

使用品管手法提昇5S活動—以南亞機工二廠為例

Using Quality Control Tools to Promote 5S Managerial Activities at Nan Ya 2nd Mechanical Plant

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(Received Feb. 26, 1996; Revised Mar. 9, 1996; Accepted Mar. 30, 1996)

摘要：品管手法是一種很好的實務工具，它係透過相關人員的腦力激盪後，組織相關的資訊，藉此資訊來尋找問題、原因並提出解答。它們將被用來提昇5S執行之績效。文中並描述一提昇5S活動績效的改進程序，並以南亞機工二廠為例，說明如何使用品管手法來改善5S活動的績效。

關鍵詞：品管手法，特性要因圖，關連圖，5S管理活動

Abstract: Quality control tools are excellent practical tools to organize information obtained from the brainstorming of relevant personnel and then finding out the problems and causes in order to propose solutions. They are applied to promote the performance of 5S execution. And, an improving process for promoting the performance of 5S managerial activities is described in this paper. The Nan Ya 2nd Mechanical Plant is exemplified to show how to improve the performance of 5S managerial activities by integrating quality control tools.

Key words: quality control tools, cause and effect diagram, interrelationship diagram, 5S managerial activities

1. INTRODUCTION

5S means the integration of the five managerial activities of Seiri, Seiton, Seiso, Seikeetsu and Shitsuke. These five words are Romanized Japanese Names. People picked up the first letters and called them "5S" managerial activities. The definition of 5S activities are explained as follows :

Seiri : Classify the "wants" and the "not wants", remove the not wants and preserve the wants.

Seiton : Settle the qualified personnel on a fit position, set up the quantity and location of the wanted materials, tools, machines ect..

Seiso : Clean the working environment of all dirt and grime.

Seikeetsu : Keep the Seiri, Seiton, Seiso in their best condition.

Shitsuke : Learn to abide by instructions and try to do everything correctly at the first time.

Through the Seiri action, the plant can remove the unnecessary and superfluties which in turn avoid the waste of resource, space and lower in inventory. By Seiton action, people can reduce the time spent in searching for items or things, therefore, the preparation time of work can be reduced. Teaching and admonishing employees to abide by standards and rules, and to do everything correctly will enhance the accuracy and effectiveness of work. Additionally, if the working space is clean and the machines and equipments are kept in good conditions, then the employee's morale will be motivated and the machine life will be extended. Many experiences in Japan show that the 5S managerial activities are important for companies to improve their image, working environment, productivity and morale. For example, through implementing the 5S, Yamato company reduced the ratio of equipment breakdown to a level under 10% and raised the productivity 1.8 times [4]. The Yen-Chuang, Yean, and Lung Po Chitzu companies all utilized 5S to remove not wants, set up locations and keep areas free of litter, removing danger and leading to a more comfortable working environment [1].

In recent years, the 5S managerial activities have been used by many Taiwan companies, however, the implementation results are not very satisfactory due to lack of procedure in finding out the problems and their countermeasures during the implementation period.

Quality control tools are excellent tools to organize information obtained from the brainstorming of relevant personnel and then finding out the problems and causes in order to propose solutions [2]. The paper is in use to promote 5S managerial activities and show progress in improving the evaluation of Nan Ya 2nd Mechanical Plant which previously had inferior performance.

2. NAN YA COMPANY

Nan Ya Company has nine plants in the Kaohsiung area (including Jenwu 1st, 2nd, 3rd and 4th Plants, Kaohsiung Plant, Chiencheng Plant, Linyuan Plant, and 1st and 2nd Mechanical Plants). The company produces plastic sheet, plastic-related products, and machines and boilers needed within the plants. The company divides 13 units, including the nine mentioned plants the Material Divisions and Product Divisions of Jenwu and Kaohsiung Plants, into Group A and B, to evaluate and compare the 5S monthly results. This paper is exemplified by the 2nd Mechanical Plant in Group B. (There are five other units in Group B, including 1st Mechanical Plant, Material and Product Divisions of Jenwu Plant, Material and Product Divisions of Kaohsiung Plant.)

