

Implementation of the 5'S methodology in SMEs during the process of the TSU Industrial Processes Stages of the UTNA

Implementación de la metodología 5'S en pymes durante el proceso de Estadias de TSU Procesos Industriales de la UTNA

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Abstract

The present study is a demonstration of the application of the 5'S in the stays of students of the career of Industrial Processes, Manufacturing and automotive area. Its purpose is to present the most important points in the application of 5'S in SMEs in the region. The 5'S is a Japanese methodology composed of 5 stages: Select, Order, Clean, Standardize and Discipline. The application of the 5'S in SMEs allows for cleaner, more orderly, standardized workspaces and thus to be able to do work faster in the organization. This methodology allows the auditors of 5 to be able to have goals on the increase in problems found in each audit.

5'S, UTNA, SMEs, Productivity, Standardization

Resumen

El presente estudio es una demostración de la aplicación de las 5'S en las estadias de estudiantes de la carrera de Procesos Industriales área Manufactura y automotriz. Tiene como fin presentar los puntos más importantes en la aplicación de 5'S en pymes de la región. Las 5'S es una metodología Japonesa compuesta de 5 etapas: Seleccionar, Ordenar, Limpieza, Estandarización y Disciplina. La aplicación de las 5'S en las pymes permite tener espacios de trabajo más limpios, ordenados, estandarizados y con ello poder hacer el trabajo más rápido en la organización. Esta metodología permite a los auditores de 5's poder tener metas sobre el incremento de issues resultados en cada auditoria.

5'S, UTNA, Pymes, Productividad, Estandarización

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Introduction

This research is a demonstration of the application of the 5'S in SMEs in the region of Northern Aguascalientes.

It aims to present the methodology that has been followed and has improved the application of 5'S in SMEs that students of the Universidad Tecnológica del Norte de Aguascalientes during the last 6 years of the TSU Industrial Processes, Manufacturing and Automotive area.

This methodology has been applied in a number of 10 internships in charge of the MIP. Rosa Inés Vázquez Gutiérrez, full-time lecturer at this university.

The benefits of the application of this methodology have been reflected in the SMEs by increasing order, cleanliness and productivity that goes hand in hand with having a work area where the 5'S methodology is applied.

Raising awareness of the importance of the application of the 5'S methodology has been a fundamental step for the students who have completed their TSU studies in these SMEs.

1. Methodology

The methodology that was carried out was applied research, based on the application of the 5'S in stays of TSU students studying the career of industrial processes in the manufacturing and automotive areas.

2. Sampling

The following shows the students who have implemented 5's and the corresponding SMEs in the stages from 2016 to 2022. The following is taken as demonstrative evidence of the stay of the student DIAZ AVALOS, Mara Alondra.

Stay in the SME	Student	Year
Tektros	Carlos David Esparza Noyola	2022
Diaz Workshops	Mara Alondra Díaz Avalos	2021
Maquinados Durfor	Mauricio Palomar Aguilera	2021
Sale of construction materials "la alameda".	Rogelio Abdel Lara Lazarin	2021
Macro Company	Jaqueline Velazquez Cruz	2020
Lácteos Ticoy S.A. de C.V.	Daniela Montserrat Calzada Esparza	2019
Rhen Engineering and Design	Isaac de Jesús Mendoza Medina	2018
Sacrosa Triturados de Aguascalientes	Ana Rosa Gutierrez Hernandez	2017
San Jacinto Group	Mireya Basurto Mauricio	2017
El Arriero de Aguascalientes S.A de C.V.	Fernando González Quezada	2016

Table 1 Students who were in internships

Note: In each of the internships, more engineering tools are applied in addition to 5'S

Background

The 5'S methodology is a method created in Japan as a model of industrial productivity that has spread in the last decades its application in western enterprises.

Japanese name	Meaning
Seiri	Selection or sorting
Seiton	Order
Seiso	Cleanliness
Seiketsu	Standardisation
Shitsuke	Discipline

Table 2 5'S and its meaning

The 5'S aims to improve and maintain the working area in order, cleanliness and tidiness. The main point is to improve the working conditions in terms of safety, staff motivation and consequently to improve productivity, quality and competitiveness.

