.1.2.1 Kobetsu Kaizen

Kobetsu Kaizen, on the other hand, is planned, measured, and timed KAIZEN made by teams. Managers or assistant managers should lead the activities in carrying out Kaizen activities. This activity is called "Kobetsu-Kaizen" or "Hinshitsu-Hozen" (Pehlivan, 2010).

In a study conducted in the Italian shoe industry, the focus is on reducing waste, performing planned work, controlling business processes with computers and software. Besides, it has been observed that the computer-based lean manufacturing method makes improvements both in quality and at the time of production. As a result, it has been observed that there is a 0.2% improvement in quality and 60% improvement in inefficiency. (Gunasekaran, 2018)

Kobetsu Kaizens are made to achieve significant improvements following the methodology. The main goal is to try to reduce the errors to zero whenever possible, in order to increase

the performance on the issues of quality, price, time, which are perceived and valued by internal and external customers. In the improvements to be made, 16 major losses called Muda can be taken as reference.

16 Major Losses

8 Major Losses Affecting Equipment

Failure Losses

1. Setup Losses
2. Team Exchange
3. Initial Losses
4. Small Postures
5. Speed Losses
6. Incorrect Production and Repair Losses
7. Closing Losses

5 Major Losses Affecting Workforce

1. Management Losses
2. Production Movement Losses
3. Land Organization Losses
4. Logistics Losses
5. Measurement Loss

3 Major Losses Preventing Material Energy Efficiency

1. Energy Loss
2. Jig Mold and Hand Tool Losses
3. Product Losses

The target period must be determined for all these improvements. In order to reduce chronic losses, it is aimed to reduce costs as a result of the method improvements obtained by performing statistical analyses, measuring, analyzing problems, finding standard solutions by a team. As with other Kaizens, the problem in a production unit can be found by the unit itself. More conscious studies are carried out in this type of Kaizen. Employees may need to have a pre-training to keep records and statistics and draw graphics. It is very important that the analysis to be made is positive and positive, not an accusation. In order to make Kobetsu-

Kaizen, Kobetsu Kaizen forms are prepared by determining the working method. Losses, errors, where the errors occurred, the application of Kaizen made, the results, goals, and others are recorded.

The Kobetsu Kaizen application consists of the following 12 steps: (Tanik, 2017)

1. Team Selection: In order for continuous improvement to existing in a company, it is recommended that teams are determined first. The team should be chosen first by gathering people with a standard physical environment or problem.

It is essential to define the structure of the teams to ensure that the actions develop well. Second, within the team structure, members from each department of the organization should be present according to the probabilities.

2. Choice of Topic: The topic that provides the most returns in Quality, Cost, and Time dimensions is selected from the existing problems.
3. Activity Plan: The team's work plan spreads over weeks and days. It is determined how many weeks Kaizen study will take and how long twelve steps will be completed.
4. Current Situation Analysis: After the description of the problem, its clear definition, and what the current situation is being revealed. Loss analysis, 5 Reasons, Pareto, Histogram techniques are used.

Table 3 5W 1H Questions Technique

Who	What	Where
1. Who?	1. What to do?	1. Where should it be done?
2. Who doing?	2. What is being done?	2. Where is it done?
3. Who should have done it?	3. What should be done?	3. Where should it be done?
4. Who else can do it?	4. What else can be done?	4. Where else can it be done?
5. Who else should do it?	5. What else should be done?	5. Where else should be done?
6. Who is doing 3-Mu?	6. What is done with 3-Mu?	6. Where is it done 3-Mu?
When	Why	How

1. When should it be done?	1. Why does it do?	1. How to do?
2. When is it done?	2. Why is it made?	2. How to do it?
3. When should it be done?	3. Why is it done there?	3. How should it be done?
4. When else can it be done?	4. Why is it done later?	4. Can this method be used in other areas?
5. When else should it be done?	5. Why is it done that way?	5. Is there any other way to do this?
6. Is time reserved for 3-mu?	6. Is there 3-Mu On the way of thinking	6. Is 3-Mu included in this method?

Source: Imai,2012

The 5W1H questions technique is used to reach the root cause of the problem.

5. Target Detection: The target is clearly defined. What and how much will be improved in Quality, Cost, and Time dimensions is clearly revealed by the team.
6. Cause and Effect Relationship: The cause-effect relationship of all factors to be considered in the study is defined by the team. The purpose of this step is to perceive possible problems in all our activities and to plan by determining the points that will pass smoothly (Fishbone diagram is activated at this stage).
7. Solution Plan / Action Plan: Problems to be solved, possible problems in the sixth step, time plan, and responsible are determined at this stage.
8. Solution Activities / Application: As will be noted, the first 7 steps are planning steps, but it can be implemented only in the eighth step. The first seven steps are, therefore, significant for a successful Kaizen. The "Start and End" style works that directly identify and jump into the problem cannot go beyond creating problems and showing how Kaizen does not work.
9. Goal - Results Comparison: It is ensured that the target determination in the fifth step is compared with the results obtained after the application step. Deflection; shows the team's predictive ability. The deviation between targeted and achieved in the repetitions of the Kaizens will decrease.
10. Gains: Presentation of the gains (Quality, Cost, and Time) to senior management is prepared. Other steps of Kaizen are included in the presentation.

11. Standardization: Studies to be carried out, and dissemination studies are determined and monitored to ensure the permanence of the application.
12. Evaluation of Team Members: Continuity of the team members participating in the study is essential. At the end of the application, team members evaluate themselves.

In order for the implementation to be carried out healthily, a working system based on planned and numerical data should be created with the support of the management, intermediate level related to production, and other engineers working in the office. Here, one of the duties of the administration is to achieve achievable but challenging goals in the Kobetsu Kaizen. While determining these goals, it should be noted that they are within the possibilities and also provide essential advantages (Tiryakioğlu, 2009).

2.1.3 Individual Priority Kaizen

Suggestion systems come into play with the individual-priority Kaizen, another stage of participation. This system is an improvement model that covers the thoughts of the workers in order to improve the work done by lower-level workers.

With the suggestion system, workers report their suggestions to management in order to make their jobs better and more efficient. In doing so, they exercise their control over their work and prepare their proposals in this way. When approved by the management, they have the opportunity to realize their thoughts. As a result, Kaizen is often seen as morale, and management does not always seek economic and profitability in proposals. Management should be careful and encouraging employees to become "thinking employees."

Besides, this method also makes significant contributions to the implementation of continuous development and improvement activities, to analyze problems and to produce solutions related to them, to determine the goals within the company and to deliver the quality to the whole enterprise. The most critical goal in the implementation of this model is to ensure that employees support management and increase their loyalty to the company (Imai, 2012).

2.1.3.1 Before-After Kaizen

It can be defined as the improvement of a method or a product with original ideas and studies.

The Kaizens to do are minor improvements. It is the type with the simplest structure. It is done by recording and comparing the new good condition born with Kaizen, which is done after seeing and recording the negativities in a situation (Pehlivan, 2010).

The form of the form in which the records of the works performed can be recorded is shown in the figure. For example; If two people, one short and one tall, should work together at a workbench, it would be a simple first-then Kaizen example to put a platform under the feet of the short-term employees. To give another example, in the working environment where the burrs of a metal piece are cleaned, the top of the table is continuously filled with metal powders, and after a while, these are poured on the floor. Employees lose time by cleaning them regularly. In this case, thanks to one of the employees opening a hole on the table and placing a bucket with a wheel under the hole of the table, the dust is not poured on the floor, and the sawdust can be easily poured thanks to the wheel bucket. This is an example of a before-after Kaizen (Tiryakioğlu, 2009).

2.1.3.2 Gemba Kaizen

Gemba is considered to be the real place in Japanese, the place where real activities occur. The Japanese also use this word in their daily dialogues. There are ten basic rules for the realization of Gemba Kaizen.

1. Traditional and fixed ideas about production and processes should be left,
2. "How is this done? Why can't this work be done?" such questions should be considered,
3. Without making excuses, the current practice should be questioned and studied,
4. Perfection should not be sought; improvement should be applied immediately, even for 50% of the target,
5. The error should be corrected at once,
6. Money should not be spent on Kaizen,
7. It should not be forgotten that facing boredom causes ideas,
8. By asking the question "Why" five times, the reasons should be investigated,

9. Instead of ten people's wisdom, one should ask for information
10. It should be known that Kaizen ideas are limitless (Wittenberg, 1994).

According to Imai, the main focus of KAIZEN should be waste sorting, order, and standardization. This is the cornerstone of the Toyota production system, and Kaizen is the most critical part of it.

