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Reducing product returns through the Six Sigma method in a supermarket

Bir süpermarkette Altı Sigma yöntemiyle ürün iadelerinin azaltılması

Ayşe ÇELİK[1], İzzettin Hakan KARAÇİZMELİ*[1]

[1]*Harran University, Engineering Faculty, Industrial Engineering Department, Şanlıurfa, Türkiye*

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Abstract

The intense competition in many sectors in recent years has led businesses to seek process improvement methods. While businesses that desire to be ahead of their competitors often try to reduce costs by improving operations in production, they focus on customer satisfaction in the service sector. Increasing customer satisfaction is quite significant because it not only ensures customer loyalty but also increases the number of customers. The Six Sigma method is mostly preferred by large corporate companies. However, in this study, a simple framework is proposed for businesses whose resources are not very large. To this end, the Six Sigma method was implemented to reduce product returns from corporate customers in a large-scale supermarket in Şanlıurfa. The potential causes of defects were determined by following the steps involved in the Six Sigma method, and the collected data were analyzed. By analyzing the collected data covering the reasons for product returns, the factors that came to the fore were matched with the potential causes determined by brainstorming. The two root causes deeply that affected the product returns from corporate customers were the insufficient training of the staff taking the orders and the lack of an order form. These two root causes accounted for 61% of the total product returns. Then some improvement actions were taken to reduce the product returns, and a monitoring system was established to ensure sustainability.

Keywords: Customer satisfaction, Process improvement, Return rate, Six sigma, Supermarket

Öz

Son dönemlerde birçok sektörde yaşanan rekabet artışı, işletmelerin süreç iyileştirme arayışlarının da artmasına neden olmuştur. Rakiplerinden önde olmak isteyen firmalar, üretim sektöründe genellikle operasyonlarda iyileştirme yaparak maliyetleri azaltma yönünde arayışlara girerken, hizmet sektöründe ise daha çok müşteri memnuniyeti üzerine çalışmalar yapmaktadırlar. Müşteri memnuniyetinin artması hem müşterileri kalıcı hale getirmek hem de müşteri sayısını artırmak açısından oldukça önemlidir. Altı Sigma yöntemi daha çok, büyük kurumsal şirketlerde tercih edilmektedir. Ancak bu çalışmada kaynakları çok geniş olmayan işletmeler için basit bir çerçeve önerilmiştir. Bu amaçla Şanlıurfa'daki büyük çaplı bir süpermarkette kurumsal müşterilerden gelen ürün iadelerini azaltmak için Altı Sigma yöntemi uygulanmıştır. Altı Sigma yönteminin adımları kullanılarak potansiyel hata nedenleri belirlenmiş, toplanan verilerin analizleri yapılmıştır. İade nedenlerini kapsayan, toplanan verilerin analiz edilmesiyle ön plana çıkan faktörler beyin fırtınası ile belirlenen potansiyel hata nedenleriyle eşleştirildi. Kurumsal müşterilerden gelen ürün iadelerini derinden etkileyen iki kök neden, sipariş alan personelin yetersiz eğitimi ve sipariş formunun olmamasıdır. Bu iki kök neden toplam ürün iadelerinin %61'ini oluşturmuştur. Uygulama sonunda ürün iadelerini azaltmak için bazı iyileştirme aksiyonları alınmış ve sürdürülebilirliği sağlamak için izleme sistemi kurulmuştur.

***Anahtar kelimeler**: Müşteri memnuniyeti, Süreç iyileştirme, İade oranı, Altı Sigma, Süpermarket*

*İzzettin Hakan KARAÇİZMELİ; hkaracizmeli@harran.edu.tr

1. Introduction

The increase in competition has recently forced organizations to be more efficient in the production and service sectors. Manufacturing companies aim to use resources efficiently, reduce costs and produce higher-quality products by improving their production processes. Service companies, on the other hand, aim to decrease the cycle times, thereby increasing customer satisfaction (Akarslan, 2003). One of the methods used to achieve these objectives is the Six Sigma method.

This method was first introduced in 1985 by Bill Smith, an engineer at Motorola company. Later, Motorola branded the term "Six Sigma" in 1987 (Vivekananthamoorthy, 2011). Over time, Six Sigma has been developed and used as a solution method in a variety of process improvement problems, and it has become widespread in other sectors (Avunduk, 2019). This problem-solving method involves five steps: Define, Measure, Analyze, Improve, and Control (DMAIC). It aims to go beyond customers' needs and expectations by achieving a defect rate of lower than 3.4 per million while solving problems. This defect rate helps us understand how the Six Sigma method handles quality.

