The Application of 5S's Workplace Organization at an Egyptian Flexible Packaging Factory

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Abstract:

In order to utilize the 5S activities as an application of workplace organization to assist one of Egyptian flexible packaging factories in improving efficiency and maximizing actual time, the production department has been selected to implement the 5S's workplace organization to evaluate the validity of these actions. It was logical to implemented the plan of 5S's activities that thought to be agreeable with the managers to change operators' background culture of these procedures. An experimental and analytical approach has been used to organize the teamwork members for implementing 5S's activities. The cause-and-effect diagram has been analyzed for production floor analysis. Later, data collection methods have been used to ensure right implementation of the 5S's. This has been analyzed prior to the implementation of "5S", which resulted in overall improvement of the factory performance. With the implementation of "5S's", major benefits in the form of the time saving have been achieved. Time has been reduced and the change-over of job order from 120 minutes to 30 minutes. "5S's" audit score has been increased from the first time to the fourth time, which reflected in a cost cut. On the other hand, implementation of 5S activities can be considered as a parallel development case that can be achieved in all workstations in this specific factory or others to achieve continuous improvement policy.

Keywords:

Continuous improvement policy
Workplace Organization
5S activities
Cause-and-effect diagram
Standard operating procedures (SOPs).

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1- Introduction

Generally, in spite of Egyptian factories have good types of equipment, skilled workers, but most of them are suffering from irregular in the workplace organization conditions, which are giving negative results on the working efficiency and actual cost, as a result of my visiting many factories. particularly as medium and small enterprises.

Workplace organization, or the 5S's, refers to a set of sequential activities designed to improve efficiency, strengthen maintenance, and to promote continuous improvement. The sequential 5S activities are regularly as following (Chang, and Chen, 2014; Jaca, et.al. 2014); sorting, setting in order, sweeping, standardizing, sustaining, and safety. These six sequential activities are defining briefed as following;

S1 **Sorting (Organization),** The key activities in S1 comprise distributing what is required from what is not wanted, managing only whatever is demanded in the quantities required and particularly during needed and repealing useless things (Venkateswaran, et.al. 2013; Gečevska, et. al. 2015).

Sorting assists in eliminating fragmented tools, scrap and old spare parts and accessories (Jiménez, et.al. 2015). This makes item movement flowing and operators work and convey easily. Define the work areas to be evaluated and recognize the kind of items which need to be evaluated (Khanam, et. al. 2013). Documentation of the effects is the next process so as to measure the improvements and savings through the process (Honarpour, et. al. 2017).

S2 **Setting in Order** (Orderliness), The key activities in S2 include arranging needed items so they are easy to find, labeling items so the storage sites are easily understood, and implementing visual control (Chang, and Chen, 2014). In other words, a place for everything (Ramlan, et. al. 2017). It focuses on separation of things and effective storage (Harrington, 2000). Activities included in this are labeling each item, using color to the quick identification, storing similar items together, storing different items together, putting names and numbers on everything, color coding of floors and using the racks for tools and materials. Arranging items in the right place will make fixtures, tools, and other sources identifiable, obvious and simple to handle (Dudek-Burlikowska, 2006).

S3 **Sweeping** and Shining (Cleanliness), The third "S" directs the cleaning activities in the organization, include removal of dirt, grime, and dust from the workplace, and always

keeping everything swept and clean (Chang, and Chen, 2014). On the other hand, daily cleanliness has to be done to have a normal work area, which more suitable and harmless workplace is ensured when the third S is implemented (Randhawa, and Ahuja, 2017), which a clean and organized work area itself acts as a motivation factor for the operators and workers that like work in a clean and good environment which boosts up their confidence (Dudek-Burlikowska, 2006).

Teamwork members should apply the third "S" as an action to have to maintain cleanliness without being told to do so. Zone-wise responsibilities should be given to the members with some standards, which have to be followed to ensure that team members do the cleaning effectively (Lancucki, 2001).

S4 **Standardizing**, The high standard of workplace organization can be guaranteed by standardization (Peterson, 2001). Operator plays a great role in developing these standards. Every operator knows his/her responsibilities, and factory keeping duties are done in a consistent routine. Best performance practices are carried out and several methods are found out to ensure that everyone achieves their individual actions in their workplace (Dudek-Burlikowska, 2006). On the hand, standard operating procedures (SOP) are designed or required if already possible (Becker, 2001). The newly improved methods are integrated into the SOP, and they become the standard way of executing operations (Srinivasan, et.al. 2016).