Management should remove obstacles by placing task awareness for the right Gemba and directing the organization to the goal. He stated that the problems of the manufacturing area are known by the best production workers and that they should be solved especially by them. This is a suitable method to reduce resistance to change and to direct employees towards solution-oriented (Moore, 2006).

2.2 7 Problem-Solving Tools In Kaizen Implementation

There are many perspectives on quality. According to Kaoru Ishikawa, one of the essential names of Japan in terms of total quality, implementing quality control; developing the most useful, affordable, and satisfying product; design; to produce and to offer after-sales services. He argues that over 90% of business problems can be solved with the seven techniques of quality control.

Acting with the numerical data in the solution of the problems and revealing their solutions with the numerical data is very important, especially in the production enterprises. The seven statistical tools mentioned are as follows: Pareto Charts, Ishikawa (Fishbone) Diagrams, Histograms, Scatter Charts, Control Charts, Check Lists, Process Map. (Cotter, 2016)

1. Pareto Charts:

These diagrams classify problems by cause and event. Problems are made into a chart that indicates the total amount of depreciation by 100% using the bar graph format according to their priorities. It is a concept that argues that the vast majority of results are due to a small percentage of causes. It is known as the 80/20 rule. It advocates the principle that 80% of the problems occur by 20% of the possible causes.

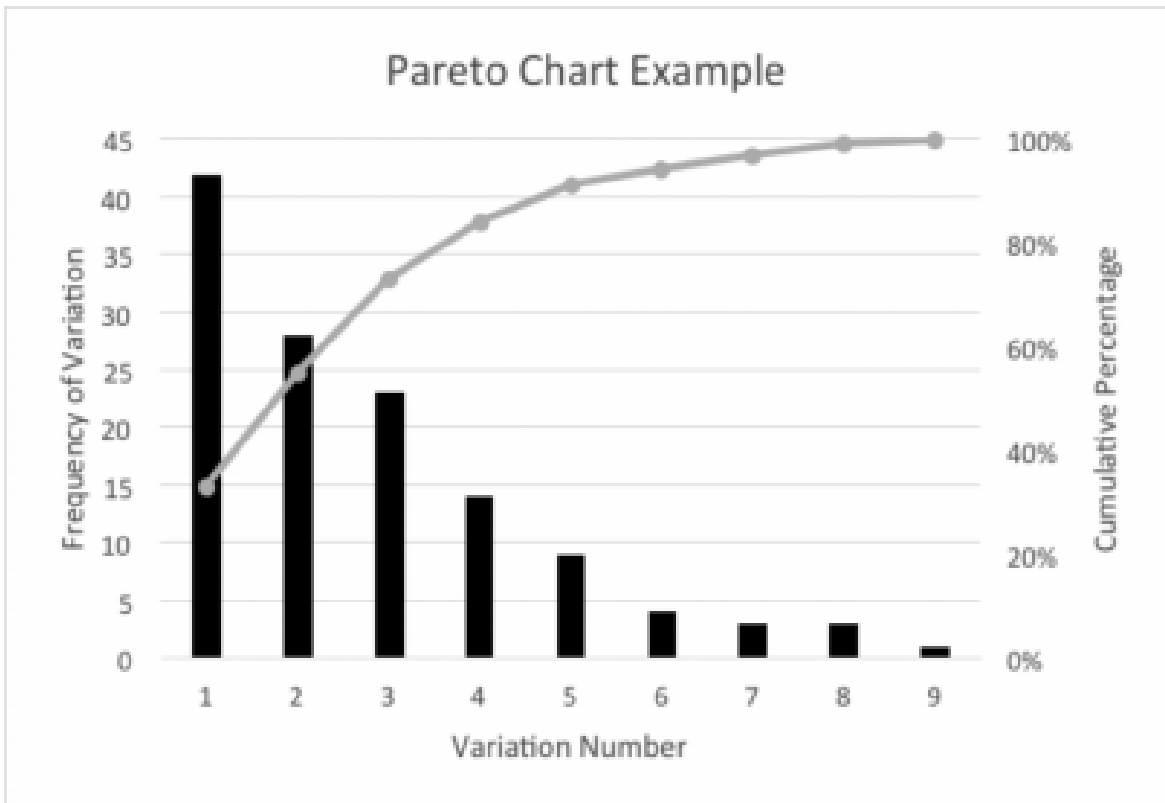


Figure 3 Pareto Chart

Source : Cotter, 2016

2. Ishikawa (Fishbone) Diagrams:

These diagrams are used to categorize the characteristics of a process, a situation, or a problem and the factors affecting them. Cause - Outcome diagrams are also called fishbone diagrams. By determining the problem and quality characteristics intended to be developed, the leading causes and root causes causing the error are determined by techniques such as brainstorming.

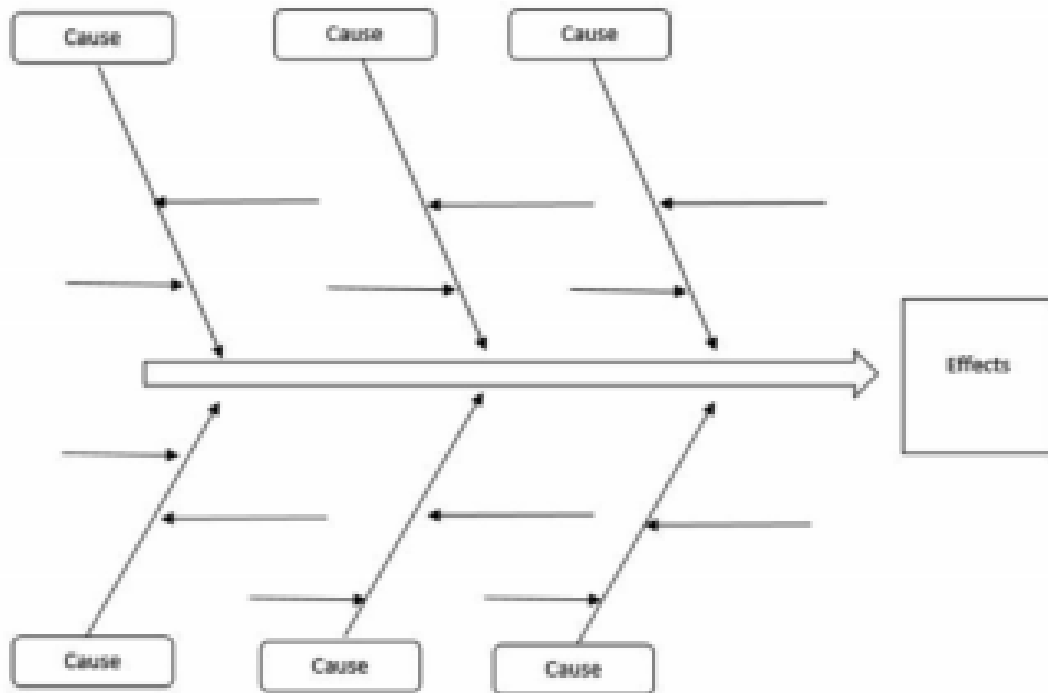


Figure 4 Fishbone Diagram

Source : Cotter, 2016

3. Histograms:

The frequency data obtained from the measurements show a cluster around a specific value. Deviations in quality characteristics are called "distribution," and the shape that shows frequencies as a peak is called the histogram. These histograms are often used to identify problems by analyzing the distribution type, center value, and nature of the distribution.

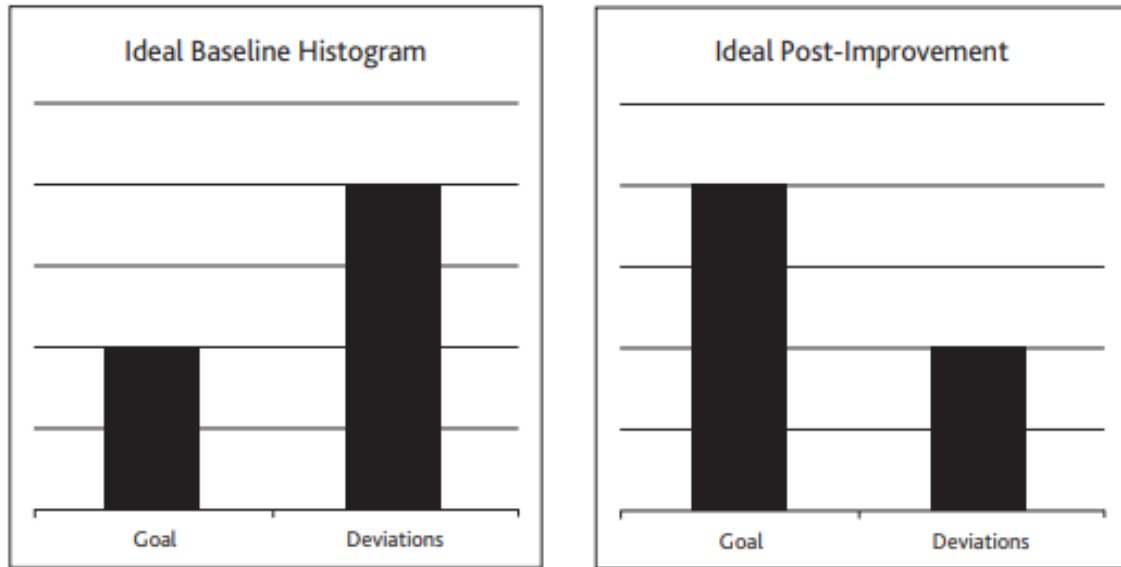


Figure 5 Histogram Examples

Source : Cotter, 2016

4. Scatter Diagrams

Two separate quantitative data related to each other can be analyzed by scattering diagrams. The data that is the opposite of a data is drawn in the diagram, and the relationship between two separate data is examined.