Six Sigma is a method of continuous improvement. This method could directly or indirectly help obtain many positive results, such as reducing defects, costs and processing times, while increasing productivity and efficiency, along with increasing market share (Akarslan, 2003). Therefore, the use of this method has become increasingly widespread since 1985. Reviews on the Six Sigma method reveal that it is widely used, particularly in the production sector, and it has many implementations in the service sector.

Researchers have used the Six Sigma methodology for various purposes, such as to minimize residues in the process of radial forging (Sahoo et al., 2008), to improve paint defects in a wheel rim manufacturing company (Tezsürücü & Tunail, 2010) and to increase energy efficiency in the distillation unit of a naphtha conversion plant (Falcon et al., 2012). Srinivasan et al. (2014) used it to reduce defects in the spray-painting process during the production of shock absorbers. They increased the sigma level from 3.31 to 4.5. Srinivasan et al. (2014) used the Six Sigma method to increase the efficiency of the tube heat exchanger in a furnace manufacturing company. The results indicated that the measured performance was increased by approximately 9%. Erbiyik and Saru (2015) used Six Sigma in the supply chain of an automotive supplier company. Pugna et al. (2016) used it to improve the assembly process in an automotive company. In this way, defects in the riveting process were reduced by 40%. By ensuring the selection of the ideal supplier, defects were reduced by 30%. Nedeliakova et al. (2017) used the Six Sigma method to ensure process improvement and increase customer satisfaction in railway companies. Smetkowska and Mrugalska (2018) took the Six Sigma DMAIC approach to improve quality and customer satisfaction in manufacturing process. Hakimi et al. (2018) improved the production quality by determining the optimum settings by using the DMAIC approach in yogurt production processes.

Adopting a case study approach in the automotive industry, Gerger and Demir (2010) used the Lean Six Sigma method, an enriched version of Six Sigma with Lean Manufacturing techniques, to increase customer satisfaction and prevent waste in an after-sales services department. Using Lean Six Sigma, Franchetti and Bamala (2013) increased productivity by reducing various non-value-added processes in a recycling company. Likewise, Indrawati and Ridwansyah (2015) used it to eliminate some problems which are encountered as a factor that causes the production target not to be achieved in the production process in the iron ore industry, and Avunduk (2019) used it to improve the processes in a PET blow molding machine. Schmidt (2019) used the same method to get rid of the problems in fume hoods that protect researchers working in a laboratory environment from dangerous fumes. The results indicated that an improvement of 65% was achieved.

Studies on Six Sigma are carried out not only in the production sector but also in the service sector. Pathiratne et al. (2018) investigated critical success factors in Six Sigma implementations in the service and manufacturing industries. They emphasized that although the production sector has been a major ground for Six Sigma implementations, this method is also quite important for the service sector. Many Six Sigma studies have been completed in the service sector (Yüksel, 2012). As cited by Yüksel (2012), Cherry and Seshadri (2000) conducted a Six Sigma study in the radiology unit of a hospital. The results of the study revealed that the defects and thus the costs in MR processes were significantly reduced. Wyper and Harrison (2000) used the Six Sigma method to improve the human resources management of an engineering company serving in many locations around the globe. The basic principle was to employ the right person at the right place and time

by paying the right amount of money. Snee (2006) used the Six Sigma method to reduce printing defects in newspapers. It reduced the costs by minimizing the rate of possible rework due to defects.

Ratnaningtyas and Surendro (2013) used this method to improve the quality of a hospital information system to increase patient satisfaction. Tagge et al. (2017) increased efficiency in a children's hospital using the Lean Six Sigma methodology. This increase in efficiency helped reduce the cycle time from 41 minutes to 32 minutes and the return time from 81.5 minutes to 71 minutes. Hussein et al. (2017) aimed to reduce the crowd in the emergency department in hospitals by minimizing the waiting time. They used Six Sigma tools to increase patient satisfaction. Riggle et al. (2018) used the Six Sigma method for the improvement of a code response system of a hospital. Thus, they reconfigured the code response system to reduce unnecessary noise factors and the amount of confusion. Using the Six Sigma method, Mitreva and Kirovski (2021) improved the work processes of the clinical microbiology unit in a public hospital in the Republic of North Macedonia.

Maleyeff (2007) showed that the Six Sigma method can also be used in public corporations. The author reports that the processing times during tax collection in the city of Hartford in the USA were reduced using Six Sigma. In a case study of a business in the tourism sector, Cengiz and Senger (2018) increased the service quality of the business by using the Six Sigma method. Sommer and Blumenthal (2019) used Lean Manufacturing and Six Sigma techniques to improve processes in an eye health clinic, involving cataract and laser capsulotomy operations, ophthalmic emergency room use, and clinical patient flow. Although the studies using the Six Sigma method in the service sector have increased, particularly after 2000, according to our best knowledge only one study has been encountered on supermarket processes in the reviewed literature. In that study, Aişeoğlu and Karaçizmeli (2022) reduced the stock levels of a supermarket using the Six Sigma method.

