








5S in Perfect Deliveries, on Time, Complete and Invoices in Industrial Companies, Lima

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Abstract

The objective of the study was to demonstrate that the application of the 5s improved perfect, timely, complete, and trouble-free deliveries in industrial companies, Lima. Because it was observed in five industrial companies located in Callao, Villa El Salvador, San Juan de Lurigancho and Huachipa that they had excessive customer complaints regarding the reception of their orders, they arrived incomplete, missing or did not correspond to the purchase order. This is a fact that unfortunately led to businesses being left short and unable to sell, in addition to the problem with SUNAT because they did not have the invoices in time to make tax payments. That is why it was decided with the permission of the managers and owners of the companies to apply the 5s methodology. Although, in the beginning, there was distrust, after the implementation and change of attitude of the employees, it was possible to have more significant support. The intervention was carried out in May, June, and July, where in the first stage it was explained about the new methodology, then the warehouse and the picking area had to be ordered with the workers themselves, where it was possible to discard approximately two tons of waste. Also, the lighting increased, as well as ventilation. Then the staff was instructed daily before the workday, and at the end of the day, everyone supported leaving the space for the next day clean and tidy. Then, in October, November, and December, we proceeded to measure the KPIs in the post-test phase; we must specify that the talks were conducted inter daily. Consequently, the results showed drastic improvements in the four KPIs, and then with the Student T-test, the calculated value of the level of significance was found to be 0.000, less than 0.05, which is why the null hypothesis was rejected. It was shown that Indeed, the application of the 5s improved perfect,

timely, complete deliveries and trouble-free invoices in industrial companies, Lima.

Keywords

Deliveries, KPI, Invoices, Picking, Industry

1. Introduction

Companies every day improve their processes and customer service time, with the aim of not losing the won market, but at the same time attracting new customers through the image of the brand. However, companies have acute problems in the distribution of products, according to the report of McKinsey & Company in Mexico, it is because of the traffic that exists in the cities, that makes time increase and the product arrives at the destination late [1]. In the United States, companies have problems due to the shortage of warehouses, which is why orders are not dispatched on time, because space is not enough, but also location [2]. In Colombia, the reality is similar to the Mexican one, even more, so its download times reach 20 hours, and the cost of the product becomes more expensive [3].

The Peruvian reality is similar to the previous ones; the stores are located at the periphery of the city of Lima, which makes transport times longer, and logical costs too, even more so that every day the traffic is chaotic, which is the reason why the products are not delivered in time, and customers continuously complain.

Five industrial companies whose factories and distribution centers are located in Callao, Villa el Salvador, San Juan de Lurigancho, and Huachipa participated in the study. The problem in common is the failure to deliver orders and, therefore, customer satisfaction. The factors that affect it are noncompliance in the preparation of the orders. The workplace is messy; the orders are mixed; the wrong location of the tables and shelves, and other elements make the delivery of the products incomplete, or it does not correspond to what is required.

For the study, different investigations were reviewed, such as Al Amin, Roy, Rahman, & Imran (2019), who also implemented the 5s to organize waste through the use of different colored cans, which is why productivity and efficiency improved [4]. Rizkya, Syahputri, Sari, & Siregar (2019), through the 5s methodology, managed to reduce the search for resources by 18.75% in addition to the optimal use of space by 11.20% [5]. Jiménez, Romero, Fernández, Espinosa, & Domínguez (2019) achieved the reduction of accidents because the materials and resources were returned to their initial location and did not hinder the traffic [6]. Zubia, Brito, & Fereiro (2018) and Hernández, Camargo, & Martínez (2015) achieved cost reduction, improved human relationships, and therefore the employee's satisfaction, demonstrating that the 5s methodology proves to be

useful both internally and externally [7] [8].

Loayza (2019) achieved a higher turnover of inventories, the transfer and movement of the collaborator in the plant were reduced by 20%, it took better advantage of the spaces by 50%, the image before the clients improved and the efficiency increased by 40% [9]. De la Cruz (2018) showed that with the application of the 5s, the meter offices are improved, and he demonstrated it with the test of the hypothesis with the Student T-test, $p = 0.000$ [10].