Figure 6 Scatter Chart Reflecting Positive Correlations

Source : Cotter, 2016

5. Control Charts

Control charts are also known as Shewhart charts. Its purpose is to monitor processes and determine when the process is out of control. If the values are within the specified statistical parameters, a process is “under control”. If the process goes beyond these limits, it means “get out of control”.

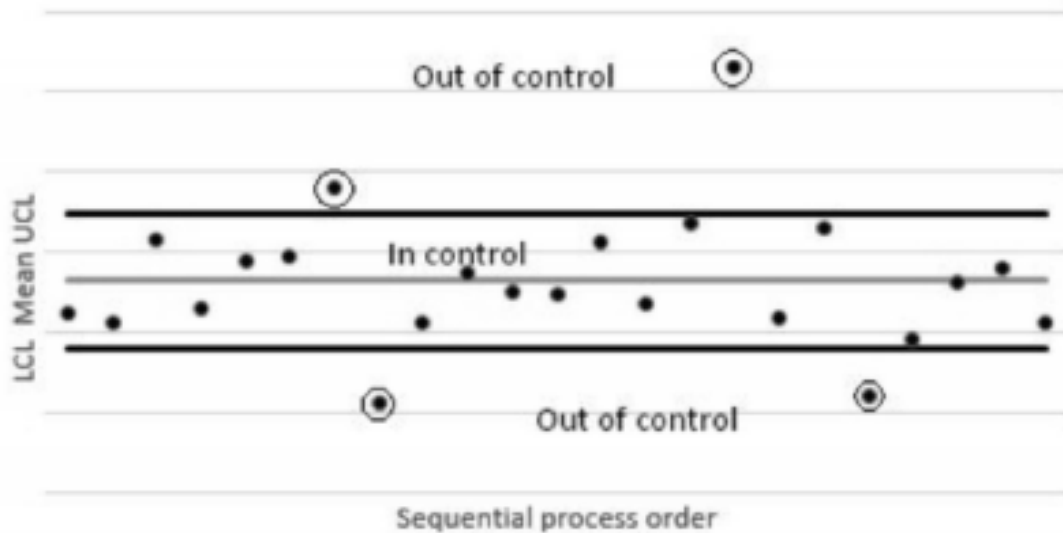


Figure 7 Control Chart Example

Source : Cotter, 2016

6. Check Lists

Checklists are a tool used to collect, compile, and convert data into analysis information. These data can be in the form of quantitative or qualitative data. The data can also be continuous variable data. In order to use the information effectively, they must know the type of data collected. A well-developed checklist will be a useful tool to identify areas for improvement. (Cotter, 2016)

7. Process Maps

Process maps, also known as flowcharts, provide visual mapping of processes. Process maps help identify and analyze steps in a process. It will help identify the value chain and identify quality opportunities throughout the process with the flow-through reviews. While examining the sub-processes within the system, it provides convenience without the need for more than one process map.(Cotter, 2016)

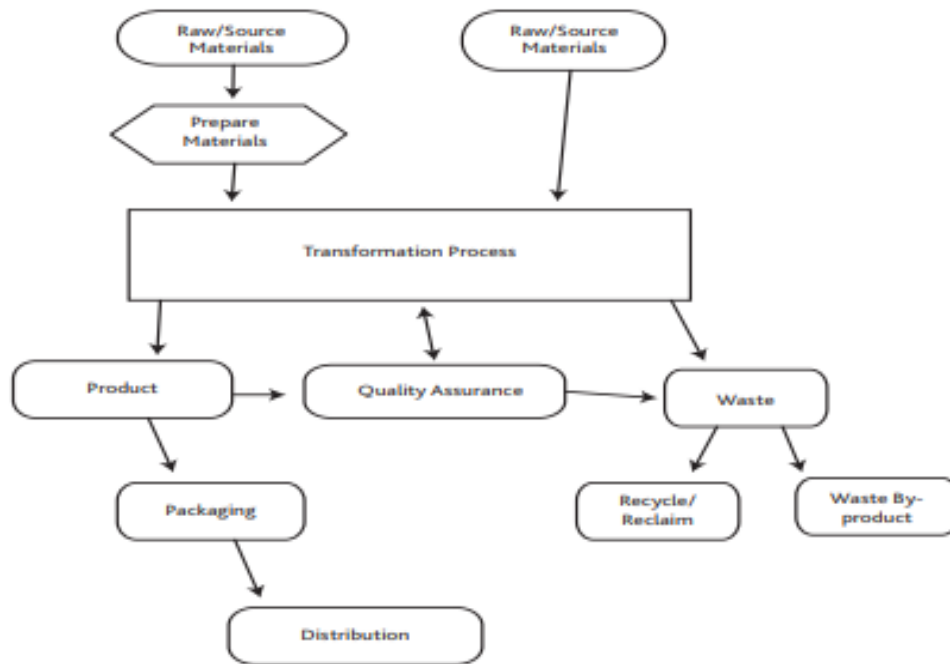


Figure 8 Process Map Example

Source : Cotter, 2016

2.3 3-Mu Control System In Kaizen Works

A group of Kaizen control systems has been developed to help employees and managers keep in mind the areas of improvement. The 3-MU Control System system shown in the Table is widely used.

Table 4 3-MU Control System

Muda (Waste)	Muri (Force)	Mura (Disagreement)
1. Human power	1. Human power	1. Human power
2. Technique	2. Technique	2. Technique
3. Method	3. Method	3. Method
4. Time	4. Time	4. Time

5. Plant	5. Plant	5. Plant
6. Tools	6. Tools	6. Tools
7. Materials	7. Materials	7. Materials
8. Volume of productions	8. Volume of productions	8. Volume of productions
9. Inventory	9. Inventory	9. Inventory
10. Location	10. Location	10. Location
11. Thinking Style	11. Thinking Style	11. Thinking Style

Source:Imai,2012

2.4 Main Components Of Kaizen

2.1.6.1 Quality Circles

It is a small group that voluntarily performs quality control activities in the workplace and continuously conducts company-wide quality control, self-improvement, joint training, flow control, and improvement programs.

2.1.6.2 Autonomation (Jidohka)

It is a feature of the Toyota production system, which means that the machines stop when they produce incorrectly. It is defined as error control. It aims to prevent the faulty parts from interfering with the production flow and interrupting production in subsequent processes. It is based on principles such as controlling the product produced by the machines, automatically stopping when it sees an abnormality, or gaining the ability to give the necessary signals (Imai, 2012).

2.1.6.3 Waste

In business life, Kaizen activities continuously improve all functions of a business from production to management. By developing standardized activities and processes, Kaizen aims to eliminate waste (Imai, 2012).

Toyota has identified 7 types of waste:

- Overproduction
- Inventory
- Transportation
- Mistakes
- Processing
- Movement
- Waiting

Waste 1 - Overproduction: (Too much, too early or too fast)

Overproduction is the worst in 7 waste; it is the opposite of just-in-time production. Overproduction is an unnecessary amount of time, unnecessary amount. Excess production occurs when parts are produced without an order.

Waste 2 - Inventory: (Raw material, a product without added value)

Overproduction causes excess stock; overstocking of anything is inventory. Inventory is all of the products waiting inside or outside the factory at any time. Inventory raw materials include in-process work, assembly parts, and finished products.

Waste 3 - Transportation: (Moving from one point to another point or semi-finished product by hand or by vehicle)

The abundance of inventory naturally causes excessive carry. Transport is the transport of materials, parts, assembly parts, or finished products from one place to another for any reason.

Waste 4 - Mistakes: (Scrap, rework or major cost defects)

Error wastage includes errors themselves, inspection costs for errors, meeting customer complaints, and repairs. All this occurs due to the mistakes themselves. Mistakes; additional time results in additional material, energy, capacity, and additional labour costs.