Sreedharan and Raju (2016) stated that 82 of 235 articles, which they reviewed, the use of Lean Six Sigma, belonged to the service industry. However, there were no studies on supermarkets among them. Similarly, Prakash et al. (2022) reviewed 253 articles published in the literature; 63 of them belonged to service industry applications, but none of them focused on supermarkets.

The Six Sigma method is applicable to all sectors. Therefore, successful implementation examples in different sectors will encourage managers and researchers for new studies. Scientific methods like Six Sigma are generally used in corporate companies where there are ample resources. This study aims to present a simple framework for how to improve the processes through the Six Sigma method in a non-corporate supermarket. In addition, it also aims to demonstrate that small and medium-sized enterprises can improve their processes by using such scientific methods and that there is no need for large investments to do this. This study will encourage potential users to implement Six Sigma and similar methods.

Using the Six Sigma method, this study aimed to improve the sales processes for corporate customers in a large-scale supermarket in Şanlıurfa. Ray and Das (2010) noted that project selection is very important in Six Sigma studies. They further emphasized that success can be achieved, particularly through the support and guidance of the top management. According to the supermarket managers involved in this study, corporate customers' return requests have recently increased at alarming rates, and this has had a negative impact on customer satisfaction. By implementing the steps in the Six Sigma method, the reasons for product returns from corporate customers were extensively investigated. The study also aimed to develop solutions that could eliminate or reduce the identified defects, thereby increasing customer satisfaction.

The next section provides information on the method used; the third section presents the implementation of the method with the results, and the conclusion summarizes the results of the study and offers suggestions for prospective studies.

2. Material and methods

The supermarket, where the study was conducted, is built on an area of 5000 m^2. It has a large area for a local market. The supermarket is operated at a single center. It has no other branches. It involves both wholesale and retail sales. The supermarket has a wide range of products from food and beverages to cleaning products, from frozen products to dry foods, from stationery products to glassware and cosmetics.

At the onset of the study, the problem was defined in collaboration with the process owner, and the scope of the study was defined. It was clear that the supermarket managers wanted to increase corporate sales as a management strategy to increase profitability and ensure sustainable growth. Therefore, the orders from corporate customers and delivery processes were specifically monitored. A major problem experienced in the supermarket at the time was the increase in the product returns from corporate customers. Recently, an average of 1000 USD/month product return has been made. The management team wanted to use the Six Sigma method to find a long-term solution to the problem because they were not sure about the causes of this problem.

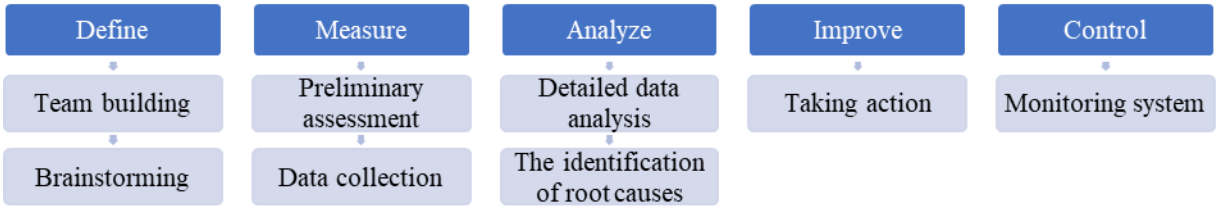

Figure 1. Phases in the study

The phases in the study are illustrated in Figure 1. In the Define phase, first of all, a study team was established, with employees in the units related to the process in which the problem was experienced. The study team consisted of six people: corporate sales manager as Six Sigma project leader, corporate sales specialist, purchasing specialist, warehouse specialist, accounting officer and a senior delivery man. Initially, the name and scope of the study were clarified. Potential root causes were identified by a brainstorming session with the study team. Then, the root causes were evaluated based on their importance (1 point: not important at all, 10 points: very important), and they were ranked using their cumulative level of importance.

After the "define" phase, the necessary data were collected for the second phase which involved measuring. The supermarket where the study was conducted had been selling its products to corporate customers since 2018. The information about the returned products from corporate customers in 2020 and during the first half of 2021 was obtained through the software used by the supermarket. The corporate customers who returned the products were also taken into account. However, no records were kept as to why the products were returned. For this reason, a return registration form was prepared and filled out for each return process. Thus, from then on, it was possible to examine the accumulated causes of the returns.