The study is based on scientific administration, whose objective is to improve production methods and achieve the goals of the organization [11]. Also critical is the classical theory, whose objective is efficiency and positive relationship between dependent areas [12]. Likewise, the theory of restrictions and systems was considered, because weaknesses or weaknesses in the friction must be overcome, so that the processes flow, the system does not stop, and the planned goals are achieved [13] [14].

Consequently, the measurement of the results will be carried out through the KPIs, which are numerical relationships used in the business field, not only to measure, but also to compare the situation, and of course, it is immediately corrected in the process [14].

The 5s methodology is born in the Toyota company [8], it is considered a philosophy whose *raison d'être* is to create and organize the work center accurately, in such a way that the efficiency and productivity of organizations is achieved, and therefore the best employee performance, which will also be reflected in the organizational climate and job satisfaction. It is also based on a clean and ergonomic environment. In summary, it is a practical and powerful methodology based on the attitude of the collaborators, which achieves fantastic results for the organization. However, to maintain it requires audits and periodic feedback processes; otherwise, it will fail [15] [16] [17]. The assumptions are based on the selection, systematization, cleaning, standardization, implication and maintenance, self-discipline. The 5s are constituted by 1) Seiri, order-centered activity; 2) seiton, classification, space for each article or element; 3) seiso, cleanliness, maintain the workplace as found; 4) seiketsu, rules, and maintenance of quality and time standards; 5) shitsuke, monitoring, evaluation and continuous improvement of processes [9] [16] [17].

Consequently, the management of the warehouses has as one of its objectives the delivery of the products in the planned time to achieve customer satisfaction, which is why there must be harmony between the supply and distribution [18]. Some frequent errors are the loss of products, repeated circuits, and lack of use of labor [19]. Customer satisfaction depends on the logistics area, correctly picking. Otherwise, you will have to address the problems of returns and claims for the delivery of missing or those that do not correspond to what is called reverse logistics [19]. The study is theoretically justified because it is based on administrative and engineering theories. Also, the implementation and results will be necessary for the companies under study, as well as for future studies, which is why experimental research was conducted in 8 months, and the results were

encouraging.

2. Method

The research was based on the positivist paradigm, quantitative approach, for which five companies participated, the implementation of the 5s methodology was carried out in three months, where the staff was trained, and daily reinforcements were carried out, as well as corrective measures, in such a way that they acquire a new form of work [20].

The approach was quantitative; the measurement of the variable both in the pre and in the post-test was performed with the support of the numbers. Also, it was statistically inferred, in addition to the hypothesis test [21].

The type was applied, because the 5s methodology and the existing KPIs were implemented, to improve a problematic situation, which is the rationale for scientific research.

The design was experimental, specifically pre-experimental, so the five companies were considered as the experimental group, and the data for the first three months: May, June, and July were considered as the pre-test. While the data or KPIs of the October, November, and December, in order to compare the results and demonstrate that the application of the 5s improves customer satisfaction rates, as shown in **Figure 1** [22] [23].

Consequently, customer service was measured with the following:

- 1) KPI1 Perfect deliveries refer to the delivery of the products as requested by the customer, $EP = (\text{Perfect delivered orders})/(\text{Total orders delivered})$;
- 2) KPI 2 Deliveries on time, delivery of orders in the promised time, $ET = (\text{Orders delivered on time})/(\text{Total orders delivered})$;
- 3) KPI 3 Complete deliveries: delivery of orders as requested in quantities, $EC = (\text{No. orders delivered complete})/(\text{Total shipments required})$;
- 4) KPI 4 Invoices without problems, an agreement between the requested, delivered and registered, $FS = (\text{Invoices without errors})/(\text{Total invoices})$.

The data were analyzed with the support of descriptive and inferential statistics with the T student test because the data presented normal distribution according to the Shapiro Wilk test.