Symptoms to apply the 5'S

Some of the symptoms that show the need for the application of the 5'S in a company are:

- Clutter in the aisles, loose cables, piled up tools.
- Shelves full of unidentified items.

- Dirt in offices and workshops, such as leaks, blockages, objects in disarray.
- Faulty equipment.
- Disinterest of staff in their work area.
- Unidentified spare parts and materials.
- Common areas dirty and in disarray.
- Too much inventory.
- Among others.

Definition of each S.

1 S Seiri -Sorting or classification

Mainly refers to accumulating various things, i.e. having excess materials, machines, products, papers, books, etc.; things that can be used at another time but will probably never be used. When you have this surplus, problems are mainly caused by lack of space for what is needed, loss of time in locating what is needed, safety risks, accidents, stress and frustration in the staff.

Seiri means to identify, classify and separate the necessary items from the unnecessary ones, and to remove the latter from the work area, as they are not required for work.

Rules for the application of Seiri

1. Separate the necessary items from the unnecessary ones in your workplace.
2. Dispose of unnecessary items.
3. From what is necessary you should separate: what is infrequently used; and dispose of: what is deteriorated; what is obsolete; what you have in excess.

Use of red card

The red card is used to indicate items that are not needed in the area.

Figure 1 Red card

2. S Seiton –Select or Sorting

After removing the items that are not needed, the next step is to organize the items classified as needed so that they stay in the most suitable location. Sorting, consists of establishing the way in which the articles, materials and machinery that are necessary should be located and identified.

This allows its use, identification, as well as its return to be facilitated, since the most important thing in the application of these S is that the articles remain in the place that was assigned. By having a correct location, the phrase "a place for everything and everything in its place" is fulfilled.

Seiton Application Rules

1. Assign a place for everything. Arrange according to order of use.

2. Determine the exact amount of items you need (avoid excesses), make sure that your container or area is adequate for this amount.
3. Make sure that each item is ready to be used. And create the means to ensure that it returns to its place.

3. S Six-Cleaning

The third S refers to taking the necessary actions to leave the areas in optimal conditions of use, eliminating the sources of dirt and contamination, making sure that everything is always in a perfect state of use.

Seiso means removing dust and dirt from all the elements of a factory or an office, when this is not done, you can end up having:

- Bad image of areas and people.
- Items that are dirty and/or difficult to clean.
- Constant cleaning events because it is not maintained.
- Bad indicators of efficiency, quality and, above all, safety.
- Failures in equipment and tools.

Seiso Application Rules

1. Ensure that the necessary cleaning supplies are available. These must have a place and be ordered and aligned (cans, brooms, mops, cleaning material).
2. If the process generates garbage, you must place a container for it to be deposited there.
3. Keep the areas clean, the garbage must be in the cans and NOT on the floor. (if I drop something, I pick it up, I don't leave it on the floor).

4. S Seiketsu-Standardize

In order to achieve the expected order and cleanliness, operations must be visually standardized.

In companies it is necessary to standardize to carry out the following points:

- Sensitize staff on the best way to do tasks.
- Define visual instructions on how to carry out the tasks.

- Establish controls that detect the origin of the problems.
- Assign resources to carry out tasks.
- Being able to control what happens in the different work areas.
- Some of the visual controls carried out by companies are:
 - Place for raw material.
 - Parameters to control the process
 - Visual cleaning procedures
 - Process indicators
 - Tags
 - Etc.

Seiketsu Application Rules

1. Establish procedures, standards and regulations that must be visible in the area.
2. Perform weekly Self-Reviews
3. Carry out audits with indicators
4. S Shitsuke-discipline

This S consists of working permanently to carry out the application of the established norms, committing the staff to maintain the previous 4 S and thus improve the level of organization, order and cleanliness in the activities involved in the daily operation at work, becoming this in a habit

Shitsuke Application Rules

1. The basic rules established here must be complied with on a daily basis.



Figure 2

2. There must be a willingness to receive/perform audits according to the program.
3. The results of the audits must be published.

4. Results

Below is an example of the methodology that has been used to implement the 5'S in SMEs in the northern region of Aguascalientes during the stays of the TSU in the Industrial Processes, Manufacturing area and Automotive area careers.