In the "analyze" phase, the data collected during the "measure" phase were analyzed based on products, product groups, brands, customers, and the interaction of these with each other. Then, the operational defects causing the returns were identified and associated with the root causes, and the most influential causes were pinpointed. In the "improve" phase, actions were planned to eliminate the identified operational defects that led to the return of orders from corporate customers. Finally, during the "control" phase, an order-delivery monitoring system was presented to help the process owner understand the benefits of improvement actions and ensure their sustainability.

Six Sigma studies are often associated with detailed statistical analysis, yet it does not always have to be so. Prakash et al. (2022) stated that in 66% of the 253 Six Sigma studies they examined, the research design was qualitative. In the present study, no detailed and advanced statistical analyses were used. Instead, the DMAIC steps were followed to identify problems through highly practical and easy-to-use tools. Therefore, the DMAIC steps in Figure 1 can be followed in all businesses in which there are limited human and data resources, along with tight budgets.

3. Implementation of the Six Sigma method

In this section, the implementation of the DMAIC steps in the supermarket is discussed together with its results.

3.1. The "define" phase

The supermarket where the study was conducted had been selling its products to corporate customers since 2018. Its total amount of sales to corporate customers in 2020 and the first half of 2021 and the number of

product returns from these customers were compared, and some striking results were obtained. As seen in Figure 2, in the first half of 2021, the product returns from corporate customers increased approximately 15 times compared to those of the previous year. This shows how critical the problem is and how vital this study is for the supermarket.

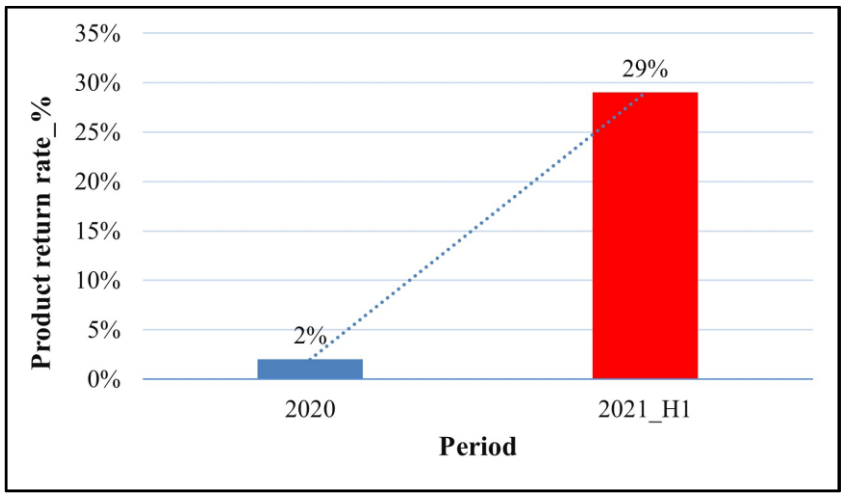

Figure 2. The rate of product returns from corporate customers

To investigate the causes of the product returns from corporate customers, the potential root causes obtained in the brainstorming session with the study team were ranked from the most significant to the least significant according to their total level of importance. According to the potential causes presented in Table 1, the first of the two root causes that most severely affected the product returns was the lack of a regular order form, and the second was the confusing orders from different customers.

Table 1. The potential root causes of the problem

Number	Root causes	Score
1	The lack of a regularly used order form	29
2	Confusing orders from different customers	24
3	The fact that the staff issuing the invoices are not adequately trained	17
4	Insufficient training of the staff who deal with orders	13
5	Inability to track the products	13
6	Insufficient size of the delivery vehicle	13
7	Insufficient training of the staff in charge of purchasing	12
8	The staff's being inadequately trained in organizing the products	7
9	The delivery personnel's not being adequately trained	5

3.2. The "measure" phase

The product returns from corporate customers were categorized according to the type of products to investigate whether the order returns were related to the product type. Figure 3 presents the product return rates by product type. In the measured period, the product returns were seen in 22 product types. No classification was made

for these product types. For example, the product type may be rice or washing machine detergent. Product 1 had a higher order return rate than the other products. After examining the detail of the orders, it was understood that this higher order return rate was a problem of delivery over customer demand. It was also seen that the expiry date was relatively important, but there were no perishable products or product-related defects.