S5 – **Sustaining**, The key activity for 5th S is making a practice of suitably maintaining right methods and continuously improving workplace conditions (Chang, and Chen, 2014). This activity is required in order for the organization to sustain the additions, which is considered to be substantial to achieve. Many factories do the 5S activities for months. But it converts very difficulty in sustaining the activities performed for a longer period (Randhawa, and Ahuja, 2017). Standards have to be maintained year after year in an effective manner (Dudek-Burlikowska, 2006). Counseling of the operators should be done regularly. Proper discipline should be maintained. Also, there should be a materialist and socially stimulation system in place to motivate the operators (Srinivasan, et.al. 2016).

1.1 Research Problem

According to several interviews to Egyptian flexible packaging factories, most of them are suffering from irregular working conditions, producing to waste a lot of time to search for any materials, parts or tools, which lead to reducing the performance. also fill the storehouses of materials, and spare parts, without any planning, orderliness, and cleanliness for a long time ago, causing to lose them.

1.2 Research aims

This research focuses on the possibility of work organization through executing in terms of 5S activities utilized to reduce waste of time, seek the ways of cutting costs, and sustain of performance.

1.3 Research Delimitation

To carry out the research works on one of Egyptian flexible packaging factory, which has two rotogravure printing machines, one laminating machine, six slitter machines and about fourteen operators for every work shift .

The research works are limited to execute the 5S activities on the actual production floor, by finding scientific and practical solutions to can analyze the results.

1.4 Research Methodology

This paper conducted to one of Egyptian flexible packaging factory in El-Oubour Industrial city. Data was collected through meeting's arrangement and observations situation. In the limited period time (16 weeks) to achieve this paper, there was organized a 5S's teamwork members from the same factory, who ready to implement and deliver its findings in a report to researcher which provided through one working day every week for four months for accessing the required data to can be analysed it, and setting the subsequent actions to reach the aim of this research. After each interview with the teamwork members and the executive manager, it was followed by factory tour opportunity where observations could be made which assisted in the construction of the case study.

On the other hand, structured discussions were held with the executive, production, and quality control managers along with three executive members of the 5S's teamwork. In planned meetings were chosen as a methodology as the researcher suggested to get a deeper insight and specific cases of the experiences of the 5S's teamwork during the preparation and implementing process, which the interviews were subsequently copied and sent back to the members teamwork by email for confirmation of content, and submit to achieve them.

After the factory firstly visiting, it has been found that there were many possibilities to enhance the workplace organization. There were some observations made after touring the production floor. Figure 1 shows a cause-and-effect diagram for an unorganized production floor problem, which can be summarized in the following items;

- The workplace is disorderly; materials are laying all around the area.
- Materials or tools cannot find, miss or misplace.
- No clarity of the actual process.

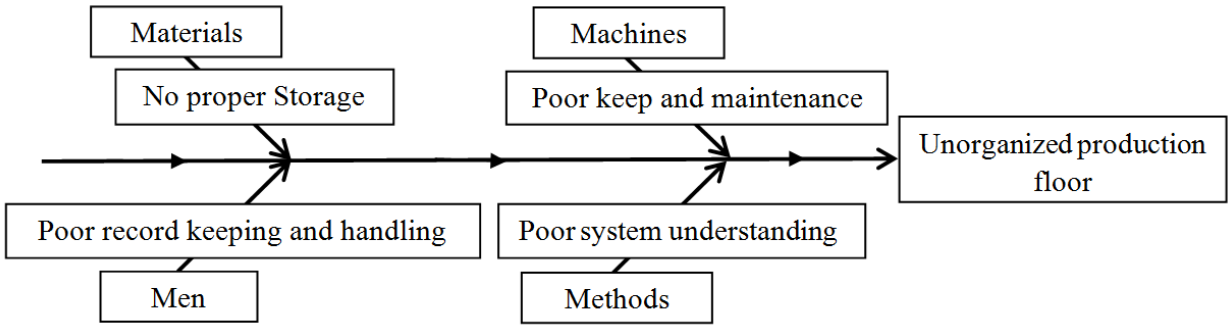


Figure 1. Cause-and-effect diagram for an unorganized workplace

The data were collected in the organization using the following methods:

- the primary observations and captured photos;
- participative marks;
- documentary evaluation; and
- systematically meetings.