3. Experiment and Results

After the application of the 5s to improve the customer service measured according to the ratios or KPIs indicated above, it is observed that the average for perfect deliveries increased by 36.74%, on-time deliveries by 17.64%, full deliveries

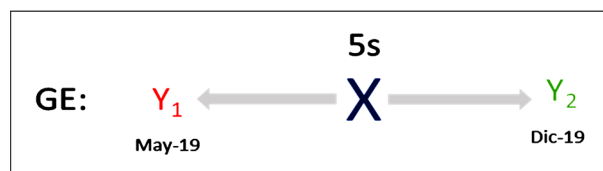


Figure 1. Research design.

9.31% and Invoices without problems 30.64%. On the other hand, the standard deviation decreased in all KPIs, which shows that the behaviors of the workers were homogeneous, which is why the results were stable, as shown in **Table 1**.

Figure 2 compares the results of KPI 1: Perfect deliveries, when comparing

Table 1. Descriptive statistics of KPIs in the pre and post-test.

	Test	N	Media	Standard deviation
KPI_1	Pre	15	45.2220	3.89316
	Pos	15	81.9620	10.55148
KPI_2	Pre	15	49.4804	15.38577
	Pos	15	67.1168	14.24391
KPI_3	Pre	15	24.2599	2.11109
	Pos	15	33.5663	1.79953
KPI_4	Pre	15	17.4859	2.58725
	Pos	15	48.1225	16.78323