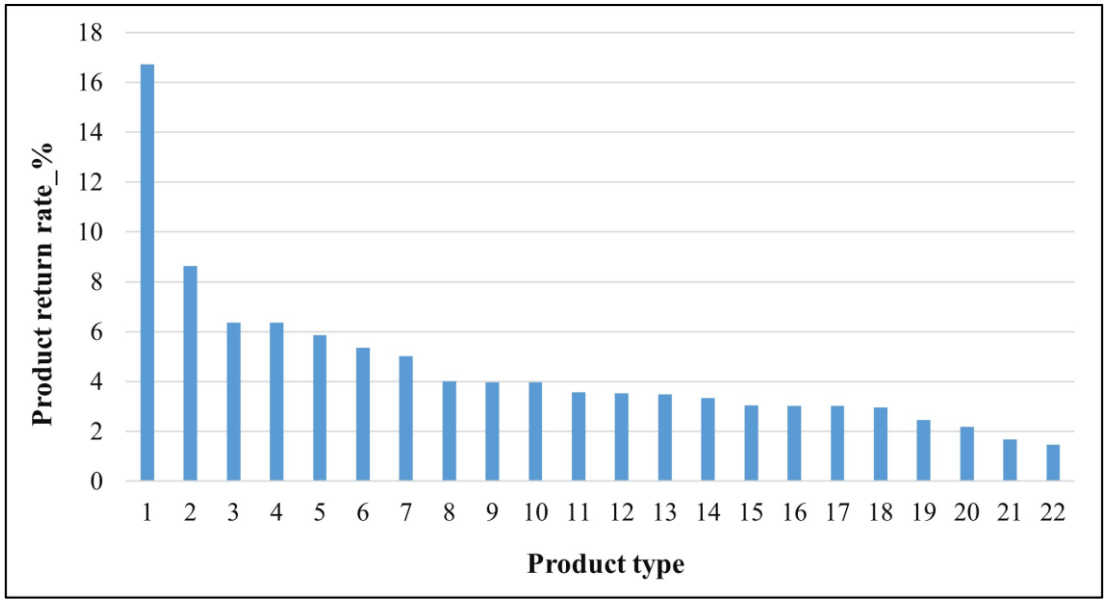

Figure 3. The product return rates by product types

The rates of customer-based product returns were calculated using the returns from all corporate customers. As seen in Figure 4, the customer who returned the highest number of products is customer A. After a closer examination, it was seen that there was no obvious customer-based trend or problem. The supermarket had 12 corporate customers. However, it was observed that product returns were seen in all corporate customers.

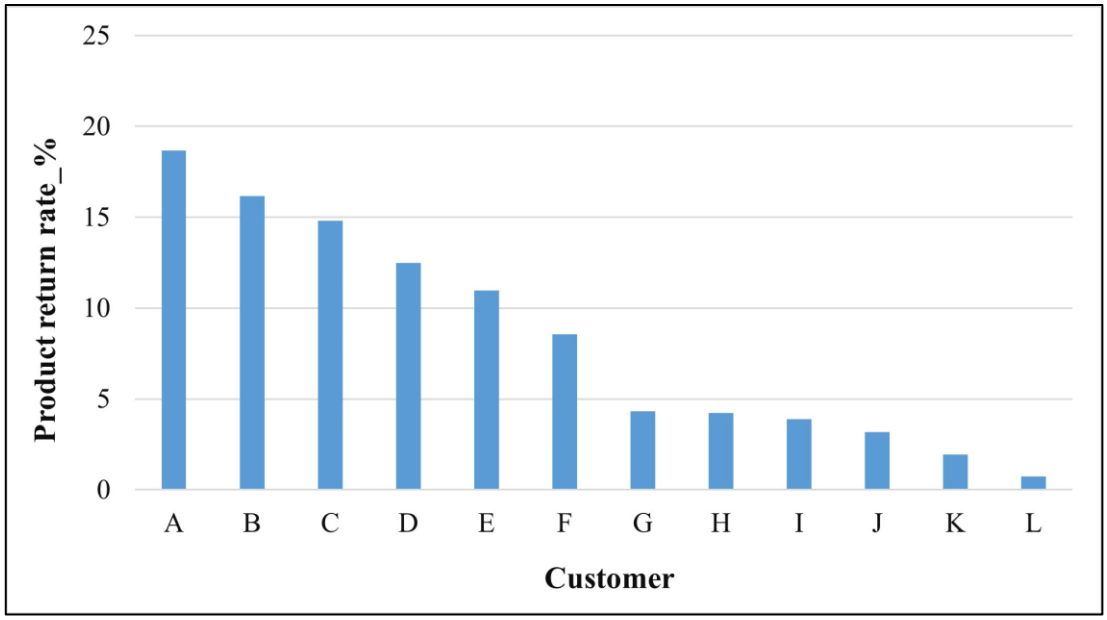

Figure 4. The rates of the product returns from corporate customers

3.3. The "analyze" phase

The reasons for the product returns, which were first recorded at the beginning of the present study, were analyzed when the number of product returns reached a particular quantity. Figure 5 shows the reasons for the returns based on the product return rates. It was observed that the reason for the return of approximately half

of the products by corporate customers was lower/higher quality expectations. In other words, the results indicated that a major problem was sending a lower-quality product when the customer expected a higher-quality product or vice versa. Further investigations revealed that some customers did not specify the brand information during the order, so the staff who prepared the order sent any brand to the customer for a particular product. While some customers disregarded this, it was understood that some others either found the product to be of poorer quality or higher quality than they desired and returned it.