To achieve the objective of this research, it was important to suggest beginning with an actual program to implement 5S demands, through design, planning, and achievement of the action changes needed to realize the desired objectives. Figure 2 shows the methodology flowchart.

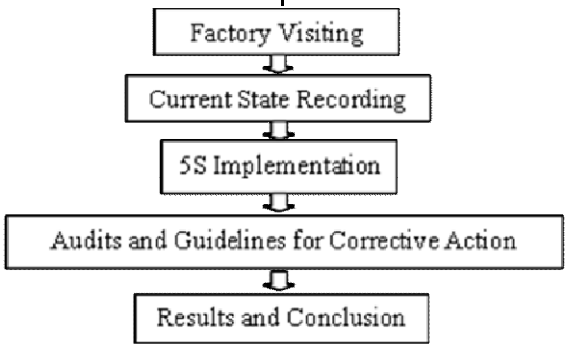


Figure 2. Methodology Flowchart

1.5 5S's implementation

In Table 1, it has identified the differences between the situation before implementation this research and after achieved it, which influenced on cost, time-saving, or both of them.

2- Results

Research on the workplace organization of the departments of production, ink laboratory, maintenance, and inventory by applying 5S's activities.

Table 1. 5S's implementation

Aspect	Before	After
Maintanenace Department		
Conditions	Unneeded spare parts, tools, inventories, materials or parts are present. Many other useless things are present. There aren't any shelves to set the	Unneeded spare parts and tools are eliminated, and many other useless items are removed. Only what they need of items were put on the shelves.

	items.	All spare parts shelves were constructed only after the start in this research.
Production Department		
Conditions	Operators were placing the tools, materials and spare parts here and there. Operators were wasting time searching for tools, gravure cylinders. Gravure cylinders were placed in a far place. Tools, gravure cylinders, and rolls of substrates are prone to damage and loss.	They have constructed the hard metal shelves, in order to place the gravure cylinders on them. These shelves were on the side of the printing machine, to ease handling and save moving time. Damage and loss of tools were prevented. Create a place to store of operational raw materials.
Flooring of Production Department		
Conditions	Without any color coding of the floor, the operators place the materials in any areas, that lead to obstruct the path and expose the semi-finished products to loss and damage.	By implementing color breaks, traffic corridors and routes are colored and are not obstructed by any barriers and also for exits.
Machine do not used		

Conditions	The erosion factors lead to rust and corrosion of the machines.	Wrap plastic around electricity dynamo leads to protect it from erosion, to can the possibility to reuse at any other time.
Gravure cylinders store		
Condition	Store the gravure cylinder in wood boxes, without any label that presented the code of job order, which need about 30 minutes to search the demand cylinders to operate with them in the current job. The gravure cylinders store was located in the third flat of the factory, which needs about 15 minutes to transfer it to printing machine place.	Place the gravure cylinders on shelves, which is considered as visuality condition. All gravure cylinders groups were coding and gathered each job order in one package, which eliminated about 30 minutes from searching it. It has constructed the shelves beside the rotogravure printing machine, resulting in reducing transfer them to about 5 minutes.

As an analysis of the results, which indicated in Table 1. By implementing the 5S's activities, and calculated time spend to obtain any tools or spare parts, also to obtain the group of gravure cylinders and raw materials. Figure 3 represents the comparison graph of time spent before and after implementing 5S's activities to search and prepare the tools or spare parts, group of gravure cylinders and raw materials.

