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**LEANNESS IN MANUFACTURING OF COIL SPRING APPLYING KAIZEN
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ABSTRACT

In this research the researcher are reduce the rejection. Today many big organizations involve in producing products with high degree of customer satisfaction. The success of a product or service largely depends on how they meet the customer demands more efforts are employed in getting the information necessary for determining what the customer truly wants. In this research collected the all process data to finalized the products in spring manufacturing industries. there was analyzed by kaizen method. According to that selected the process where is most rejection, most wastage of cost in that process, than applying 5 s implementation in the production process and reduce the wastage time in production process & improve the product quality.

KEYWORDS: Spring manufacturing industries, kaizen, 5 s implementation.**INTRODUCTION**

The common impressions of doing work in an organization are being neat, clean, and comfortable. However, the working environments in industrial firms are quite poor. As all of the reasons above, there were many employees unwilling to work long term as was the relationship with the employees working in. To change this bad situation, it was decided to implement a 5S system within the factory.

What is 5S? 5S may be the first step for the company to embrace Lean; this study will focus on 5S. 5S stands for five different characters which are **sort**, **set in order**, **shine**, **standardize**, and **sustain**. The 5S system is a tool, or system that supports a philosophy of operating in an organized fashion. The philosophy that this system supports is one of discipline, efficiency, and attention to detail. The idea behind 5S is that if a workplace is clean and well laid out, the identification of waste is much easier. Most of the manufacturing companies in India do not run 5S, or they do not even know what 5S is. 5S is a way to help the company to reduce the waste and enhance possible profits.

LITERATURE REVIEW

The overview of 5S: 5S is a systematic technique used by organizations comes from five Japanese words; Seiri (sort), Seiton (set in order), Seiso (shine), Seiketsu (standardize), and Shitsuke (sustain). This system helps to organize a workplace for efficiency and decrease wasting and optimize quality and productivity via monitoring an organized environment. It also provides useful visual evidences to obtain more firm results. There is a real need for empirical studies in field of new management systems and their impact on company's performance. As importance role of continuous improvement in today's organizations, and lack of sufficient evidence to show the positive impact of 5S on organizational performance, this paper aims to determine performance factors and characteristics in industrial organizations and identifying the effectiveness of 5S implementation on organizational performance as well. The target organizations are chosen from different industries and diverse field of work. The 5S method begins each programme of improvement. It is the tool for helping the analysis of processes running on the workplace. The 5S is the methodology of creation and maintaining well organized, clean, high effective and high quality workplace. Its result is the effective organization of the workplace, reduction of work's environment, elimination of losses connected with failures and breaks, improvement of the quality and safety of work Before a company implements the 5S, they should know what 5S are and why 5S. A lot of companies feel that they should do 5S first in order to go lean. Some proven reasons for this: 5S is clear, easy and gets people's attention. Yet, there is no rule to ask where to start. Begin 5S implementation when there is a reasonable point

within a company. Let employees understand what the purpose is and how to follow it (Figure 1). Do not use 5S just because everyone else is doing it; 5S is not a trend towards fashion. When a company wants to implement 5S, just like anything new for the company, a leader should describe what 5S is and how it will be utilized.

Table 1. 5S Definitions

Japanese term	English Equivalent	Meaning in Japanese Context
Seiri	Tidiness	Throwaway all rubbish and unrelated materials in the workplace
Seiton	Orderliness	Set everything in proper place for quick retrieval and storage
Seiso	Cleanliness	Clean the workplace; everyone should be a janitor
Seiketsu	Standardization	Standardize the way of maintaining cleanliness
Shitsuke	Discipline	Practice 'Five S' daily - make it a way of life; this also means 'commitment'

MATERIALS AND METHODS

KAIZEN METHODOLOGY:- It is a people oriented approach which promotes discipline participation and involvement, skill development, morale, motivation and communication. KAIZEN based on the 5s process. 5s means seiri, seiton, seiso, seiketsu, shitsuke.

5 S means : **X Seiri** (sorting, organization of the workplace, elimination of unnecessary materials). Refers to the practice of sorting through all the tools, materials, etc., in the work area and keeping only essential items. Everything else is stored or discarded. This leads to fewer hazards and less clutter to interfere with productive work.