Nan Ya 2nd Mechanical Plant was established at March 10, 1981. Its main tasks include : (1) Production of machines : Including press machine, calender, combination exchanger and accessories. (2) Plant expansion : Including the expansion of domestic and overseas plants of Nan Ya Company, installation of machines and related public utility. (3) Supportive task : Provide support to each plant of Nan Ya Company in respect to the disassembly, repair, maintenance and trial of machines.

Reasons for execution of 5S in Nan Ya Company are :

- (1) 5S activities are soundless but charming salesman because a clean plant will attract clients to place orders and to trust the product quality.
- (2) People working in a clean environment will be praised.
- (3) A plant promoting 5S activities will decrease waste and stock thereby lowering costs.
- (4) A plant performing 5S activities will be very bright and attractive, establishing a safe and hygienic working environment.

- (5) Through the requirement in Shitsuke, employees will establish pride in themselves and their co-workers, and will be more willing to improve.
- (6) After 5S activities, a certain number of executives and personnel with planning and managing abilities will show up.

3. EXECUTION OF 5S ACTIVITIES

In this section, a procedure for implementing 5S activities in Nan Ya Company is described. It consists of the following four steps :

Step 1 : Establishment of 5S promotion organization :

Promotion organizations are established in each business unit and plant to take the responsibility for regulating, executing and evaluating.

Step 2 : Introduction and education of 5S activities :

In this stage, the main responsibility is to introduce 5S to all employees and inform them of the determination to implement 5S activities. And then, promotion, education and communication to and with employees in each business unit and plant are implemented in order to encourage willingness to perform 5S. It is require that the plant manager or division chiefs described the key points of 5S managerial activities during the morning exercise every day.

Step 3 : Setting up of 5S orientations, promotional plans and targets :

The 5S orientations of the Nan Ya Company consist of (1) all employees participate in 5S managerial activities, (2) continuous communication through panel discussion in order to reach a mutual understanding, (3) operators should self-inspect and accomplish products quality according to the operation standard. Through the mentioned orientations, the tartgets include : (1) no delay in delivery (2) no unusual occurrence in product, (3) continuous effort to provide more comfortable and safer working environment. Under this guidance, each plant is requested to set up its own 5S orientations, promotional plan and estimated targets according to its operational characteristics and needs.

Step 4 : Implementation and evaluation :

Each plant should implement 5S activities stage by stage according to the schedule and targets set in the previous step. In 2nd Mechanical plant, everyone cleans his/her own working area every day. A thorough clean up should be performed every Friday. In addition, the lable of "Red Alarm" is used to pick up a unit or individual who is wasting materials, or not working hard enough, and should be applied at this stage. The so-called "Red Alarm" is used to distinguish between wants from not wants, and to see if the cleanliness and tidness have been achieved. With this labeling, the objects of Red Alarm, including idleness, waste and unusual occurrence, ect., are absolutely clear and can be further improved within a certain period of time. After the improvement, the plant manager reviews and collects the improving results to evaluate the relevant personnel. Such evaluation will be considered with regard to individual bonus in working efficiency.

A 5S evaluation group from the executives of each plant is established to evaluate the situation of each plant at the end of each month. The evaluation results are publicized at the 15th of each month. The score of the evaluation (from October 1993 to March 1994) of the 13 plants of Nan Ya Company is indicated in Table 1. We can see that the average score of 2nd Mechanical Plant is 84.7, ranking in tenth place.