Waste 5 - Processing: (Unnecessary process due to process weakness that customer does not want)

It is wasted to spend more time or effort on a part than the customer's need. Processing waste is unnecessary operations and processes. The increase in errors is caused by inappropriate or invalid operations or processes. Increased labour hours lead to process waste and errors.

Waste 6 - Movement: (More than people needed to complete the process)

Movement waste; It is the movement of any person, machine, or material that does not add value. Movement wastage due to poorly placed parts, molds and tools. Movement waste can also be called operational waste. Operation wastage is the really slow or too slow, too fast, too extreme, or too cumbersome movement to operate.

Waste 7 - Waiting: (People or machines waiting for the work cycle to expire)

Wasting from waiting; idle time arises from waiting for people, machines, materials, and information. The need for waiting caused by many things is due to transport delays, machine failures, some operators working too slow or too fast.

The current situation is analyzed objectively in order to eliminate the 7 major waste mentioned above and to identify the improvement activities. Then the improvement activities are implemented by selecting the problem-solving technique appropriate for waste.

2.1.6.4 Kanban

It is a communication tool developed by Taiichi Ohno in Toyota and used in instant production and inventory control systems. A kanban card is placed on top of the produced parts, indicating the quantity delivered. When all parts are used, the same card returns to the first point where it was processed and creates the next request.

2.1.6.5 5S

5S takes its name from the initials of 5 Japanese words starting with S; these words are Seiri, Seiton, Seiso, Seiketsu, and Shitsuke.

As an indicator of openness in management, five repetitive steps are usually announced on the boards.

The 5S steps can be explained as follows:

1. Seiri (Classification): It means separating the necessary things from the unnecessary ones and discarding the unnecessary ones.

- ◆ Working method
- ◆ Necessary tools
- ◆ Unused machines
- ◆ Fault products, forms, and documents

2. Seiton (Arrangement - Placement): In this philosophy, the order can be explained as follows: "There is room for everything, and everything must be in place."

Items should be kept organized so that they are ready for use when necessary.

3. Seiso (Cleaning): Employees are also responsible for the cleanness of their work area. Because dust and dirt are indicative of disorganization and discipline and cause inefficiency.

4. Seiketsu (Standardization): The aim is to create and maintain an excellent environmental and workplace environment. With the PDCA cycle, a more efficient state is continuously tried to be reached.

5. Shitsuke (Education - Discipline): Classification, regulation, cleaning, and standardization are not sufficient to ensure efficiency in enterprises. In order to be permanent and permanent, they must have discipline (Mitchell, 2013).

2.1.6.6 Just In Time Production (JIT)

Considering just in time production as a modern concept and looking at the last accepted form of this concept, the narrowed form of the definition is zero stock and zero error. The zero stock mentioned here is the ideal size since it will not be rational to achieve this ideal size; the individuals forming the system will have to develop themselves to achieve this perfection. Kaizen, which is called continuous improvement in the terminology of Japanese production models, means continuous work and continuous development in order to achieve absolute goodness. Zero error occurs as a system imposed by zero inventory. In an environment that no longer tolerates error with the reduction of stocks to the minimum, errors are the most inexcusable elements. In this way, necessary efforts are made to prevent mistakes, and waste is tried to be prevented in every way.

Just in time, production is a system that deals with residual and waste prevention in the complete production process. Waste and waste in the production process are determined as inventories, delays and queues, quality problems, long production preparation times, and unnecessary accounting processes. Just in time, the production system is a system that aims

at continuous development, eliminates unnecessary expenses, and focuses on customer satisfaction. In this system, production is started based on real needs, not based on estimates, and raw materials and materials come into operation whenever necessary, thus working with zero or very low inventory levels (Mitchell, 2013).

2.1.6.7 Work Teams

Working teams are used to catch the most sensitive points that will create an opportunity to reduce the cost in the Kaizen. While the working teams are being formed, each employee is assigned to a single team. The members of the team come from engineering, maintenance and administrative departments, and the work teams operate as an independent unit under the leadership of a team manager. These teams have full authority and responsibility about the production processes to which they are assigned, such as engineering, process, safety, quality, improvement, general layout, and equipment maintenance. They receive intensive training, especially in quality, as a team, information systems, process technology, problem-solving, security, and efficiency. The team members make suggestions on technical and managerial issues such as technology, work order, and quality improvement used in the factory at certain times.

These work teams undertake tasks such as the design, manufacture, and distribution of a product or the provision of a service. They often perform work undertaken by workers on the assembly line and directly add value to the business. Among these are research and development, production, sales, and customer service. For example, production teams, new product development teams, marketing teams are working teams. Work teams are generally employed in multi-directional training and have all the necessary features to produce a particular product. At the same time, work teams usually consist of permanent teams (Oropesa, 2015).

2.1.6.8 Total Efficient Maintenance

With Total Efficient Maintenance activities; It is aimed to combine production and maintenance functions through the appropriate combination of work experience, teamwork, and continuous improvement. Achieving this goal requires participation in all departments and at all levels, motivating small group work and volunteer activities for factory

maintenance. To put it simply, it is a term that covers all the work carried out in order to increase the efficiency or effectiveness of the equipment used in a factory and to prevent scrap from potential machine errors. In a broad sense, it is an auxiliary quality and kaizen technique that provides support for increasing quality and efficiency.

Total Productive Maintenance is the implementation of production, maintenance, and engineering departments, and small group works to achieve maximum efficiency with the participation of all employees. In other words, it is a strategy adopted by all working persons who will realize zero work accidents, zero errors, and zero downtime in production. The relationship between Total Efficient Maintenance, losses, and equipment efficiency is clearly defined by product quality and ready-to-operate equipment. There are planned and urgent maintenance activities in Total Productive Maintenance, as well as reducing maintenance, facilitating maintenance, and increasing operators' responsibilities and motivations. The main goal in Total Productive Maintenance is to maximize equipment efficiency. Activities aimed at preventing equipment losses are aimed to minimize energy, material, and labour losses.

2.1.6.9 Suggestion System

As Kaizen has continuity, employees need to participate and support it. When faced with a problem, they should provide ideas to solve this and present their ideas and suggestions to the company management about what can be done based on the solution. The main principle of the suggestion system is that there are many ideas in order to reach a solution. In this way, employees will be able to present their ideas and improve their self-confidence in improvement works related to their areas of expertise. The purpose of this system is to enable employees to increase productivity in the company and make suggestions for improvement activities expected in product quality.

Suggestions to be given to management in order to improve the applicability levels of the work done by the employees in the enterprise will be used to improve the work. In this way, both the motivation of the employee's increases, and their personal development improves. Besides, among the suggestions expected from the employees of the company, issues such as improvement work to be done for the areas they are specialized in, providing the product

range to be expanded by expanding the products to be produced, ensuring that all the machines involved in the production process are more efficient (WEISS, 2016)

2.1.6.10 Poka-Yoke

Poka-Yoke, Poka in Japanese; error means preventing Yoke. Thus, Poka Yoke means "Error Prevention." The Poka-Yoke method, developed by the engineer named Shigeo Shingo in the early 1970s, is one of the innovations that revolutionized the production line. Error inhibitors are measuring instruments or instruments that are generally used in processes where production is likely to be at fault.

Poka-Yoke; It is a system that aims to detect and eliminate faults and faults that may occur during production in enterprises. This work is done in advance with the help of very simple structures that are easy to set up and use.

Employees in business are likely to make mistakes for physical, psychological, or physiological reasons. With Poka Yoke, it is ensured that the errors passing to the other process are minimized as a result of such minor carelessness. Aiming to prevent errors before they occur, Poka Yoke reduces errors by reducing errors and consequently increases efficiency. Poka-Yoke can be used in many areas, such as production, sales, marketing, distribution, and customer service.

Poka-Yoke methods are divided into two groups: prevention and finding. Poka-Yoke for prevention aims to realize that there will be errors, appropriate methods or errors, and prevention without errors. On the other hand, Poka-Yoke aims to detect the error after finding an error or to find the wrong product and prevent it from continuing. Poka-Yoke techniques are also part of kaizen techniques. Kaizen is about continuous improvement in performance, cost-benefit analysis, and quality.

In the Poka-Yoke system, the working or related group makes efforts to prevent the error before it occurs or to eliminate it immediately after it occurs. As a result, error-free production takes place. The working group gains experience over which stage of possible errors occur over time and for what reasons, and takes the necessary precautions on time, thereby preventing downtimes in the production line. Although Toyota has the authority to

stop production in the production line of each employee, uninterrupted production can be achieved, and production can be carried out within the factory without error correction area. However, 20% of the factory area and 25% of working hours are spent on correction of errors in mass production, which undoubtedly results in an additional cost incurred (O'LEARY, 2017).