X Seiton (set in order, place for everything). Focuses on the need for the workplace in order. Tools, equipment, and materials must be systematically arranged for the easiest and the most efficient access. There must be a place for everything, and everything must be in its place.

X Seiso (shine, cleaning, removing of wastes, dust etc.). Indicates the need to keep the workplace clean as well as neat. Cleaning in Japanese companies is a daily activity. At the end of each shift, the work area is cleaned up and everything is restored to its place.

X Seiketsu (standardize, constant place for things, constant rules of organization, storage and keeping cleanness). Allows for control and consistency. Basic housekeeping standards apply everywhere in the facility. Everyone knows exactly what his or her responsibilities are. House keeping duties are part of regular work routines.

X Shitsuke (sustain, automatic realization of above-mentioned rules). Refers to maintaining standards and keeping the facility in safe and efficient order day after day, year after year.

Implementing the 5S rules should begin from trainings of productive workers in the range of the 5S's elements and advantages from their usage. It is important that all participants of trainings will understand the need of using the 5S rules on the own workplace and will agree on the changes. During trainings it is essential to train the usage of all rules on the clear example, so that every participant can understand the methodology of realization of the 5S's elements. Very important fact is that these rules do not refer only to the productive positions, but also refer to the warehouse, office positions and others .

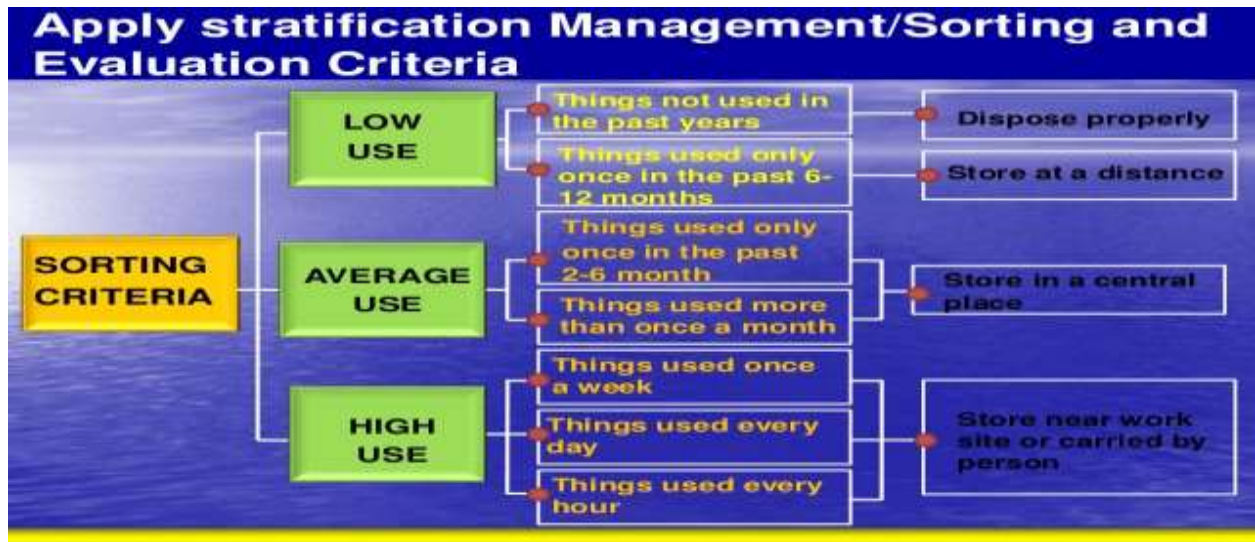
1 S – Sorting Through the suitable sorting it can be identified the materials, tools, equipment and necessary information for realization the tasks. Sorting eliminates the waste material (raw materials and materials), nonconforming products, damaged tools. It helps to maintain the clean workplace and improves the efficiency of searching and receiving things, shortens the time of running the operation. The 1S rule's proceedings :

A) On the first stage one should answer to so-called Control Questions:

- Are unnecessary things causing the mess in the workplace?
- Are unnecessary remainders of materials thrown anywhere in the workplace?
- Do tools or remainders of materials to production lie on the floor (in the workplace)?
- Are all necessary things sorted, classified, described and possess the own place? - Are all measuring tools properly classified and kept? On the basis of the answer to the above questions it is possible the estimation of the workplace in terms of the 1S rule so littering the workplace. If on any question answer is yes, it should execute sorting of things, which are in the workplace.