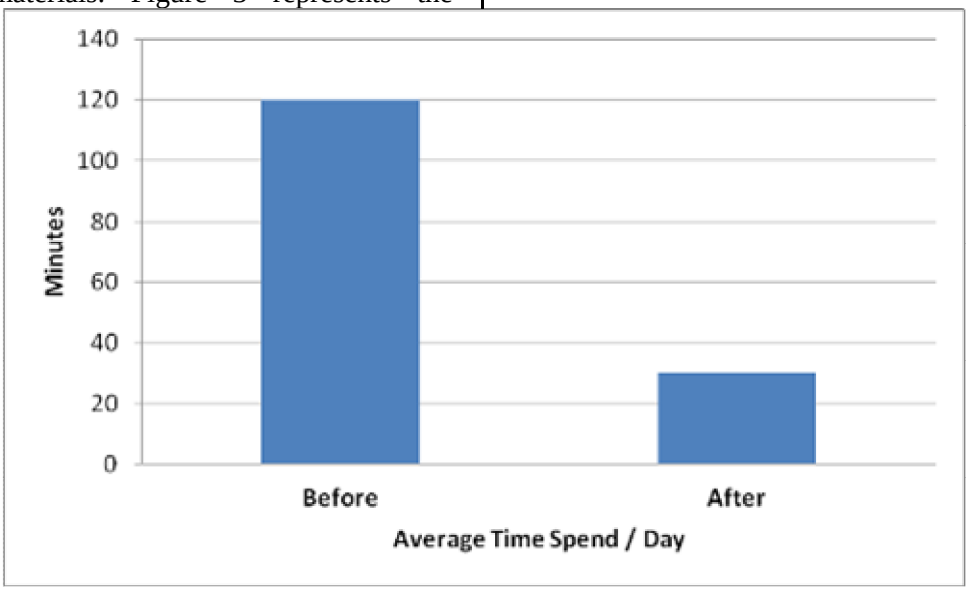


Figure 3. Time spent before and after implementing 5S's activities

2.2. Cost analysis

Average of operator pay per month	LE. 4,000 / month	Average working hours per day	8 h./day
Number working day/month	26 days/ month	Number of operators per shift	14 Operators / shift
Number of shift/ day	2 shifts	Number of operators per 2 shifts	28 operators / day
Average labor rate per minute	Average of operator pay per month / (Number working day/month x Average working hours per day x 60 minutes)		4,000/(26 x 8 x 60) = LE. 0.32
Saved minutes/day	(Time spent before implementing 5S's activities -		(120 - 30) = 90

	Time spent after implementing 5S's activities)	minutes
Total money saved/day	(Saved minutes/day x Average labor rate per minute)	90 x 0.32 = LE. 28.80
Total money saved/month	(Total money saved/day x Number working day/month)	28.80 x 26 = LE. 748.80
Average operators pay per month	(Number of operators per 2 shifts x Number working day/month)	28 x 4000 = LE. 112,000
Average operators of month saving	(Number of operators per 2 shifts x Total money saved/month)	28 x 748.8 = LE. 20,966.4
Present saving	(Average operators of month saving / Average operators pay per month) x 100	(20,966.4/112,000) x 100 = 18.72%

On the other hand, according to accounting department that was calculated the Fix cost of printing machine/hour = LE. 10,000
Consequently, when it can be saved 18.72%, i.e. save about LE. 1872 / hour.
Saved money/ 2 shifts = 16 x 1872 = LE. 29,952
Saved money / month = 26 x 29,952 = LE. 778,752
They worked for 11 monthes / year
Saved mony / year = 11 x 778,752= LE. 8,566,272

2.3. Standard operating procedures.

Standard operating procedures (SOPs) are documents which consist of instructions, steps to be followed and descriptions indicating how a task must be performed accordingly. They describe the easiest way of doing the job to achieve quality requirements as well as the safety one, without any hazard or damage. They also specify which materials and tools are necessary to do the job. Using them, the operators themselves can control the job efficiency and improve their performance. They are proved to be a very important tool to improve productivity; reduce faults and mistakes; and decrease time, energy and material wastefulness.
The printing industry relies on non-stereotypical work, meaning that every job order is a specific case of SOPs. Consequently, each job order can be considered as an individual SOPs, Table 2 is shown one example of SOPs, which designed by the researcher after conduct monitoring and analysis of production processes and have been determined after discussion with members of 5S's teamwork and after approved by the executing manager.