Table 1: The scores of the evaluation of 5S activities in Nan Ya Plants

Plant Score Date	Jenwu 1st Plant	Jenwu 2nd Plant	Jenwu 3rd Plant	Jenwu 4th Plant	Kaohsiung Plant	Chiencheng Plant	Linyuan Plant	1st Mechanical Plant	2nd Mechanical Plant	Material Division of Jenwu Plant	Product Division of Jenwu Plant	Material Division of Kaohsiung Plant	Product Division of Kaohsiung Plant
Oct. 1993	96.6	78.6	86.5	81	84	93.6	89.4	84.6	86.7	86.8	86.6	94.6	82.7
Nov.	86.6	85.1	85	80.4	89.1	92.4	91.5	81.6	81.7	91.1	86.7	94	87.9
Dec.	95.5	83.1	81.4	81	85.9	88.5	92.6	85.0	86.6	87.8	84.9	92.4	82.3
Jan. 1994	94	89.4	85.5	85.5	86	83.9	86.4	86.3	86.8	87.7	90	90.1	81.6
Feb.	91.1	84.9	82.1	84.4	85.5	91	86.5	79.5	81.1	88.4	94.6	93.5	85
Mar.	88.5	87.6	86.1	88.6	87.5	84.4	86.6	83.4	85.1	82	91.8	88.4	92.8
Average Score	92.1	84.5	84.4	83.5	86.3	89	88.8	83.4	84.7	87.3	89.1	92.1	85.4
Rank	1	9	11	12	7	4	5	13	10	6	3	1	8

4. IMPROVEMENT BY QUALITY CONTROL TOOLS

5S activities is a determined policy made by the headquarters and each plant should coordinate and execute with full effort. The headquarters also evaluate the performance every month. The 2nd Mechanical Plant, however, usually could not get satisfactory improvement.

The target of the 2nd Mechanical Plant is to know how to actually practice 5S managerial activities in order to follow the policy made by the headquarters and also to elevate the monthly results of 5S improvement from last to first.

At this time, we need to review and find out causes for inferior performance in order to improve. The so called "seven basic tools" and "seven new tools" in quality control will be the best improving methods.

In what follows, we will describe how to improve the effect of 5S managerial activities by integrating quality control tools. The improving process consists of six steps : (1) survey of current situation, (2) analysis, (3) setting up of countermeasures, (4) execution of improving countermeasures, (5) confirmation of effect, and (6) tracking and standardization. In each step, the application of quality control tools is described as following.

4.1 Survey of Current Situation

Because the purpose of this case study is to elevate the results of 5S improvement, therefore reasons for ineffective results of 5S improvement should be found out. The 2nd Mechanical Plant do not have accurate records in their fraction defective, even they don't know what specific causes of defects are occurring. So, in this step, getting timely and accurate information on problems of executing 5S activities is required. To do this effectively, the development the check sheets are used.

In consideration of different types of work, we divided 2nd Meacanical Plant into 13 division. For each division a specifically designed check sheet was employed to examine how 5S worked. Check sheets were manually constructed and completed to summarize two week's causes of defects. Bases on the information collected from all the check sheets. Pareto diagrams were drawn to figure out the causes that made the execution of 5S ineffective and to reveal how the causes affected each other. According to those causes in the Pareto diagrams, 25 potential causes were found out through brainstorming.

4.2 Analysis

In this step, cause-and-effect diagram and interrelationship diagram are used to organize the information generated in an open brainstorming session. We first applied cause-and-effect diagram to group the 25 potential causes into 6 factors, namely, personnel, environment, Kanban operation, Red Alarm, management and others. The participators in the brainstorming session were also asked to generate possible solutions or actions for each factor in order to improve the performance of 5S. We then used the interrelationship diagram to indicate which solutions or actions are related and explore the logical links among them [3]. Cause-and-effect diagram and interrelationship diagram are presented in Figure 1 and Figure 2.