B) On the second stage one should execute the review of all things which are in the workplace and group them according to the definite system. According to carried out sorting it should execute the elimination from the workplace the things, which were found „unnecessary”.

C) To permanent usage the 1S rule is so-called the Programme of the Red Label. It means giving the red label to things, which operator will recognize as useless within his workplace. This label will make possible not only the elimination of the given thing, but through its own formula will make possible the liquidation of the reasons of appearing on the workplace this given thing.



2 S – Set in order Especially important is visualization of the workplace (eg. painting the floor helps to identify the places of storage of each material or transport ways, drawing out the shapes of tools makes possible the quick putting aside them on the constant places, coloured labels permit to identify the material, spare parts or documents etc.).

Implementing the 2S rule : It should execute the segregation of things and mark the places of their storing. Used things should always be divided on these, which should be:

- in close access (1st degree sphere),
- accessible (2nd degree sphere),
- in the range of hand (3rd degree sphere).

To the estimation of the workplace in terms of the 2S rule, that is setting in order things, serve the following Control Questions:

- Is position (location) of the main passages and places of storing clearly marked?
- Are tools segregated on these to regular uses and on specialistic tools?
- Are all transport palettes stored on the proper heights? -

Is anything kept in the area of devices against the fire?

- Has the floor any irregularity, cracks or causes other difficulties for the operator’s movement? Things used occasionally and seldom should be on the workplace but outside the direct using sphere. Their distance and location from the place of work should depend on the frequency of using these materials or tools. Places of storage should be marked in the manner making possible their quick identification. It can be used colored lines, signs or tool boards. Once defined places and methods of storage should be invariable.



3 S – Shine Regular cleaning permits to identify and to eliminate sources of disorder and to maintain the clean workplaces. During cleaning it is checked the cleanness of machine, workplace and floor, tightness of equipment, cleanness of lines, pipes, sources of light, current data, legibility and comprehensibility of delivered information etc. Indispensable is also taking care of and maintenance the personal tidiness of the operator.

Implementing the 3S rule: The first step of realization the 3S rule is renovation the workplace. It is assumed that „the first cleaning” forces the exact checking of usage two of the previous rules. The usage of the 3S rule relies on everyday keeping in faultless cleanness the workplace. It is executed by the operator of the given workplace. To the estimation of the workplace in terms of the 3S rule, that is cleaning the workplace, serve the following Control Questions:

- Are the oil's stains, dust or remains of metal found around the position, machine, on the floor? - Is machine clean?
- Are lines, pipes etc. clean, will they demand repairing? - Are pipe outlets of oils not clogged by some dirt? Are sources of light clean

4 S – Standardize Worked out and implemented standards in the form of procedures and instructions permit to keep the order on the workplaces. Standards should be very communicative, clear and easy to understand.

Regarding this during preparation and improving, it should be involved all participants of the process on the given workplace, it means direct workers. The group knows the best specificity of its own activities, and process of elaboration and after that, usage gives them possibility of understanding the essence and each aspect of the operation. In the aim of assuring all the easy access, obligatory standards should be found in constant and visible places. It is assumed that standards should not be implemented only in the typical operational processes e.g. production, movement maintenance, storing, but also in the administrative processes, for example: book-keeping, customer service, human resources management, or secretariat service .