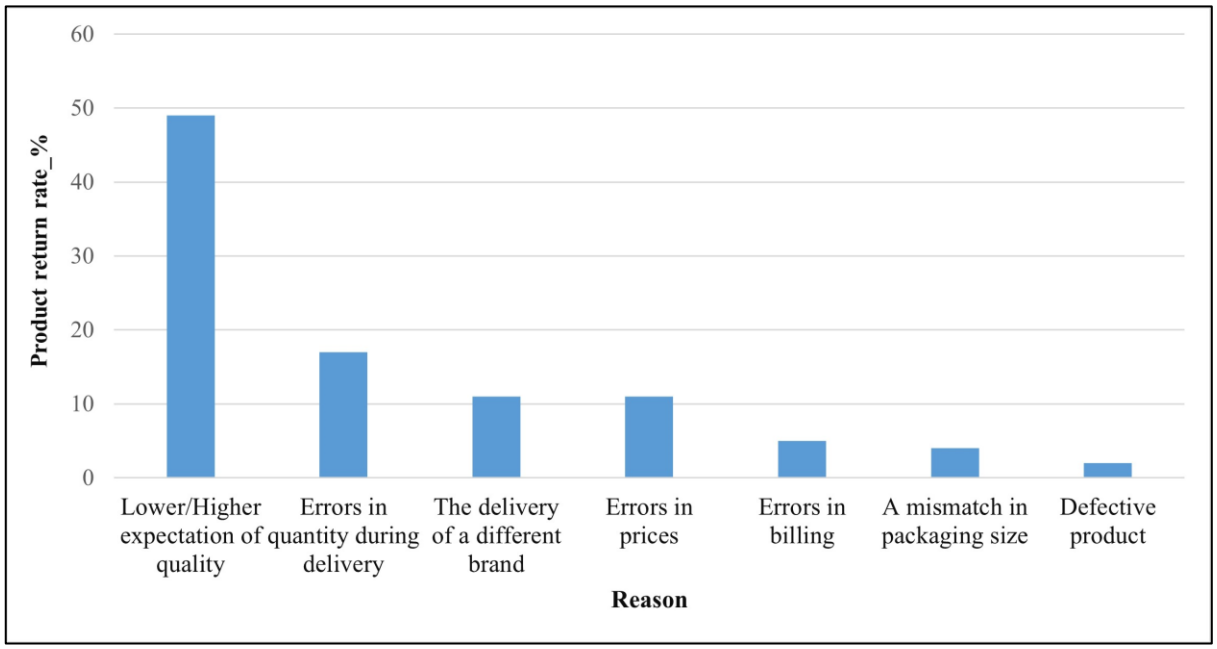

Figure 5. The reasons for product returns by the rates of the total price of the returned orders

In the rest of the study, the reasons for the product returns were associated with the potential root causes suggested during the brainstorming session. The results are presented in Table 2. The rates of product returns caused by each root cause are provided in Figure 6. According to the results in Figure 6, it is seen that the root causes most deeply affecting the product returns from corporate customers were “the staff in charge of taking orders are not sufficiently trained (Number 4)" and "the lack of an order form (Number 1)".

Table 2. The reasons for the product returns and the root causes

The reasons for the product returns	Root causes
Lower/higher expectations of quality	1, 4
Errors in quantity during delivery	2, 4, 9
The delivery of a different brand	1, 2, 4, 9
Errors in prices	3
Errors in billing	2, 3
A mismatch in packaging size	1, 2, 4
Defective product	5, 6, 7, 8, 9