Table 2. Standard operating procedures (SOPs)

Date	
Job Order	
Printing	
Printing Press Code	
Gravure cylinders Code	
Width Unit	
Circumference	
Substrate Code	
Thickness of Substrate	
Width of Substrate	
Repeat of Width	
Repeat of Length	
Direction of photocell load	Internal ( ) External ( ) Both direction ( )
Color of Photocell	
Number of Colors	
Color sequence on printing press ; 1 ( ) – 2 ( ) – 3 ( ) – 4 ( ) -5 ( ) – 6 ( )	
Lamination	
Type of lamination	Sovent Based ( ) / Solventless ( )
Slitter	
Slitter machine code	
Operation Standard	
Printing	
Cycle Time	
Tension Value	
Drying Temperature; 1 ( ) – 2 ( ) – 3 ( ) – 4 ( ) -5 ( ) – 6 ( )	
Ink Viscosity; 1 ( ) – 2 ( ) – 3 ( ) – 4 ( ) -5 ( ) – 6 ( )	

Lamination	
Gumming Type	
Gum Weight/sqm.	
Cycle Time	
Operating Phases	One Time ( ) – Twice ( )
Slitter	
Core Length	
Number of Cores	
Width of Tape	
Number of Cutter Knifes	
Distance between Cutting Knifes	
Rotary Knifes	
Product Specification	
Direction Of Printing	
Direct of Wrapping	
Weight of roll	
Number of Rolls / Pallet	

Production Manager *Approved; Executive Manger*

As results to implement the SOPs in practice;
It has sustained the production rates, through similar production batch of the same product in just time.
Adjust the quantity without any increased or reduced, and reduce the losses.
Production manager adopted the work of 120 individually SOP's during the period time of implementation this research, which was ease to gain a specific each job order, plus the processes parameters to can produce the similar products of the same job order.

2.4 5S audit

To perform of 5S's activities of the factory and adjust the performance in a routine style, one of each 5S's teamwork members has been selected. 5S activities applied in the production department of the surveyed factory have been evaluated for four months and the forms have been filled as feedback results of the monthly regular checks. Scores of per month are totaled, so monthly complete evaluation scores are received and the assessments are made through following the monthly scores on the Excel spreadsheet, which was designed by the researcher and have been determined after discussion with members of 5S's teamwork and after approved by the executing manager, as shown in Table 2.
In the study, the data on these forms have been used and the analyses are performed by observing the applications within the factory. Five assessment items have been prepared and the 5S assessment form has been prepared. For answers to be given to these questions in each month, assessment scores as 0 = ZERO EFFORT, 1 = slight effort, 2 = moderate effort, 3 = minimum acceptable level and 4 = very good (above average results "3 audits").

Table 2. 5S AUDIT CHECKLIST

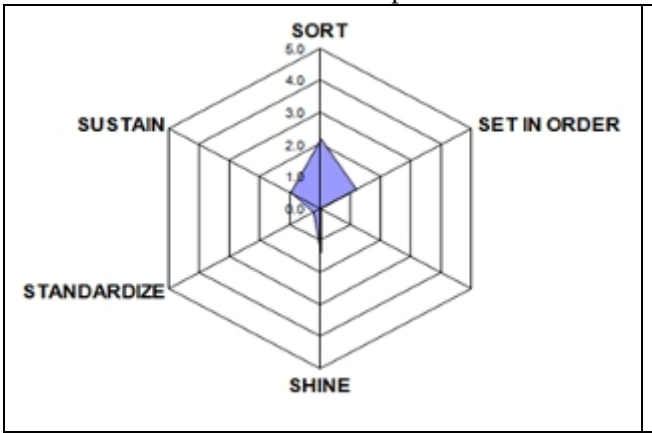
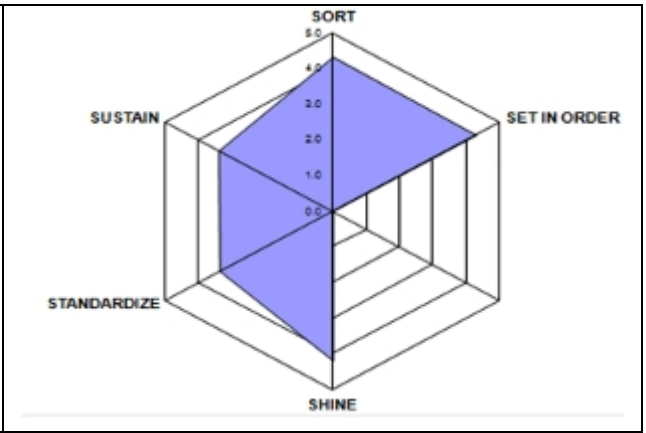
AREA:	Work Area				DATE:	10-Feb-17
	SORT	SET IN ORDER	SHINE	STANDARDIZE	SUSTAIN	TOTAL
Total Score						
Average Score						