5 S – Sustain Implementing the idea of the 5S will demand from workers the compact self-discipline connected with implementing and obeying the rules of regularity in cleaning and sorting. It leads to increasing the consciousness of staff, and decreasing the number of non-conforming products and processes, improvements in the internal communication, and through this to improvement in the human relations. It is also important to understand the need of executing the routine inspections of usage the 5S rule. This inspection is executed by helping of so-called Check List and created on its basis the radar graph of the 5S, which serves to estimation of the workplace. The inspection of realization of the 5S rule is executed once a month by chosen team implementing the 5S rule implemented and in consequence the great changes have appeared:

1 S:

- things were sorted on necessary and unnecessary,
- unnecessary things were removed,
- workplaces were released from the disturbing things,

2 S:

- all things to quick usage were properly arranged,
- the time of preparing the workplace was shortened,

3 S:

- machines are maintained in cleanness,
- conditions of work are tidy and safe,

4 S:

- all obligatory rules in the company are obeyed (procedures, instructions, regulations, orders),

5 S:

- self-control,
- cooperation in team solving the problems,
- proceedings is in accordance with decisions. In the aim of execution the inspection of the 5S rules' activity it is used so-called Check List once a term.



RESULTS AND DISCUSSION

5.1 INTRODUCTION:- This chapter present an example of the proposed approach through a case study in the industry to illustrate the usefulness and case of application of the method as well as considering the practical implimention of the approach. The case study is undertaken at a small scale process industry (rail spring karkhana sithouli Gwalior) involved in producing coil spring product. The application of the methodology to a real case would require interviewing industries members, to get information based on their infield experience. Such information should be expressed following the linguistics scale and should be translated in **KAIZEN** method for computational process.

5.2 SAMPLE AND DATA COLLECTION:-

Data collected for the past one month. The operation is based on the three shifts per day every shift is for eight hours the planned down time per shift 15min at the end of each shift for cleaning and tiding up the work area.

In view of this following data for last 1 month was calculated and analyzed.

Rail spring karkhana sithouli is ISO-9001 certified company, there are 456 employees. There are 28 machines available in two line . The company's products include suspension products, coil/helical springs. The company has its production facilities in India. It manufactures coaching stock and locomotive springs ranging from 3.8 kilograms to 171 kilograms. The main product of the company was coaching stock and locomotive springs.

After the selection of machine data collection have been carried out. For seven days of analyzation during data collection and data of actual problem have also been collected. I found three common problems of machines cell which were occurred again and again on the machine and I also made corrective action plan for reducing such problems. After implementing **KAIZEN** makes them to distort major problems by analyzed 5s implemetation.

5.2.1 SELECTION OF MACHINE FOR THE FOLLOWING REASONS:

- Oldest cell in the unit
- Low performance efficiency
- Most expensive machines.
- High maintenance cost
- Skill worker required.
- Power supply problem.

5.2.2 MAINTENANCE ACTIVITIES SHOULD BE CARRIED OUT ON THE MACHINE:-

Maintenance activities should be carried out by equipment operator are given below

- Cleaning
- Oiling
- Tightening
- Assist specialized maintenance staff during major repairs.

5.3 DATA ANALYSIS

KAIZEN METHODOLOGY:- It is a people oriented approach which promotes discipline participation and involvement, skill development, morale, motivation and communication. KAIZEN based on the 5s process. 5s means seiri, seiton, seiso, seiketsu, shitsuke.

SEIRI – SORTING:-In this step of 5s we have reduce unwanted operation and problem. There are following problem observed in rail spring karkhan shithouli.

- Tool breakage
- Sudden power failure
- Unplanned maintenance
- Procedures not follow properly
- No awareness
- Improper coolant flow
- Setup not effective
- Machine breakdown
- Improper material flow

S.NO	Causes	Failure in %
1	Machine breakdown(min)	90
2	Equipment failure	85
3	Hydraulic oil leakage	72
4	Air problem	14
5	Sudden power failure	07
6	Tool breakage	06
7	Untrained operator	10

4.5.1-Table for coil spring before 5s implementation

SEITON – SYSTEMATIC ARRANGEMENT:-In this step we have arrange problems systematically reduce time spend on following problems

1. Untrained operator Problems:-

- Procedure not follow properly

- No awareness
- Experience with instrument
- Improper material flow
- Unplanned maintenance

Corrective action plan: - Untrained operators provide training by experienced person. During research of rail spring karkhana we have found 05 untrained workers out 24. These 05 untrained operators provide training by trained operator. We have arranged untrained operator in order they have complete training without any investment.