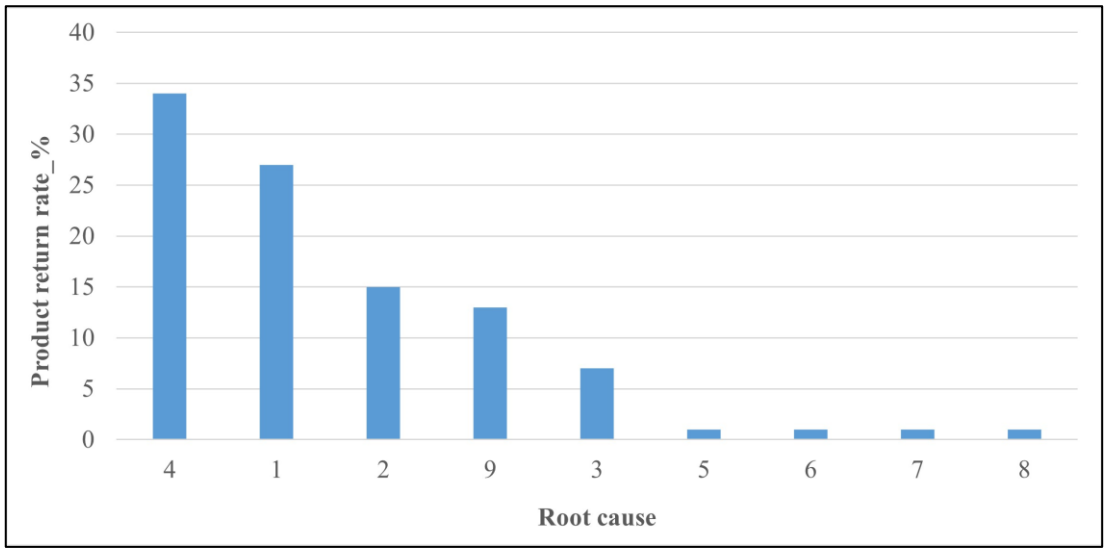

Figure 6. The total rates of product returns caused by root causes

3.4. The "improve" phase

The results of the analysis were examined by the study team, and improvement actions were taken to reduce the product returns from corporate customers. The planned actions are presented in Table 3.

Table 3. Actions for improvement

Root causes	Actions for improvement
1	Preparing order forms and writing instructions for their use
2	Planning the ordering processes
3, 4, 7, 8, 9	Making training plans
5	Making a layout plan for the warehouse
6	Planning the distribution of orders (the selection of suitable vehicles)

In the supermarket where the study was conducted, the lack of a regularly used order form was one of the root causes that most seriously increased the product returns from corporate customers. A sample order form is presented in Figure 7. The order form should contain all kinds of distinguishing information so as not to cause any confusion while taking and delivering the orders. However, only preparing the form is not enough. The task of filling out the form must be added to the standard work instructions.

The supermarket sector is one of the sectors where the staffing turnover rate is relatively high. Although the work hardly requires many qualifications, it is necessary to have and implement standard training plans. As the results of the study and the identified root causes indicated, the employees, who take orders, issue invoices, deal with delivery processes and manage purchases, were not adequately trained. Therefore, newly employed staff must be provided with adequate training. In order to obtain the expected benefit from the training efforts, there should be no untrained personnel, training should be offered regularly, and additional trainings should be given at certain periods. In order to achieve all these, it is necessary to employ a training officer.

It is known that there is often no planning regarding the ordering processes in the supermarket, and orders can be taken at any time. The supermarket, where the study was carried out, is very busy, particularly at weekends,

so this may have caused the staff in charge of the orders to confuse the orders. Therefore, planning was made regarding the order and delivery processes for corporate customers:

- Orders can be delivered after 12:00 o'clock, three days a week; that is, on Monday, Wednesday, and Friday.
- The orders to be delivered on a particular day must be notified to the supermarket by 11:00 on that day at the latest; otherwise, the customer must wait for the next delivery day.
- If there are urgent orders for the weekend, the urgent delivery team can deliver orders of a maximum of 50 kilograms or 50 liters. Otherwise, the customers must come and buy the products themselves.

It is not easy to direct customers in this way in the supermarket. However, it may be possible to introduce some sales strategies into the desired work plan, such as special discounts and gifts. If the customer is satisfied with additional benefits, he/she will get used to the system in a short time.

Order Form				
Date				
Customer				
Product name	**Requested brand**	**Quantity**	**Unit**	**Volume/Weight per unit**
Address of customer			**Person in charge**	
Contact person			**Signature**	
Contact's phone				

Figure 7. A sample order form

3.5. The "control" phase

At the outset of the study, a system was established to keep track of the reasons for product returns. With the implementation of the improvement actions, a monitoring plan was created to keep track of the reasons for the product returns, the return rates and the sustainability of the actions. As can be seen in Table 4, it is recommended that four items be regularly prepared by the corporate sales department and reported to the supermarket managers.