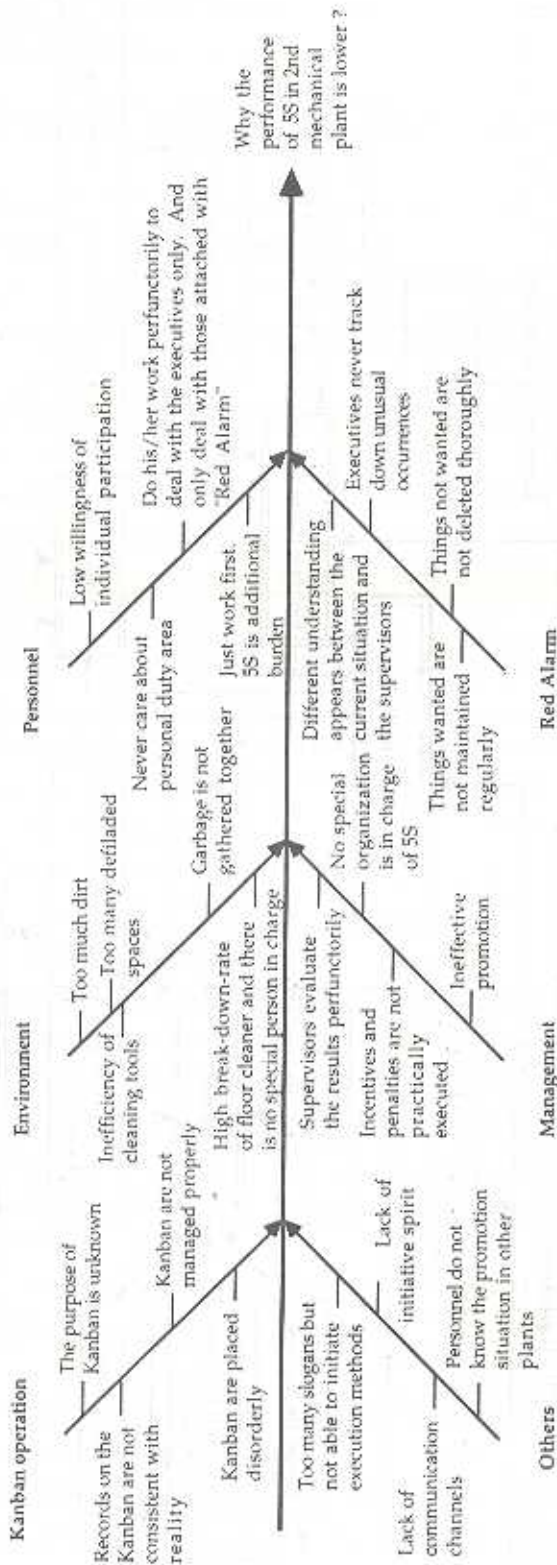


Figure 1: The cause and effect diagram for lower performance of 5S in 2nd Mechanical Plant