3 Kaizen Implementation In Crown Cork&Seal

Crown Cork founder "William Painter" founded CROWN CORK & SEAL, which makes soft drinks and beer packaging in 1892. Today, as Crown, it serves all over the world with more than 100 years of service. It manufactures in different varieties with its factories spread all over the world and offers this service to humanity with its fully automatic factories. These production facilities include Aerosol cans, beverage packaging, lids, food containers, promotional packaging, and transit packaging. After its founding in 1892, Crown, which constantly renewed itself as a company and started to grow with the understanding of improvement, took the first step on the path of growth by developing a machine that filled 24 bottles of an operator and closed the lid. In 1906, Crown expanded its production approach to Europe, South America, and Pacific Asia. As the years progressed, Crown, which has always adopted the innovation as per its company policy, progressed with glass bottle manufacturing until 1969, after this year, it changed the production system and introduced it to the world by providing a rapid transition to the Aluminum box. With this introduction, it has demonstrated its innovative and sustainable service. By the year 1996, he became the packaging leader of the world and presented the entire packaging and packaging system to the whole world.



Figure 9 Crown Holing Product Picture

Source: Internal sources from company

3.1 Kobetsu Kaizen Implementation

Implementation 1 - DECORATOR SPOILAGE

Plant:Jeddah

Date: 11/10/2019

Problem Description

The deterioration in the decorator area (1.11%) is higher than the CROWN target (0.8%). Two problems have been identified for the works to be done for decorator distortion. The first is a printing fault due to inhomogeneous ink flow and low feeding, which results in stop / start and prevents rejection. Second, leakage in the ink nozzle causes contamination inside the decorator.

Plan:

1. **Team Selection:** Team members are composed of the people listed below.

Leader is specified as Hatem Horchani, sponsor is Nazih Alsaadi and team members are electricians , decorator team, engineering and shift supervisors.

2. **Topic Selection:** In the choice of subject, earnings, convenience, and urgency were scored from 1 to 10, and the subject with the highest score was determined as the subject of Kaizen.

Table 5 Topic Selection Table

Topic	Benefit	Convenience	Urgency	Total
1. A printing defect occurs due to inhomogeneous ink starting and low feeding that causes rejection to stop, start, and blow.	7	3	9	19
2. Leaking in the ink nozzle causes contamination in the interior of the Decorator.	2	5	2	9

Source: My own work

3. Activity Plan: In the activity plan shown in Table, the planned situation is indicated in yellow, and the actual situation is indicated in green.

Table 6 Activity Plan

	1.day	2.day	3.day	4.day	5.day	6.day	7.day
Selecting the team	Planned						
	Actual						
Choosing subject	Planned	Planned					
	Actual	Actual					
Time Plan	Planned	Planned	Planned	Planned	Planned	Planned	Planned
	Actual	Actual	Actual	Actual	Actual	Actual	Actual
Analysis of current situation		Planned	Planned				
		Actual	Actual				
Detection of quality errors			Planned				
			Actual				
Review of the process			Planned				
			Actual				
Setting Goals			Planned	Planned			
			Actual	Actual			
Root Cause Analysis			Planned	Planned			
			Actual	Actual			
Actions				Planned	Planned		
				Actual	Actual		
Target and Result					Planned		
					Actual		
Standardization					Planned	Planned	
					Actual	Actual	

Evaluation							

Source: My own work

4. Current Situation Analysis:

Quality Error: In the examination made by electricians and decorator operators, errors were found in adjusting the over varnish pressure and mixing the paint.

Additional Workmanship: The average due to stopping start and blowing rejection occurs every 15 minutes.

Cost: As a result of the additional workmanship done by the decorator team, an average labour cost of \$ 190 per day is incurred.

5 Reasons Method was used to analyze the root cause of the problem.

Reason 1: Overvarnish pressure could not be adjusted.

Reason 2: Undetected defects in mechanical parts.

Reason 3: Occlusion in over varnish nozzle.

Reason 4: Lack of ink mixer.

Reason 5: Defects due to paint preparation or paint quality.

The root cause of the problem was determined as "Why 1 and Why 4".

5. Achieved:

Quality objective: Increasing the quality of decorator printing

Additional labour target: Reducing the additional labour time to 0.

Cost target: Reducing the costs caused by additional labour and semi-product waste to 0.

Do:

6. Action

In the improvements made, the pressure booster was first installed in Overvarnish. Secondly, an ink mixer is installed to improve ink flow and reduce minor printing defects in some inks.

And finally, to check the amount of rejection boxes, the start / stop function started to be checked in case of low supply from the decorator.

7. Solution Activities: All actions mentioned in Article 6 have been completed.

Before:

Without Air Booster and Ink Agitator.

After:

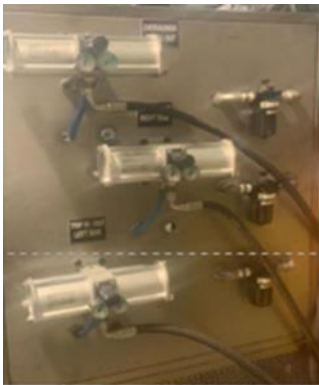


Figure 10 Air Booster

Source: Internal source from company



Figure 11 Ink Agitator

Source: Internal source from company

Check:

8. Goal - Result: Actions were completed in 2 days, and as a result, desired target results were obtained.

9. Earnings:

Hard savings for every day, cost of 6600 boxes was saved and \$190 labour cost was saved; and as soft saving, less Decorator losses occur, and print quality is improved.

10. Evaluation: Criteria such as discipline, morale, teamwork, data collection, quality, brainstorming, cause-effect relation, and working with the target were evaluated and scored before and after Kaizen. Evaluation; It was made by scoring each criterion from 1 (very bad) to 5 (very good).

Scoring points give to each evaluation as; 1 very bad, 2 Bad, 3 Acceptable, 4 Good, 5 Very good.

Table 7 Evaluation

Evaluation Topic	Before	After
Discipline	2	4
Morale and Motivation	2	5
Teamwork	2	5
Data Collecting	1	4
Quality	1	5
Brainstorming	1	4
Reason-Result	1	4
Work with Target	2	4
Result	12	35

Source: My own work

Act:

11. Standardization: All improvements made have been added to the procedure.

3.2 Before-After Kaizen Implementations

In Crown Holding, Inc., the topic selection is selected by the Employee, Before-After Kaizen Subject Selection and Evaluation Form, and presented to the manager. If the Kaizen issue is approved by the manager, it is put into practice. During these implementations, the Before-After Kaizen Form is used.

Implementation 1. ENDS ACB Camera Spoilage

Plant Botcherby

Date: October 2019

Problem Description

Update all QUISS cameras in CP1, 3, 4, and 5 to optimum settings to detect errors without rejecting the excellent product.

Team

Team is specified as leader is Paul Christie, sponsor is A. Cowan and team Members are Electrical Team and QUISS Engineers.

Improvement actions

It is decided to carry out improvement and maintenance applications for all cameras.

Failure examples were followed to verify that the products are suitable for the customer.

Responsible

Responsibles is specified as Paul Christie and Nigel Key.

Results

As hard saving, defective box weight has decreased from 25 kg to 10 kg; and as soft savings, electricians will not have to constantly adjust between different products.

Implementation 2. DECORATOR and LINE SPOILAGE

Plant: Parma

Date: October 2019

Problem Description

The time required during decorator replacement was roughly calculated, and no distortion was observed. As part of our Improve Performance and Distortion Reduction Program, a Smartline Report was created to create an automated and sensitive reporting system.

Besides, a Line Failure analysis report was created using data from distortion boxes to monitor line distortion fully. The next step is to fully automate our reporting system using Smartline.

Team

Team is specified as leader is Davide Macchiarini; sponsor is George Tsoukantas and, team members are Juan Cedolin and Harris Mavrikos.

Improvement Actions

The improvements to be made were determined as the creation of the Smartline Report for the duration of the breakdown and the creation of the Line Defect analysis report.

Responsible

Responsibles are specified as Juan Cedolin and Harris Mavrikos.

Result

As hard savings, reporting time reduced; and it was decided to reduce the defect in a separate project. As soft saving, Improved information flow and steps have been taken to improve Failure Management.

Implementation 3. DECORATOR

Plant: Patras

Date: 11/11/2019

Problem Description

Material fogging due to excessive splashing.

Team

Team is specified as leader is John Spais, sponsor is Marios Anargyrou, team members are Panagiotis Linardos, Polyvios Ravazoulas, Theodoros Aspromallis, Spyros Markeziss.