4.1. Initial diagnosis stage

During the initial diagnosis, the student is asked to take photographs of all the areas that offer opportunities to apply the 5'S.

The example of the stay of the student Mara Alondra Diaz Avalos is shown.

Workshop Analysis – Initial Diagnosis

The tour of the workshop was carried out and some photographs of the different work areas were taken. With these photographs it was possible to carry out a diagnosis with the main problems found in the workshop, and with this verify why it was necessary to carry out the implementation of the 5'S methodology, the development of plant distribution, and the design of a tooling for transport.

Below is a sample workshop diagnosis.



Figure 3 messy tool

- Tool in disarray. The tool is in disarray and in places where it is difficult to find it, as well as accumulating dirt in the places where it is located.
- Objects between aisles. Some of the tools are stored in jars and these are found between the aisles where the worker carries out his activities.

- Rubbish. Accumulation of rubbish in the place where clients are received, which gives the workshop a bad image and a lack of hygiene.
- Use of red cards. Red cards were used for objects that were found, with their respective annotations such as general information, category, reason for the card, and action required.



Figure 4 Tool in disarray

5'S training stage

In order to do the 5's training, the students are asked to develop the training material which consists of the following elements:

- Power point presentation
- Triptych
- Examination

A day is chosen, and the training is given at the premises of the SME.

Evidence of the training in the mentioned stay. Tool in disarray.

4.3. 5'S training stage

In order to do the 5's training, the students are asked to develop the training material which consists of the following elements:

- Power point presentation
- Triptych
- Examination

A day is chosen, and the training is given at the premises of the SME. Evidence of the training in the mentioned stay..



Figure 5 Training and evaluation of staff

4.3. Stage Selection of the Audit Teams in the SME

At this stage, the student is asked to divide the SME into 3 areas in order to have at least 3 teams for the cross auditing, a day a week is established with a specific time where the audits will always be carried out.

Evidence of the stay.

Teams for 5'S Audits

Working teams were created, made up of the same workshop staff.

The teams created were as follows:

Team	Team members
A - Warehouse	Marina Rodriguez Velázquez Agustín Chávez
B - Production	Juan Manuel Rivera Juan Carlos Díaz
C - Administration office	Mara Díaz Avalos

Table 3 Audit teams

The evaluation will be as follows:

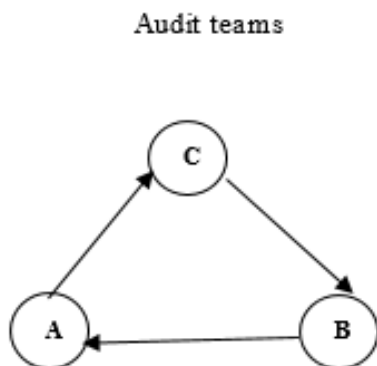


Figure 6 Audit teams

- Each team should evaluate the following:
- The working conditions are analyzed and evaluated
- Each of the concepts of the 5's for which they were previously trained are put into action.

The audits will be carried out every Friday, with a schedule from 8:00 a.m. to 5:00 p.m. to 9:00 a.m., each leader will be in charge of evaluating the other team and recording the new findings and the findings that have been resolved.

4.4. Stage presentation of findings

During this stage, a format for the presentation of findings is made, after making the findings in the format, the number of findings found is presented in a bar graph to observe weekly the progress of the application of the findings in the SME.

Evidence of stay

Presentation of findings

They will be given the format that will be used for the audits and the requested data will be filled out, this must be done by each team leader to deliver it to the appropriate person at the end.

The format will be as follows:



Diaz workshops

Presentation of findings

Team: _____

Leader's name _____

No.	Descripción de hallazgo	Fecha	Revisión

No. of findings found	Resolved findings		
	1 ^{er} Week	2 ^{da} Week	3 ^{er} Week

Auditor's signature

Figure 7 Format of findings

4.5. Audit verification stage

In this stage the learner is asked to record the percentage of compliance of the audits carried out each week. He/she is asked to carry out at least 3 audits before the end of his/her stay in the company and thus obtain the corresponding graphs.