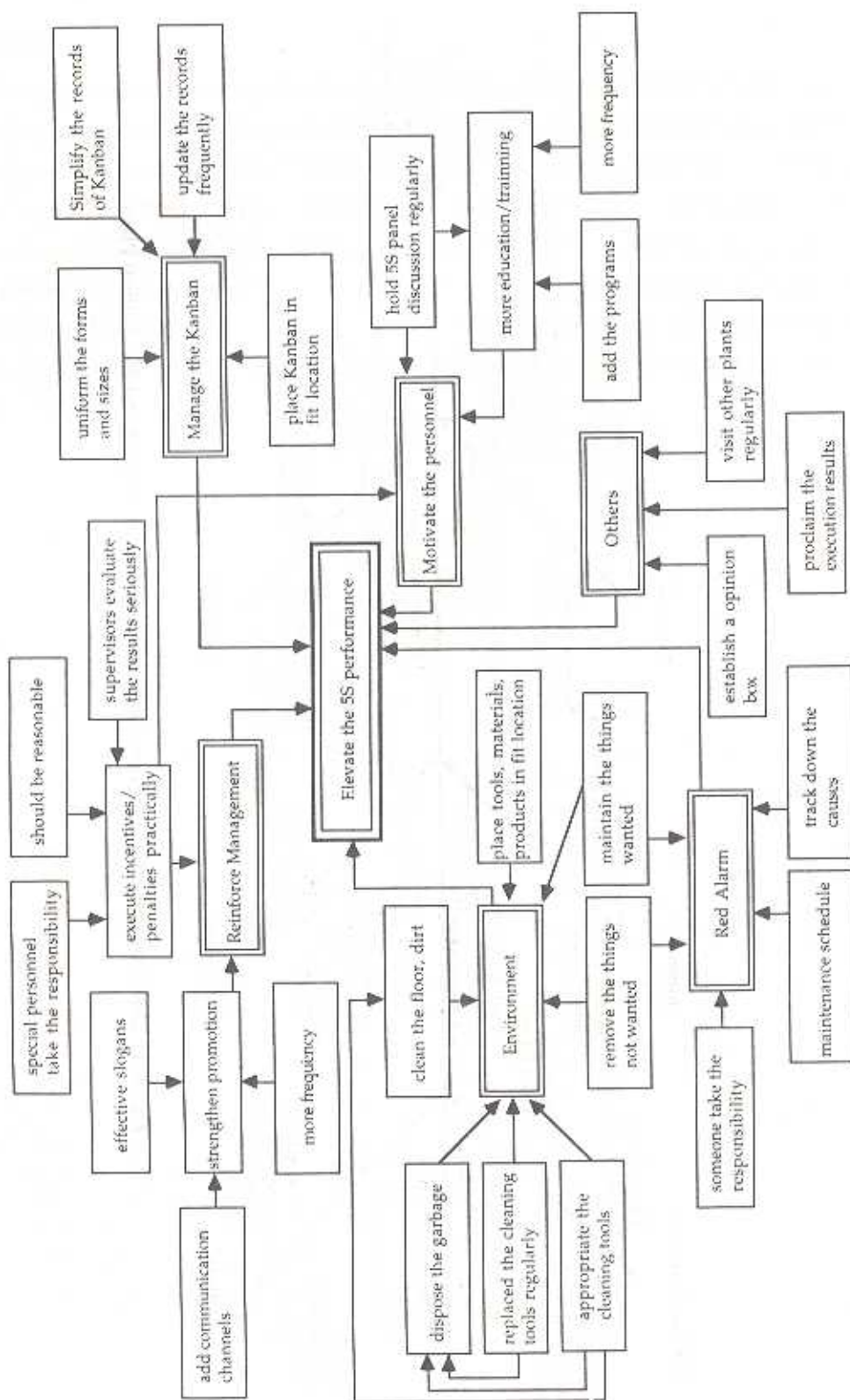


Figure 2: Interrrelationship Diagram of improving the performance of 5S

Table 2: List of improving countermeasures

Improving Countermeasures
A. Personnel
<ul style="list-style-type: none"> * Arrange training related to 5S activities to make employees understand the importance of 5S to themselves. * Hold 5S panel discussion regularly to let subordinates and executives communicate face to face in order to know the problems and solve those problems. * Check personal duty area once a day at a fixed time. If unusual occurrence appears, improve immediately. Employees derelict to their personal area should be penalized.
B. Red Alarm
<ul style="list-style-type: none"> * Red-Alarm prosecutor should understand the current situation completely and track down the sources of unusual occurrences. * Things wanted have to be kept and maintained carefully. Make a maintenance schedule and designate special personnel to be in charge. * Things not wanted have to be removed thoroughly to avoid waste in space.
C. Environment
<ul style="list-style-type: none"> * Special personnel should be designated to regularly clean the sources of dirt, on the top awning of the plant building. * Red-Alarm prosecutor should pay attention to those defiladed spaces. * Garbage should be gathered together and classified every day before working hours are over. * Cleaning tools should be replaced regularly. * Special personnel should be designated to be in charge of the floor cleaner to ensure that it can be used every day.
D. Management
<ul style="list-style-type: none"> * A promotional group should be established to supervise and execute 5S. * Supervisors should regard 5S as routine work and should not carry out the task perfunctorily. * Promotion should be performed from the morning exercise and extended to every time. * Incentives and penalties should be reasonable, and can not be interrupted.
E. Kanban operation
<ul style="list-style-type: none"> * Records on the Kanban should be simple and understandable to ensure that they can be realized clearly by employees and visitors. * Contents of the Kanban should be changed immediately as long as the things wanted are changed. * Forms and sizes of the Kanban should be uniformed.
F. Others
<ul style="list-style-type: none"> * Visit other plants regularly to compare the execution situation and learn from each other. * Perform autonomous management and publicize the execution situation of each group regularly. * In addition to the practical execution of incentives and penalties, the scale of evaluation should be extended from group to individual. People with excellent performance should be praised in public. A opinions box should be established.