Improvement Actions

Overvarnish exhaust system has been redesigned. Initially, the exhaust duct was close to the blanket segment. At this point, a guard was installed to prevent cut blankets, and two over varnish exhaust points were created in the middle and at the over varnish outlet.

Responsible

Responsibles are specified as Engineering and Production department.

Result

As hard saving, insulation caused by excessive over varnish jumps has been reduced. As soft savings, more efficient process was achieved, cleaning time was reduced, and time was saved.

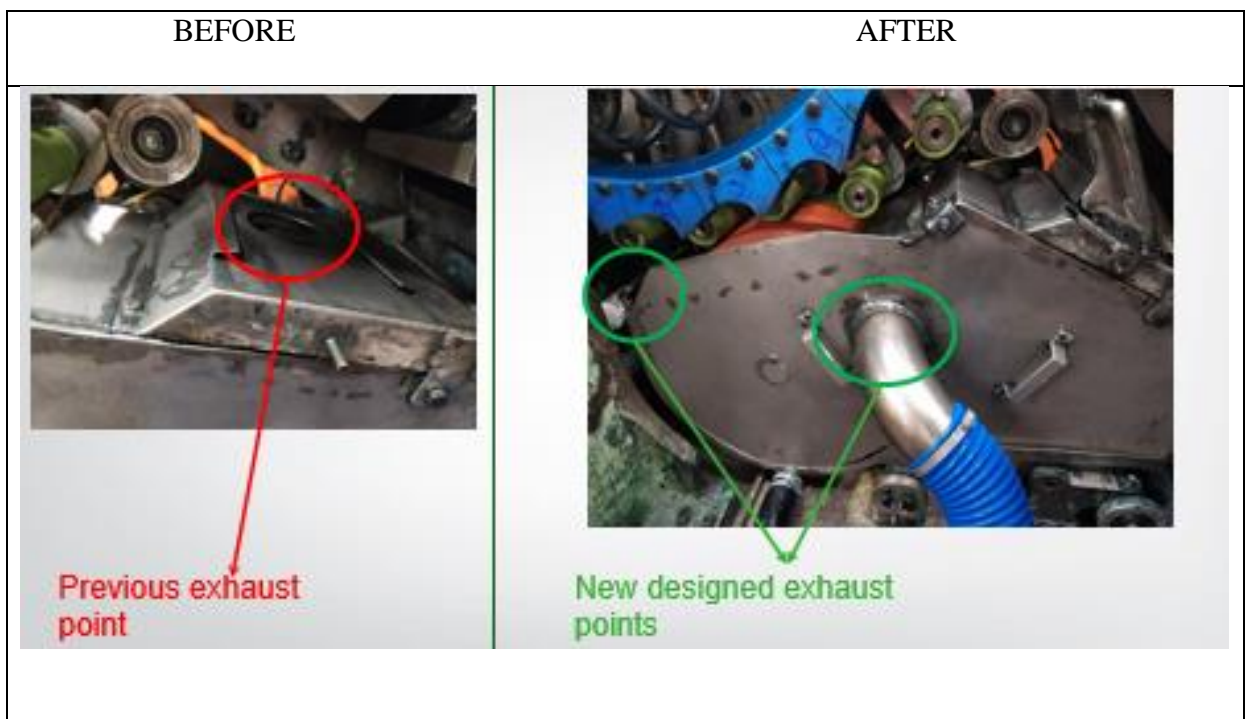


Figure 12 Implementation 3 Before-After Pictures

Source: Internal source from company

Implementation 4. DECORATOR

Plant: Amman

Date: 07/11/2019

Problem Description

Ink build-up occurs at Inkers.

Team

Team is specified as leader is Faisal Joher, team members are Kamal Abu Amoud, Ehsan Karazon, Mohammad Jaber, Mohammad Haider, Tamer Manna, machine maintainers.

Improvement Actions

It was decided to clean the cooling zones for sufficient air and to prepare a monthly cleaning procedure for the cooling zones and, add the Ink Mist to all Decorators and clean it daily.

Responsible

Responsible is Kamal Abu Amoud.

Result

As hard saving, amount of boxes that have been scrapped as a result has been reduced and, as soft saving, a periodic cleaning procedure has been created for Machines and Inks.

AFTER

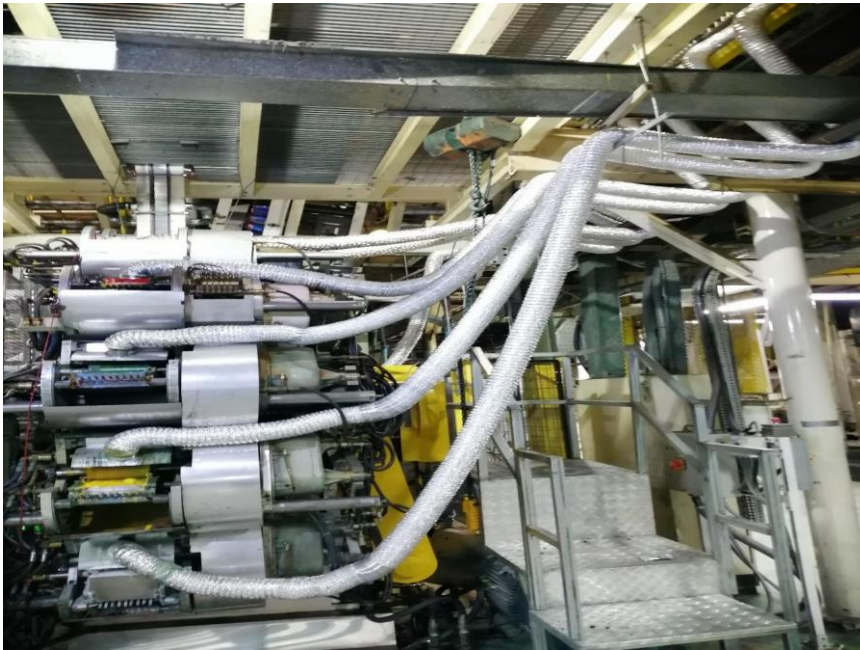


Figure 13 Implementation 4 Before-After Picture

Source: Internal source from company

Implementation 5. NECKER FLANGER

Plant: Damman

Date: 09/11/2019

Problem Description

The most deterioration area in our factory is the decorator. And decorator is focused more on this area to reduce it.

Team

Team is specified as leader is Shibu George, sponsor is Abdul Salam Sirajudeen, team members are B.S. Reddy, Noel Bonstain, P.S. Varun.

Improvement Actions

As a result of the studies, the following action decisions were made for improvements. A new form will be prepared for data analysis. Fixed air lift opening roller assembly will be performed for fast movement. For the printed box visual checks, 1.8 and 2.4 keys should be available depending on the need. And an alarm will be applied for periodic checking of tin cans in the decorator area.

Responsible

Responsinles are specified as B.S. Reddy, Ganesh Karakera, Varun Prabhakaran, Shibu George and electric department.

Result

As hard saving, decreased amount of defect and improved quality and, as soft saving, less hold for inspection.


BEFORE	AFTER
No Alarm alert for the decorator operator for checking the can print visual quality	

Figure 14 Implementation 5 Before-After Pictures

Source: Internal source from company

Implementation 6. UPGRADE REGISTRATION ADJUSTABLE SHIFT

Plant: Dubai

Date: 30/10/2019

Problem description

Adjusting the record on the old adjustable shaft was difficult due to wasted time and time during label replacement. After upgrading the new recording shaft, adjusting the recording will be more precise and more comfortable, which saves less time and distortion.

Team

Team is specified as leader is Nattaphol, sponsor is Sirichai, Craig and team members are Fransisco, Winai C., Adisorn, Narathip, Phollawut, Montree.

Improvement actions

The following decisions were made and implemented for the improvements to be made. The spindle set in record for Inker will be replaced. Saving data and giving feedback. Planning the renewal of all printers.

Responsible

Responsibles are specified as Nattaphol Fransisco, Winai C. , Adisorn Narathip, Phollawut Montree.

Results

As hard savings, label change times average is reduced, the amount of defect per label has decreased by 200 boxes and 70 tags on average per month; saved 14000 boxes per month. As soft saving, movement loss has been reduced for the operator.