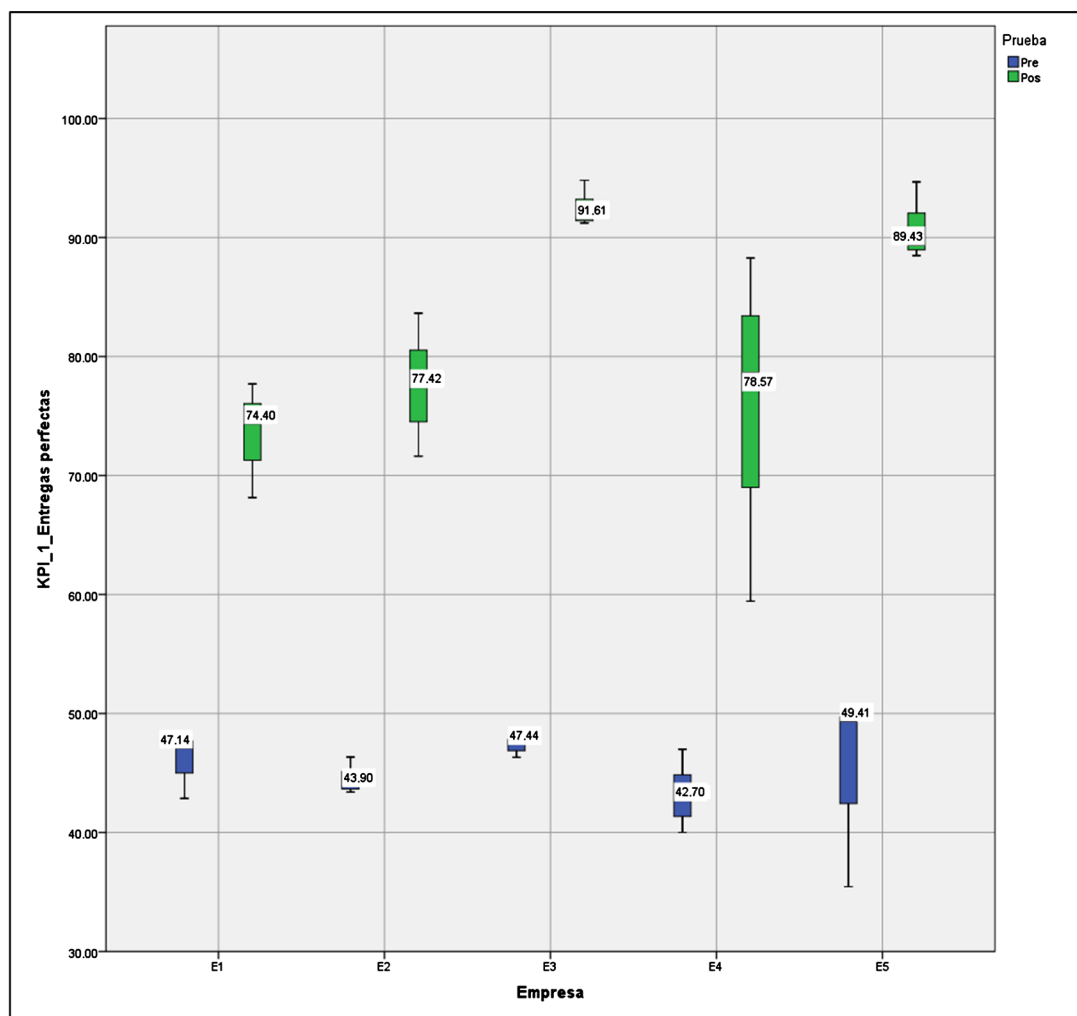


Figure 2. Comparison between the KPIs pre and post-test perfect deliveries.

the median in the five companies, drastic modification is observed in company 3 and 5, where the value of 47.77% to 91.61% and 49.41% to 89.46% respectively were modified., the average was 42%. While in company 4, there was a modification from 42.70% to 78.57%, but the data were more dispersed, which meant an increase of 35.87%. In addition, in the case of companies 1 and 2, there were modifications, managing to improve the KPIs from 47.14% to 74.40% and from 43.90% to 77.42% respectively, which on average, was 30.39%.

Figure 3 compares the results of KPI 1: Deliveries on time, observing that in the case of companies 3, 4 and 5 there were drastic improvements, so that the median increase from 56.41% to 67.57%, from 42.17% to 62.50% and from 20.24% to 66.67% respectively, on average the increase was 23.14%. In company 2, it increased from 58.10% to 61.29%, which meant an increase of 3.19%. However, in company one, the expected goal was not achieved, because, on the contrary, the result decreased from 69.41% to 57.78%. When analyzing one of the factors is that there is a lot of staff turnover, basically due to the remoteness of the company, and there is not ease of mobility.

Figure 4 compares the results of KPI complete deliveries, where there are drastic changes in the five companies. The average of the median increased by