Table 4. The monitoring plan

The item to be monitored	**The frequency of monitoring**
The returns by reasons	Monthly
Product-based returns	Monthly
Product group-based returns	Monthly
Customer-based returns	Weekly

After the improvements were made, there was a significant decrease in the product return rate. As seen in Figure 8, the product return rate, which had increased to 29% before the study, followed a downward trend during the study. The product return rate decreased to 10% at the end of approximately 4 months. After the improved system was in place, it was observed that the product return rate decreased to approximately 4%. According to the 2-Proportions test, the p value was 0.000. In other words, the decrease in the product return rate is also statistically significant.

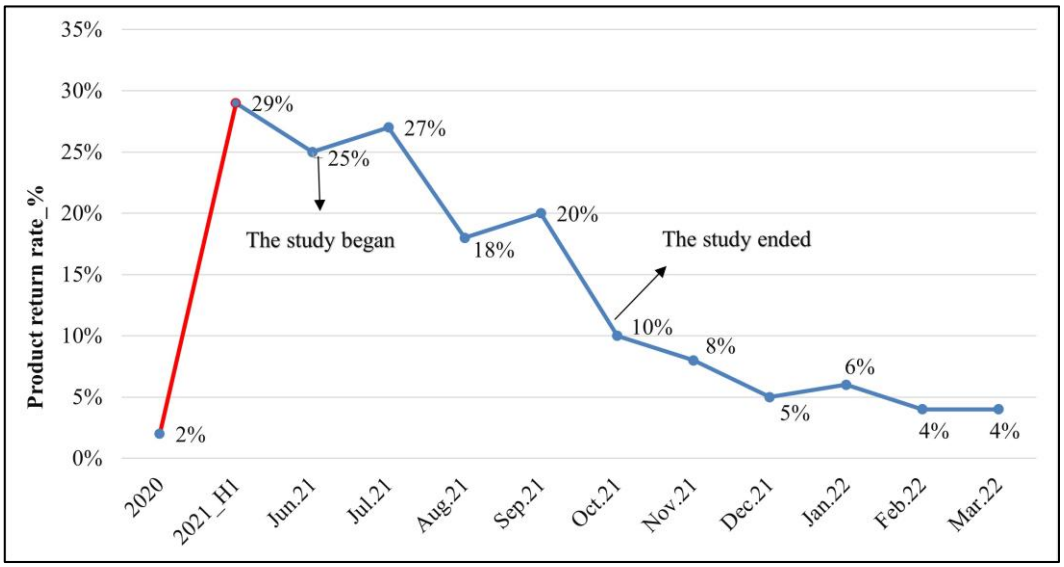

Figure 8. The rate of product returns before and after the study

4. Conclusion

This study was carried out to reduce product returns from corporate supermarket customers by using the Six Sigma method. The results indicated that the two root causes that affected the returns from corporate customers deeply were the insufficient training of the staff taking the orders and the lack of an order form. These two root causes accounted for 61% of the total product returns. Some actions for improvement were suggested to the supermarket managers, and they were put into practice. Thus, the product return rate fell to 10% at the end of the study.

The results obtained in this study could be considered as a notable example for the whole retail sector, particularly for supermarkets. For instance, Arya and Jain (2014) shortened transaction times and achieved significant profits by applying Kaizen in a small business without incurring large expenditures. In this study, the product return rate, which causes customer dissatisfaction and negatively affects costs, was reduced to 4% without making any investments. The economic loss caused by product returns to the supermarket has easy and difficult parts to calculate. The amount of the returned product is a turnover loss and can be easily calculated. There may be products that are damaged during transportation and become waste. These can also be calculated if followed well. However, it is not easy to calculate the cost of situations such as loss of time in terms of labor, transportation costs, and customer loss. With the improvements made, product returns in this study were reduced by an average of 850 USD/month. Six Sigma studies are commonly known to be challenging and costly to carry out, especially for small and medium-sized enterprises in the service and production sectors with limited resources. The results could encourage such businesses to use Six Sigma and other scientific methods.

Tjahjono et al. (2010) noted that although Six Sigma is quite well known in large organizations, its applications in the service sector and small organizations need to be further investigated. Future researchers can address such issues as the planning of warehouse layout and order distribution, regarding the inability to track the product in the warehouse and the size of the distribution vehicle, which were among the root causes with limited impact in this study. In addition, further studies can be carried out on online ordering systems.

Author contribution

Author Ayşe Çelik studied in the design, operational implementation and analysis phases and article writing phase of this study. Author İzzettin Hakan Karaçizmeli studied in the design and analysis phases of the study. He acted as a consultant to the implementation phase. He studied during the writing phase of the article and he has made the article ready for scientific review.

Declaration of ethical code

The authors of this article declare that the materials and methods used in this study do not require ethical committee approval and/or legal-specific permission.

Conflicts of interest

The authors declare that there is no conflict of interest.

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