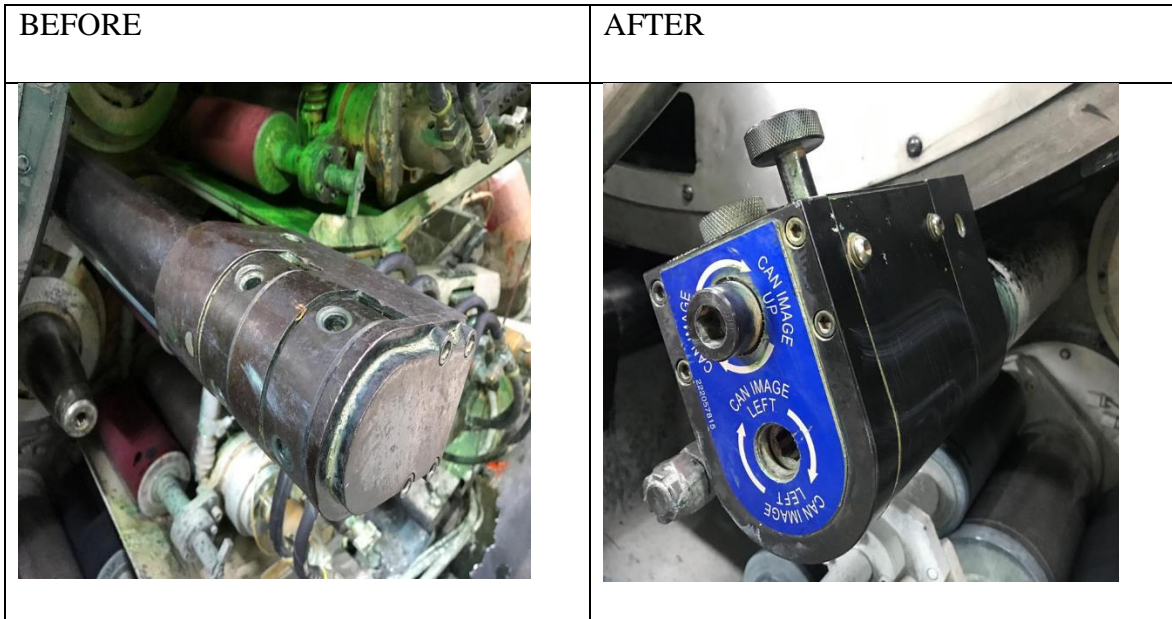


Figure 15 Implementation 6 Before-After Pictures

Source: Internal source from company

Implementation 7. DECORATOR INFEEED MODIFICATION

Plant: Osmaniye

Date: 24/10/2019

Problem Description

After changing the guide, maintenance, and size-changing at the decorator entrance, the cans were damaged, and opening problems occurred as they could damage them. The exchange time should have been an average of 5 minutes, while it took 45 minutes.

Team

Team is specified as Fatih Yiğit and decorator technicians.

Improvement Actions

In order to reduce the change over time, it was decided to make a fast-moving unit (adjustment arm) to the Decorator supply wall. Joints were cut. During the label and guide replacement, the guides were fixed on the sidewalls, and the adjustment was made only with the adjustment lever.

Responsible

Responsible is Fatih Yigit.

Result

As hard saving, label replacement time reduced from 45 minutes to 5 minutes. And as soft saving, labour savings were achieved during the change.

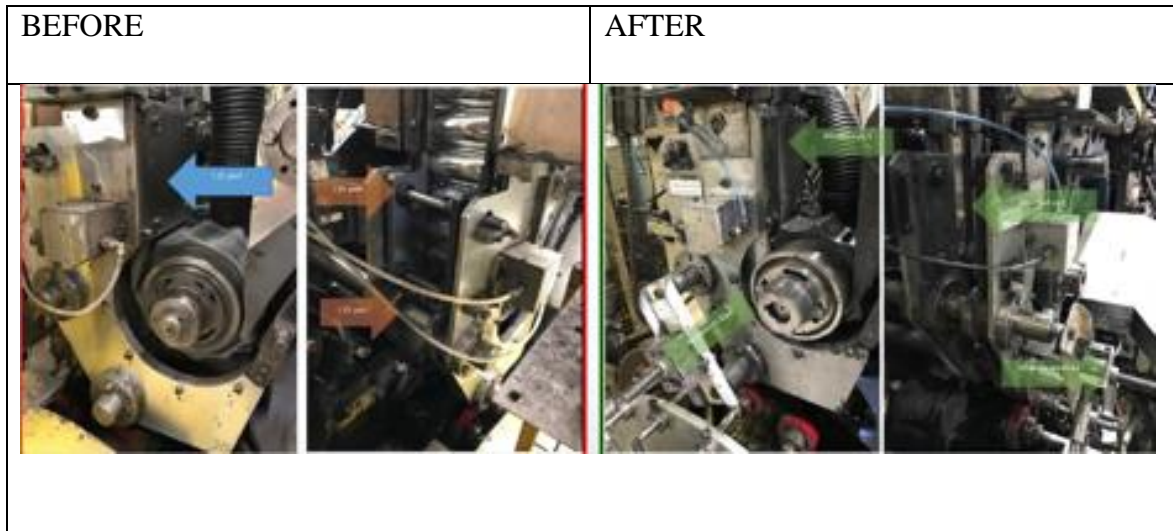


Figure 16 Implementation 7 Before-After Pictures

Source: Internal source from company

3.3 Evaluation Of Kaizen Implementation

In Saudi Arabia's Jeddah Plant, as a result of the systematic Kobetsu work carried out to improve the rate of distortion occurring in the decorator machine, 6,600 boxes of waste was saved per day and \$ 190 per day in labour cost was saved. With the increase in print quality, an increase in customer satisfaction was also achieved.

In the Botcherby Plant of England, the study conducted, the problem of rejection of good products is encountered in QUISS cameras. In order to prevent the problem, maintenance work was done to improve the cameras and the camera settings were adjusted again. Box weight sent to scraps decreased to 10 kg from 25kg. 15 kg boxes were saved daily. As the workload is reduced as a result of the elimination of the obligation of the employees to adjust between different products, morale, and motivation are increased.

In Italy's Parma Plant, an automatic Smartline reporting system was created for the registration process for the Decorator label change, in order to increase the performance and reduce the amount of distortion. In this way, improvements have been made in saving labor and information flow spent on the daily reporting period.

In the Patras Plant of Greece, due to the excessive bounce from the Overvarnish nozzle used in the preparation of the external printing of packages, condensation occurs in the produced packages and contamination in the Decorator. As a result of the improvement made, both the insulation material used in Decorator was saved, the amount of scrapped product was reduced, and the labour time spent on cleaning was saved.

In Jordan's Amman Plant, as a result of the improvement made in order to solve the ink accumulation problem occurring in ink, the scrapped box was saved, and monthly and daily cleaning procedures were created, and future failures and losses were prevented.

In Dammam Plant of Saudi Arabia, the decision was made to make a series of improvements to the Decorator machine, which has the most significant deterioration and malfunction. As a result of the improvement, the quality of the packages produced has been increased, and less scrap has been released. This means that by preventing machine breakdowns, labour time is saved, customer satisfaction is increased by increasing quality, and scrapped packaging is saved.

In Dubai Plant in United Arab Emirates, as a result of the improvements made in order to prevent the loss of time during the label replacement process at the Decorator machine and the defect in the adjustment process, the time and the amount of the box were saved. While saving 1 minute time for changing each label; The average amount of boxes per label has decreased by an average of 200 boxes. If we calculate a monthly average of 70 tag changes, Labour time spent for 14000 boxes and 70 minutes of label change per month was saved.

In Turkey, Osmaniye Plant, DECORATOR guide change after opening the box and manual opening produced in the machine in the damage occurs as a result of the improvements made, and the label exchange time came to 5 minutes from 45 minutes. In other words, 40 minutes of labour time spent on each label change was saved. Of course, as a result of this improvement, morale and motivation increased as the burden of the employees was ensured.

As a result, if we make a general evaluation in monetary terms, the average data is calculated approximately as follows:

The average weight of each box is 13 grams.

The average cost of each box is \$ 0.20.

The average hourly labour cost is \$ 6.

The average number of daily tag changes is 5 times.

And if we calculate the average savings by looking at these values, the monthly results for each Plant with numerical values are calculated as follows.

- ✓ **Jeddah**: $6600 \times 0,20 = \$1320$ box cost + \$ 190 labour cost ~1510\$
~1510\$*30days
~ \$45300
- ✓ **Botcherby**: $1500\text{gr}/13\text{gr} \times \$ 0,20$
~ \$231*30days ~\$6930
- ✓ **Dubai**: $14000\text{box} \times 0,20 + 70\text{minute} \times \6 labour
~ \$3220
- ✓ **Osmaniye**: $70\text{label change for month} \times 2/3\text{hour (40minute)} \times 6$
~ \$140

Table 8 Monetary Saving per month for Plants

PLANT	MONETARY SAVING PER MONTH
Jeddah	\$45300
Botcherby	\$6930
Dubai	\$3220
Osmaniye	\$140

Source : My own work

3.4 Suggestion

Organizations' reaching their goals and increasing their competitiveness; establishment of teamwork environment, regular working environment and removing all kinds of activities that can be described as unnecessary from the production environment, paying attention to the fact that every person from the lowest level to the highest level have labored in any point

of production, giving the necessary importance to the maintenance of the machines, the production without disturbing the product quality is possible by continuing.