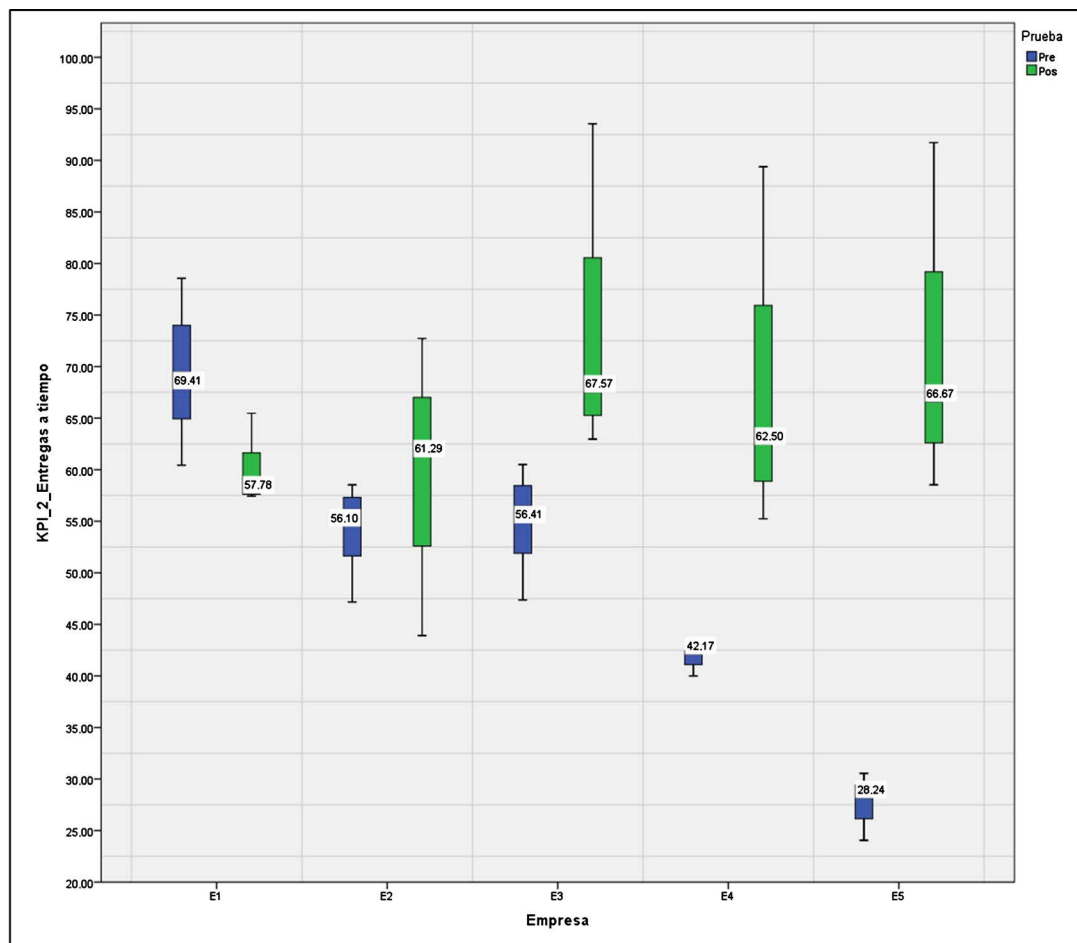


Figure 3. Comparison between the pre and post-test of the KPIs Deliveries on time.

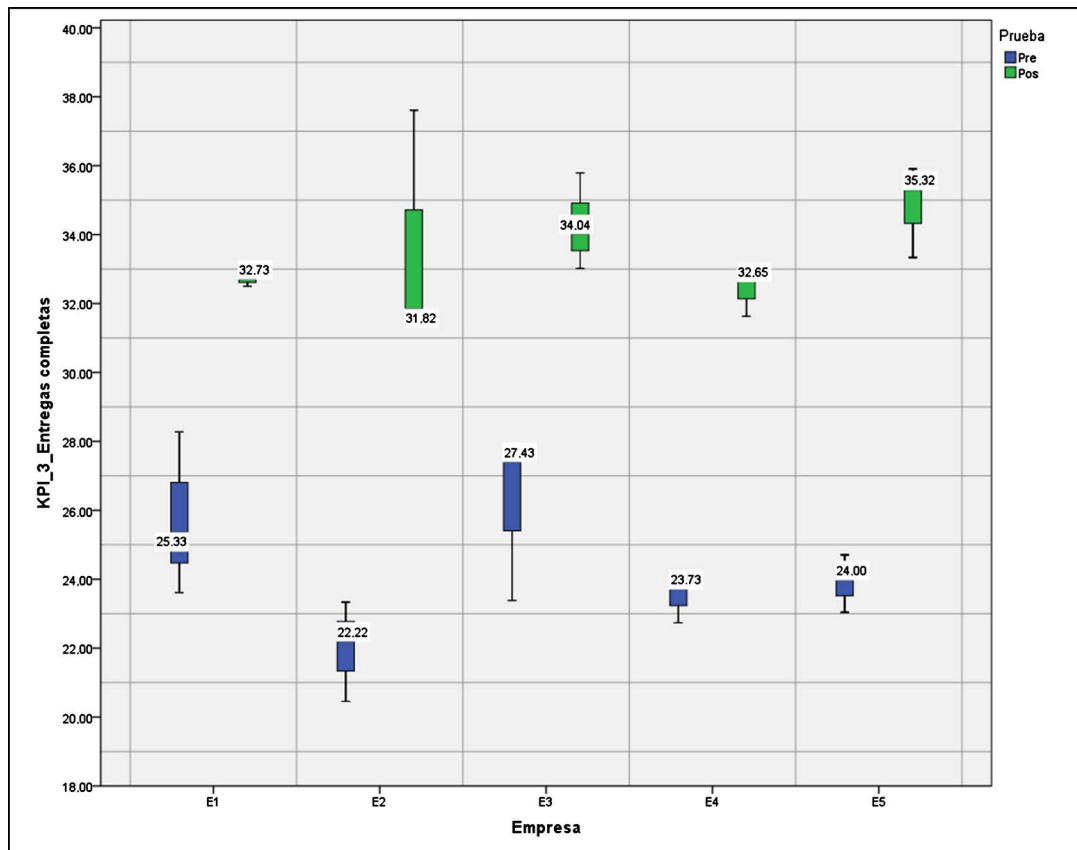


Figure 4. Comparison between the KPIs pre and post-test complete deliveries.