2. Handling method not ok

- No proper stand for part



- Setup not effective
- Procedure not specific

Corrective action plan:- This step consists of putting everything in an assigned place so that it can be accessed or retrieved quickly, as well as returned in that same place quickly. If everyone has quick access to an item or materials, work flow becomes efficient, and the worker becomes productive. The correct place, position, or holder for every tool, item, or material must be chosen carefully in relation to how the work will be performed and who will use them. Every single item must be allocated its own place for safekeeping, and each location must be labeled for easy identification .



3. Erroneous entries to computer

- Programme disturb
- Not running control
- Machine breakdown

Corrective action plan:- Supervisor or Operator/in-charge of machine shop should know details of the machine and provide operation panel, Alarm & indicator and safety devices which provided to alert the operator time to time.

4.5.3 SEISO – CLEANING:- This step involve cleaning the workplace free of burrs, trash, dust other foreign matter, Oil leakage, air waste, scrap and finding minor problem with cleaning inspection then we have reduce in down time and number of accidents.



Trash – Dirt – Knocking
 Loose parts – Leaks – Scattering
 Rust – Scratches – Eccentricity
 Lurching – Abnormal movements – vibration
 Abnormal sound – Heat – Abnormal smells

Corrective action plan:- Supervisor or Operator/in-charge of machine shop should clean machine area time to time. and not put unwanted material in near of machine side



SEIKETSU – STANDARDIZATION: - In this step industry setting up standards/norms for neat, clean workplace and details of how to maintain the norms(procedure).

There are following Norms/ Standards setup in industry

- Each employee prepares his own autonomous chart/ schedule in consultation with supervisor.
- Schedule should be made regarding cleaning, inspection and lubrication.
- Everybody should follow the work instructions strictly.
- After clean up, problems are categorized and suitably tagged. White tags are place where problems can solve by operators. Pink tag is placed where the aid of maintenance department is needed.
- The industry invited an annual event “Long service awards” to recognize those employees who have been with the industry for 10 year and more.

SHITSUKE – SELF DISCIPLINE: - Everyone sticks to the rule and makes it a habit, high employee morale. We need everyone maintain 5S guidelines. Maintain discipline in inspection, routine maintenance and every level.



S.NO	Causes	
1	Machine breakdown(min)	45
2	Equipment failure	42
3	Hydraulic oil leakage	36
4	Air problem	00
5	Sudden power failure	00
6	Tool breakage	00
7	Untrained operator	00

4.5.2-Table for coil spring After 5s implementation

S.No	Causes	Before implemetation	5s	After implementation	5s
1	Machine breakdown(min)	90		45	
2	Equipment failure	85		42	
3	Hydraulic oil leakage	72		36	
4	Air problem	14		00	
5	Sudden power failure	07		00	
6	Tool breakage	06		00	
7	Untrained operator	10		00	

After the use of kaizen method we reduce wastage of time 50 % of machine breakdown, equipment failure, hydraulic oil leakage and wastage of time reduce 100% air problem, sudden power failure. Tool breakage, and untrained operator.

CONCLUSION

During research process, after getting familiar with 5S practice, its implementation and its benefits for industrial organizations, the results showed that the technique is very useful, applicable and beneficial. The first objective, which was determining factors and characteristics of industrial organizations' performance has been achieved by reviewing 5S activities, their significant specifications in literature review, experts' opinion and judgment. This could lead the research to identify eight performance factors. The second and main objective of this research, which was identifying effectiveness of 5S implementation on the organization performance, has been achieved by using a comparative measurement between performance of organization before and after 5S implementation. According to the achieved results from the study, performed on SRK, it could be concluded that 5S has positive effect on overall performance and could improve the quality, efficiency and productivity of industrial organizations. According to the results, future researches can be a comparative study of 5S affects on performance in similar organizations, review requirements of the implementation and deployment of 5S practice, and review of the key success factors for organizations that have been successful in implementing of 5S and other quality management systems. The methodology used in this research can be extended for more factors by involving more

experts to get more accurate results. Future research also can be applied for any other industry and organization to achieve best form of relationship among directional indicators and overall performance and so on. Studying success factors and their effects on organizations or projects can be investigated and all details which will result in competitive advantage of company are also recommended for future study.

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