4.3 Setting up of Countermeasures

Using interrelationship diagram from the previous step as input, a long detailed discussion was held, in which key actions or solutions were selected and generated to the countermeasures of improving 5S performance. By using the stratification, the resulting 21 improving countermeasures were further classified as shown in Table 2.

4.4 Execution of Improving Countermeasures

Respective countermeasures were performed according to the factors listed in Table 2. Furthermore, some cooperative for promoting the 5S activities were executed within the plant, including : overall suspension on April 8 for Seiri and Seiton with the participation of all employees for two hours; visit to the Material Division in Kaohsiung Plant for emulation purpose on April 10; 5S educational training supported by the Plant Manager on April 12; visit to Jenwu 1st Plant on April 15; establishment of 5S Opinions Box on April 17; overall participation in Seiso and Seikeetsu for one hour on April 20; another 5S educational training on April 20, etc..

4.5 Confirmation of Effect

The 2nd Mechanical Plant spared no effort in promoting 5S activities. It was, however, often the last in the evaluation made by the company, so was the 1st Mechanical Plant. After investigation, it is found out that 1st and 2nd Mechanical Plants easily appear to be untidy and oily because they are production units, while the other four units are mainly storage units. The 2nd Mechanical Plant has less advantage than the other units with regard to environment when the evaluation is made in units with great difference.

After executing the improving countermeasures which are mentioned in Table 2, the 2nd Mechanical Plant had remarkable improvement in the results of 5S activities. Its scores of evaluation made it move from the tenth (October 1993-March 1994) to the second best (April and May, 1994). Its results were even more outstanding than the units of different features (Product and Material Divisions of Jenwu Plant and Material Division of Kaohsiung Plant). Therefore, quality control methods were verified that they can improve 5S activities with excellent effect.

4.6 Tracking and Standardization

In this step, check sheets are used to track of these data for providing management with information upon which improvements to the 5S activities are based on. Based on the information collected, the Grier diagram developed by Ted Grier, National Service Manager

for Casio, was show trends by including three or more periods. The causes of nonconformity were located on the x-axis, the percentage was located on the y-axis. Data were collected in the same manner as a Pareto diagram, in this case, the data represent the reasons for inferior 5S performance.

Throughout the improvement effort, the standardization has to be set up in order to maintain the results achieved from Seiri, Seiton and Seiso. The standardization is really indispensable. In this case, basic principles of Seiri, Seiton and Seiso are established in each division. Activity methods, tools used, frequency and person(s) in charge are specified and displayed through photographs, graphics and Kanban. Execution performance is reviewed through weekly discussion in order to improve and follow up the schedule. Only by doing these can 5S activities be fully promoted and keep excellent evaluation results.

Penalties are imposed on those who are labeled "Red-Alarm" which is attached to those who improve very little. And, an incentive/penalty system of 5S execution is recommended. Plants with better performance in 5S execution are invited to hold performance presentation as good examples for other plants.

5. CONCLUSION

A procedure is offered for implementation of 5S managerial activities. And, the application of quality control tools in 5S managerial activities and the opportunity of using quality control tools in different improving stages have been introduced in this paper. This paper was further exemplified by the case study of the Nan Ya 2nd Mechanical Plant. Through the brainstorming of field personnel, reasons for ineffective results were found out and the cause and effect diagram, interrelationship diagram were drawn accordingly to look for and execute improving countermeasures. Finally, through the evaluations made by Nan Ya Company in each plant, the improving countermeasures are proven to have remarkable improved the results of 5S evaluation of the 2nd Mechanical Plant which previously had inferior performance.

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