8.77%, with the best results being company 2, 4, and 5.

Figure 5 shows the results of the KPI Invoices without problems, where the five companies improved their results. Therefore it shows that SUNAT was taxed according to sales, no cancellations were made, and customers also reduced the tax problem. In the case of the company 1, 2, 3 and 4, the results improved on average concerning the median by 23.92%, while the company 5 increased by 38.14%.

Table 2 shows the results of the Shapiro Wilk test ($n < 30$), where the values of the level of significance exceeded 0.05, therefore, it is accepted that the data have a normal distribution in the pre and the post-test. This situation led to the application of the parametric T student test.

The hypotheses raised were:

H_1 : The application of the 5s will improve perfect deliveries in industrial companies, Lima.

H_0 : The application of the 5s will not improve perfect deliveries in industrial companies, Lima.

H_2 : The application of the 5s will improve deliveries on time in industrial companies, Lima.

H_0 : The application of the 5s will not improve deliveries on time in industrial companies, Lima.

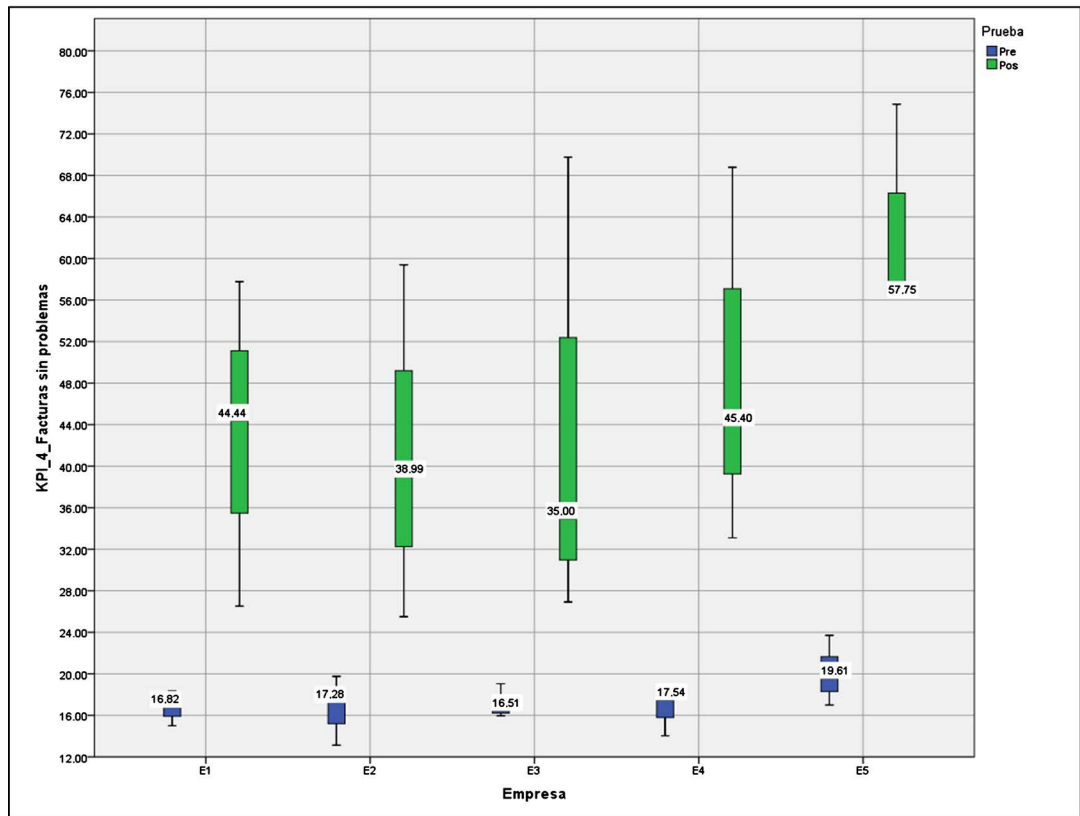


Figure 5. Comparison between the pre and post-test of the KPIs Invoices without problems.