Verification of audits

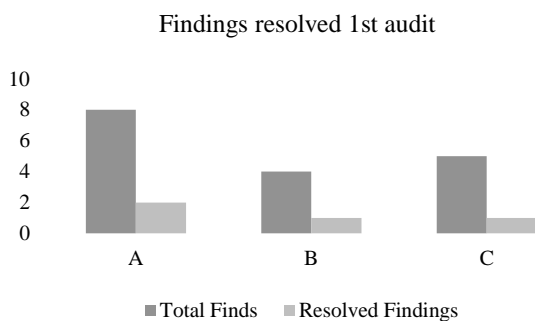
According to the formats where the record of findings was kept, graphs were made to analyse and evaluate the results obtained per week.

1st audit week

At the end of the first audit applied on July 4th, 23% of the total number of findings were solved.

Team	Total findings	Resolved findings	Percentage
A	8	2	25%
B	4	1	25%
C	5	1	20%
	Total		23.33%

Table 4 Results 1st audit



Graph 1 Findings resolved 1st audit

2nd Audit week

After concluding the second audit applied on July 11, it is possible to solve 40% of the total findings.

Team	Total findings	Resolved findings	Percentage
A	8	6	75.50
B	9	7	77.77
C	6	5	83.33
			78.70%

Table 5 Results 2 of the audit



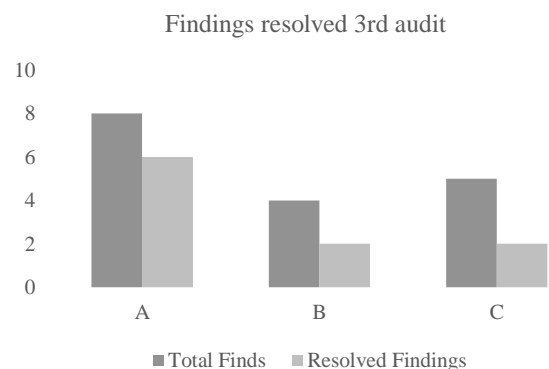
Graph 2 Resolved findings 2nd audit

3rd Audit week

Finally, at the end of the third audit on July 18, 81.66% of the total number of findings were resolved.

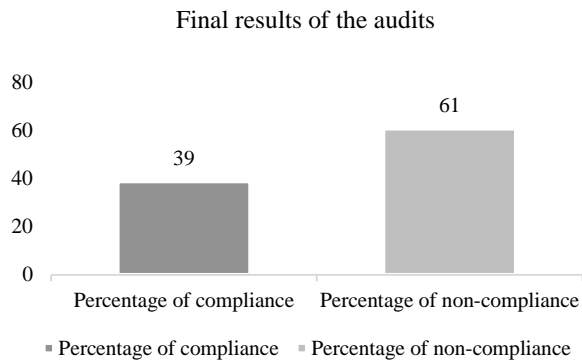
Team	Total findings	Resolved findings	Percentage
A	10	7	70%
B	7	7	100%
C	8	6	75%
			81.66%

Table 6 Results 3rd audit



Graph 3 Findings resolved 3rd audit

At the end of the implementation of the findings the overall results were:



Graph 4 Final results of the audits

4.5. Evaluation of the SME

Final evaluation of the workshop

In this stage the student evaluates the SME according to an evaluation that includes the 5'S elements.

Evidence of the stay

The final evaluation is presented after the application of the 5'S methodology, in order to verify if each of the stages of the 5'S methodology is being fulfilled.

The table of evaluations is attached so that it can eventually be applied as an evaluation of staff compliance with the 5'S methodology.