Using Kaizen (continuous improvement, continuous development) approach in businesses will contribute to both the economy of the countries and the economy of the organizations. Instead of choosing new and expensive investments, Kaizen, which will be applied for full use of existing production tools and systems, should be preferred as it is very useful and cheap as a system.

Kaizen with minor developments and changes in the existing order; it makes the working environment much better by changing the behaviors and approaches of both managers and employees. Therefore, the benefit of the institutions from Kaizen should be applied since it will bring positive results in terms of harmonization of the working environment.

Companies that want to maintain and increase their competitiveness should make Kaizen a corporate culture, as the path to their goals in the local or international market passes through customer satisfaction.

This study can be a guiding guide for Kaizen in terms of giving academics an idea of knowledge and practice to experts and students interested in lean manufacturing techniques in different sectors.

Conclusion

With the Kaizen approach, the best way to minimize the losses that occur as a result of some problems in the factories and to realize the minimum costs of these studies is possible. In this thesis, the production problems in the factories of a company that produces metal packaging are discussed. The control and solution tools of the Kaizen approach were used to solve the problems encountered. As a result of these studies, improvements were made, and savings were achieved.

With the awareness of continuous improvement, one of the most critical stakeholders of the Kaizen approach, it has been ensured that the current scrap-waste amount is reduced to minimal levels. While the reduction in discard-wastage ratios was huge, the setting times were reduced. Therefore, the result of improving the actual costs, which was aimed in this study, was successfully achieved.

As a result of the work done, with the improvement of the production equipment, an increase in the increasing quality of the product produced has occurred; customer satisfaction, which increases the competitiveness of companies and is one of its primary goals, has been achieved.

Besides, the establishment of a Kaizen improvement team, in order to overcome the problems, has allowed the problems to be viewed from different perspectives through brainstorming. The inclusion of the workers and staff responsible for the processes where the problems are experienced in the improvement teams ensured that the solution of the problem was reached efficiently and effectively, however, the team spirit was strengthened and contributed to the employees to work with a high level of discipline with higher morale and motivation. At the same time, the awareness of the workers performing the transactions and the personnel responsible for the execution of these transactions about the problem in question and the increase of their awareness have also been realized.

Studies conducted do not require high costs. As a result of teamwork, customer satisfaction is achieved through small improvements, saving raw materials, reducing labor costs, reducing the workload on employees, more useful information flow, reducing waste-wastage, taking precautions against malfunctions, producing high-quality products. High morale and motivation were provided with discipline.

References

Citations

CHARANTIMATH, Poorinma M. 2011. Total Quality Management. 2th edition; Pearson India, ISBN-13: 978-8131732625.

COTTER, T. S., Galli, B. J., a Kush, P. 2016. What is quality management? 2nd edition; engineering management handbook, 2nd edition, huntsville (2nd edition ed., pp. 337-360). Huntsville: American Society for Engineering Management (ASEM). Retrieved from <https://search.proquest.com/docview/2173844736?accountid=17116>

ÇETİNAY, H. 2016 Operasyonel Mükemmellik El Kitabı 3, Kaizen Program Yönetimi, Kaizen Atölyesi. [online]. Available at: <https://kaizenatolyesi.com.tr/>

ESKİN, Merih a Uran Tiryakioğlu a Deha Yüceli. 2011. Sanayide Sürekli Gelişme için “Kaizen”, İstanbul Sanayi Odası Yayınları. 11(2): 8-12. ISBN: 9944600946.

GERGER, Atakan a Bülent DEMİR. 2010. Otomotiv servis hizmetlerinde Yalın 6 sigma Kullanımı ile Servis Müşteri Memnuniyet Arttırılmasına Yönelik Bir Örnek. İzmir: Taşıt Tekolojileri Elektronik Dergisi [online]. 2(1): 33-47. [cit. 2010-03-23]. e-ISSN 1309-405X. Available at: https://www.researchgate.net/publication/299388996_Otomotiv_Servis_Hizmetlerinde_Yalın_Altı_Sigma_Kullanımı_Ile_Servis_Müşteri_Memnuniyet_Oraninin_Arttırılmasına_Yönelik_Bir_Ornek

GUNESAKARAN, A. a Subramanian, N. a Yusuf, Y. (2018). Strategies and practices for inclusive manufacturing: twenty-first-century sustainable manufacturing competitiveness. 31(6):490-493. ISSN: 0951192X.

GÜRDAL, Kadir. 2007. Maliyet Yönetiminde Güncel Yaklaşımla. 1st ed. Ankara: Siyasal Kitapevi. ISBN 9756325742.

IMAI, M. 2012. Gemba Kaizen: A Commonsense Approach to a Continuous Improvement Strategy. 2st ed. McGraw-Hill Education. ISBN-10: 0071790357.

MITCHELL, F. Nørreklit, H. a Jakobsen, M. 2013. The Routledge companion to cost management. Reference and Research Book News [online]. 28(1). ISSN 08873763.

MOORE Ron. 2006. "Kaizen, Selecting the Right Manufacturing Improvement Tools: What? Tool? When?". 1st ed. Butterworth Heinemann, Burlington. ISBN: 9780080468198.

MORSE, A. P. 2017. Kaizen Model: What Is It And How Do You Use It. [online]. SDLC Report. Available at: <https://airbrake.io/blog/sdlc/kaizen-model>

O'LEARY, Bill. 2017. Poka-yoke Go. Electrical Apparatus [online]. 70(2): 19-20. ISSN 01901370.

OROPESA-VENTO, Midiala et al. 2015. Effects of management commitment and organization of work teams on the benefits of Kaizen: Planning stage. Dyna [online]. 82(191):76 . ISSN 00127353.

PEHLİVAN, S. 2010. Bir İşletmede Makine Etkinliğinin VZA(Veri Zarflama Analizi) ile Ölçümü ve Toplam Üretken Bakım Yönetiminde Kullanımı. (Master Thesis). İstanbul Teknik Üniversitesi Fen Bilimleri Enstitüsü.

PYZDEK, T. a KELLER P. 2013. The handbook for quality management; a complete guide to operational excellence, 2d ed. Reference and Research Book News, 28(2) Retrieved from <https://search.proquest.com/docview/1322463067?accountid=17116>

TANIK, M. Sarıbay, E. a Seyyar, E. 2017. Kaizen Yaklaşımı Kullanarak Hizmet Sektöründe Kalite İyileştirme: İzmir Metro'da Bir Uygulama. 3(17): 56-65. ISSN:2149-8598.

TİRYAKİOĞLU, U. 2009. Yaratıcı Bireyler İçin Kaizen Kılavuzu. İstanbul Sanayi Odası Yayınları. 1st ed. İstanbul KİTAP. ISSN: 2009-26.

ULUKANOĞLU, Ceren. 2001. Toplam Kalite Yönetimi ve Kaizen Felsefesi. İş-Güç-Endüstri İlişkileri ve İnsan Kaynakları Dergisi. 3(2): 4 ISSN:2148-9874.

WEISS, E. N. a Stevenson, D. 2016. Kaizen in translation: Suggestion systems across cultures. Charlottesville: Darden Graduate School of Business Administration. Retrieved from ProQuest Central Retrieved from <https://search.proquest.com/docview/1845982155?accountid=17116>

WITTENBERG, G. 1994. Kaizen - the many ways of getting better. Assembly Automation, 14(4), 12-17. doi:<http://dx.doi.org/10.1108/EUM00000000004213>

Bibliography

BENNETT, Jason a Jennifer BOWEN. 2018. Lean: 8-in-1 book ultimate collection. England: Independently published. ISBN 978-1-720-21629-2.

GARCÍA-ALCARAZ, Jorge Luis, Aidé Aracely MALDONADO-MACÍAS a Midiala OROPESA-VENTO. 2017. Kaizen Planning, Implementing and Controlling. Cham: Springer. ISBN 978-3-319-47746-6.

MILLER, Jon, Mike WROBLEWSKI and Jaime, VILLAFUERTE. 2014. Creating a kaizen culture: Align the organization, achieve breakthrough results, and sustain the gains. Berkshire, UK: McGraw-Hill. ISBN 978-0-071-92685-3.

ROTHER, Mike. Toyota kata. 2009. New York: McGraw-Hill Professional Publishing. ISBN 978-0-07-163985-9.