Table 2. Normality test applied to KPIs with the Shapiro Wilk test.

KPI	Test	Shapiro-Wilk		
		Statistical	gl	Sig.
KPI_1	Pre	0.960	15	0.694
	Pos	0.946	15	0.462
KPI_2	Pre	0.971	15	0.868
	Pos	0.986	15	0.994
KPI_3	Pre	0.904	15	0.108
	Pos	0.933	15	0.298
KPI_4	Pre	0.974	15	0.911
	Pos	0.888	15	0.062
KPI_5	Pre	0.932	15	0.291
	Pos	0.886	15	0.058
KPI_6	Pre	0.963	15	0.745
	Pos	0.925	15	0.231

H_3 : The application of the 5s will improve complete deliveries in industrial companies, Lima.

H_0 : The application of the 5s will not improve complete deliveries in industrial

companies, Lima.

H_4 : The application of the 5s will improve the delivery of invoices without problems in industrial companies, Lima.

H_0 : The application of the 5s will not improve the delivery of invoices without problems in industrial companies, Lima.

After the data collection and the application of the T student test, it was shown that they have equal variances. In the case of KPI 1, the T value was -12.652 , gl. 28 and $p = 0.000$; for KPI 2 the T value was -3.258 , gl. 28 and $p = 0.000$; The KPI 3 T value was -12.993 , gl. 28 and $p = 0.000$; KPI 4 the T value was -6.987 , gl. 28 and $p = 0.000$.

It has been shown that the null hypothesis was rejected, and it was shown that the application: The 5s improved the perfect, timely, complete deliveries and invoices without problems in Lima. The results harmonize with Al Amin, Roy, Rahman, & Imran (2019), Loayza (2019) and De la Cruz (2018) because it also improved productivity and efficiency, also coincides with Rizkya, Syahputri, Sari, & Siregar (2019) and Jiménez, Romero, Fernández, Espinosa, & Domínguez (2019) given that resources improved in order and time was not wasted in their search. It is also harmonized concerning the improvement of human relationships and employee satisfaction with Zubia, Brito, & Fereiro (2018) and Hernández, Camargo, & Martínez (2015). Consequently, this work contributes to business management and invites researchers to implement this methodology to improve their productivity and effectiveness indices, which is beneficial for shareholders and collaborators, not only in the company but also in life daily.

4. Conclusions

The methodology of the 5s helped drastically in improving the company's results regarding the delivery of perfect, timely, complete, and trouble-free orders as demonstrated statistically with the T student test. The 5s methodology implied the change of attitude of the workers; of course at the beginning it was complicated in each of them because the workers were in their comfort zone and preferred to continue working in the same way, although they complained that things were not in place and wasting time. However, as the days progressed, they gradually accepted and became involved, such as cleaning their workspace at the end of the day, if any tool was out of place, on their initiative they returned it to their place, even though they did not use it, they verified the orders before sending them. When they returned the truck, they asked if it was delivered on time. This situation improved not only the numerical results but also the working environment improved, there was more exceptional communication between the staff, and they stated that at home, they were also making their attempts to implement them. The 5s methodology is applicable to different companies and areas, it is cheap in its application, but it requires much effort from who directs it, in addition to being empathic, because authoritarianism does not work in this case.

The research having been carried out under a pre-experimental design in five companies allowing the application of the 5s methodology in eight months; in this sense, there is the existence of different cultures, climate, and staff performance, among others. Unfortunately, its acceptance was not rapid. However, with the proactivity and tenacity of the researchers, it was possible to obtain positive and encouraging results. We also consider that in order for the intervention to be sustained, this methodology should continue to be applied in the companies for three years, so that the workers incorporate said guidelines in your daily work. Therefore, this work turns out to be important because, despite the years, the 5s methodology is still in force, it is also cheap, its objective lies in the change of attitude for the achievement of the organizational objectives.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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