SORT ACTIVITY DESCRIPTIONS		SCORE
1)	Only the required spare parts, gravure cylinders, inks, substrates, etc. are present at the workstation. Items not needed to perform the current product are eliminated from the workplace.	
2)	Only the required accessories are present at the workstation. Items not required to make the current product are eliminated from the workplace.	
3)	Only the required documents are presented at the workstation. Outdated or otherwise useless documents are removed from the workplace.	
SET IN ORDER ACTIVITY DESCRIPTIONS		**SCORE**
4)	Locations for containers, recycle bins, materials, etc. is clearly defined by painted lines and properly labeled.	

5)	Tools, materials, and equipment have a designated location that is within reach of the operator. The location is properly labeled and they can easily be identified if lost.	
6)	Stop switches and breakers are highly visible and located for easy access in case of emergency.	
7)	Walkways and vehicle paths are clearly identified and unobstructed. Exits are clearly labeled.	
	SHINE ACTIVITY DESCRIPTIONS	SCORE
8)	Substrate rolls, ink containers, and tools are clean and not cracked, torn, or otherwise damaged. They are neatly stacked.	
9)	Paperwork is not torn, kept clean and protected from dirt.	
10)	Work surfaces (printing machines, lamination, slitters, and other equipment including electrical boxes) are clean and painted.	
11)	Floors are free from dirt, debris, oil, parts, hardware, empty boxes, packaging material, etc. Drains (if required) are properly located and unclogged.	
	STANDARDIZE ACTIVITY DESCRIPTIONS	SCORE
12)	Substrate rolls, ink containers, and tools are stored neatly in designated areas and are returned immediately after each use.	
13)	Documents are labeled clearly as to contents and responsibility for control and revision. The date and revision number are clearly visible.	
14)	Product and material wastes (e.g. containers, liquids, wrappers, etc.) are consistently and often cleaned up and removed from the workplace.	
	SUSTAIN ACTIVITY DESCRIPTIONS	SCORE
15)	A member of 5S's teamwork has participated in a 5S activity such as an audit or other activity within the previous audit periods.	
16)	Time and resources are designated to 5S activities (e.g. designated daily/weekly clean-up time).	
17)	All operators, team leaders, supervisors, etc. are assigned 5S activities to be completed at least once/week.	
18)	The team carried out the action to make improvements to the workplace that were distinguished through the last 5S's audit.	

As a result of 5S audit results, it has been observed that from the first to fourth audit, the graph is increased, that means till the first audit, sort activities are accepted as work discipline by the workers of the factory, but other 5S's activities are observed the fluctuation, due to in this period of time, sort activities are not performed well, reasons being the increased workload in this activity and the cultural background of operators was not enough. In the fourth audit, start from the twelveth week to the sixteenth week, set in order and other activities are performed that are taken as a continuous process, and it can be noted that most of the operators were preferred to complete these activities with a lot of efforts to continue improvement, as shown in Table 3.

Table 3. Comparison between the results between first and fourth audit

	
Result after the first audit	Result after the fourth audit

3- Conclusion

The 5S activities were several changes of workplace organization as the operating procedures, tool organization, cleaning performance and material handling.

According to implement the 5S activities, it is obvious that was reflected on time-saving and consequently cost cut.

In the current case study, it has saved 75% of changeover time, which reduced the cost by LE. 8,566,272.

Also, when applied the SOPs, it had sustained the production rates, through similar production batch of the same product in the decided time, adjust the quantity without any increased or reduced, and

reduce the losses.
The 5S's activities have changed the culture of the operators such as:

- Each operator should use the tools assigned to him and put back the tools in their allocated location after use.
- No units or products should be placed on the floor.
- Anytime a tool is missing, it should be immediately reported to the supervisor.
- All operators have responsibility for achieving the continuous improvements.

4- Acknowledgment

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