Area: Workshop					
Evaluation date: 25 July					
Score:	3 = Good				
1 = Not very good	4 = Very good				
2 = Acceptable	5 = Excellent				
Classification assessment (seiri)	Score:				
	1	2	3	4	5
What is the classification of equipment, machines, etc.?				4	
How is the raw material classified?				4	
What is the classification of tools and working instruments?					5
Overall, how would you rate the workshop?					5
Subtotal	18				

Table 7 Classification assessment

Evaluation of order or organisation (SEITON) Score:					
	1	2	3	4	5
Are the work teams correctly identified?					5
Are circulation areas free of objects?				4	
Is the location of tools and work objects signposted?					5
Subtotal	14				

Table 8 Order assessment

Evaluacion de limpieza (SEISO)	Score:				
	1	2	3	4	5
¿Cómo es la limpieza de los equipos de trabajo?				4	
¿Cómo es la limpieza de las herramientas de trabajo?				4	
¿Los materiales están limpios y etiquetados?					5
Subtotal	13				

Table 9 Evaluación de limpieza

Standardisation evaluation (SEIKETSU)	Score:				
	1	2	3	4	5
Is the work tool properly sorted?				4	
Is the rubbish deposited in its place?					5
Is the work equipment well marked out?				4	
Subtotal	13				

Table 10 Standardisation evaluation

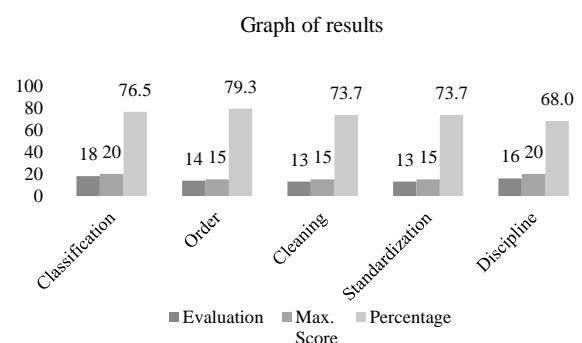
Discipline assessment (SHITSUKE)	Score:				
	1	2	3	4	5
How is compliance with tidiness?				4	
How is compliance with cleanliness?				4	
How is filing compliance?				4	
How is compliance with the use of PPE (Personal Protective Equipment)?				4	
Subtotal	16				

Table 11 Discipline Assessment

The overall results of the 5'S implementation are shown below.

5's' stage	Evaluation	Max. Score	Percentage
Classification	18	20	76.5
Order	14	15	79.3
Cleaning	13	15	73.7
Standardization	13	15	73.7
Discipline	16	20	68.0
Total	74	85	74.23

Table 12 Overall assessment



Graph 5 Overall Assessment Chart

4.6. Etapa de análisis de los resultados

At this stage the learner is asked to make a comparative table illustrated with photographs of before and after the application of the 5'S in the SME.

Evidence of the stay

The before and after of the areas where the 5'S methodology was applied is shown in a comparison table for a better appreciation of the results obtained.

Only 2 examples are presented



Figure 8 Before and after 5'S on dirty and messy tools



Figure 9 Before and after 5'S tool labelling

4.7. Stage of improvement proposals

During this stage the student is asked to make improvement proposals for the company, which the SME will have to consider in order to continue with the implementation of the 5's.

Evidence of the stay

Proposals for improvement

Take responsibility for the implementation of the 5's.

Respect the conservation standards of the workplace.

Participate in the formulation of continuous improvement plans.

Continue with the application of monthly evaluations in order to have an analysis of the workshop.

A proposal and quotation is made for the acquisition of shelves to organise the material for which there is still no destination.

The proposal is made through the free market App, as they deliver to the home and have different payment facilities, which can be convenient for the workshop owner.

Conclusions

The development of an internship in an organisation is of utmost importance so that students can carry out the generation of practical knowledge about the engineering tools seen in class and with this they can develop successful projects.

Nowadays all types of industries are governed by the culture of continuous improvement, one of them is the implementation of the 5's methodology, with this application results are obtained such as increased efficiency, control and organisation of work areas, as well as standardisation of manufacturing or administrative processes.

After carrying out the process of implementing the 5'S in the SMEs of the mentioned region, it can be concluded that the process of implementing the 5'S is an activity that helps to improve the appearance in the work areas, which allows to increase the productivity since the worker will be working in a better way. Likewise, it has been interesting to find out how to implement the 5'S in SMEs, as it has often been a challenge due to the lack of information that workers sometimes have in the companies. Finally, we can emphasize that in our system of Technological Universities it is of great importance the presence of the future professionals in the labour field, with this it can be guaranteed the application of methodologies in the labour field with the solution and proposals of improvement of some project given by the SMEs with a stay of 4 months, as the implementation of the 5'S has been.

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