

Relation of 5S principles and Human Factors Engineering (Ergonomics) in Possibility of TPM Implementation (case study)

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Abstract. The present paper is a field work aim to clarify the case study situation from viewpoint of implementation of 5S principles, human factors engineering (Ergonomics), providing of possibility condition of TPM execution, and its analysis their relation with each other. This research was conducted in Tabriz-IDEM company in Iran. For gathering required data, the researchers have used three kinds of questionnaires that each one investigates the related area. The result shows that the company has successful actions in employing and implementation of 5S, Ergonomics and executing TPM and also their relations are meaningful.

Keywords: 5S principles, Ergonomics, TPM

1. Introduction

Today 5S, Ergonomics and TPM are recognized as key concepts in Lean and World Class Manufacturing models. Few organizations understand how to integrate these concepts to generate more benefits. Producing high quality products without any defect counted as strategic goals that help organizations to gain ideal market share and competitive advantages. This happens while reducing wastes, manpower and material utilization and environment engineering play an important role in achieving the mentioned goals. Developing countries, especially Asian south-east, not only uses technology of developed country for economic and industrial development, but they also employed their techniques, Because some part of industries productivity is up to how using and holding machines and man powers. Total Productive Maintenance (TPM) is one of the most employed managerial techniques in this area [1]. Ergonomics aimed in increasing productivity regarding health, safety and welfare of employers in a work place [2] and organizing of work place is done based on one of the well-known systems named as Seiri, Seiton, Seiso, Seiketsu and Shitsuke (5S) [3].

In this research the researchers have applied descriptive study to determine the situation of the case study from viewpoint of implementation and employing of 5S principle, Ergonomics and providing feasibility of TPM executing and discovering their relations with each other.

2. Problem statement

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In industrial units, frequency of machines and tools, force workers to face with different kind of dangers. With advancing of technologies and increasing of machines usage in manufacturing, probability of incidents increases in such a condition. We should have say that to get the comfortableness, we need to get rid of three big enemies: Difficulty, Dirty and Dangerous conditions [4], [5].

Due to the details of work place engineering, it is necessary to invest for supplying material and equipments which are controlled severity through the related rules to the safety and health. In other word, in a safe work place where the man powers are the main factor and resources and equipments have been organized in a systematic way, workers with feeling of exciting, property and proud do their best through the inventions and innovations. They work with responsibility and prefer organization's profit to their own profits [6], [7].

Regarding this point that nowadays most of industries work place has been organized based on 5S principles that are prerequisite for all the improvement plans. Also implementation of the Ergonomics in an industrial units decreasing work incidents remarkably and providing possibility of TPM execution conditions in an organization leads to maximizing efficiency of equipments, performance improvement, creating a good work place and considerably reducing defects result in equipments performance [8]. Hence the aim of this paper is using descriptive research to determine and analyze the situation of the 5S, Ergonomics and TPM in a case study and also answering this question that is there any meaningful relation between the mentioned items or not.

3. Methodology

The researchers have used three kinds of questionnaires for collecting needed data and also to answer to the research questions, each ones investigate the 5S, Ergonomics and TPM areas. The questionnaires designed based on Likert's table. After gathering the data from the sampling, they analyzed based on final tables in questionnaires and each one of the mentioned areas were examined.

The studied populations of this research were managers, assistance managers, analysts and experts of Tabriz- IDEM Company in Iran. The total numbers of population were 55 persons which some part of it selected as a sample. For sampling the researchers have employed Krejcie and Morgan's tables [9] to determine sample volume. Based on this table chosen sample were 48 persons that 44 of them helped the researchers in this research. So for the final analysis of the questionnaires, 44 samples were taken.

3.1. Validity and Reliability of Research

Validity means that the scale and content of tools or questions exactly measure the variables and the study area [10]. In this research, first, the researchers distributed the early questionnaires to the expert people and after taking their opinions the final questionnaires were designed. By having done this the content validity of the research has provided. The content validity is based on judgment.

For reliability of the research the Chronbakh's Alpha coefficient using SPSS was applied and 0.86 for 5S, 0.79 for Ergonomics and 0.97 for TPM were calculated that shows the reliability of the questionnaires.

3.2. Research Questions

- 1- What is the situation of the Company when the 5S are executed?
- 2- What is the situation of the Company when the Ergonomics are executed?
- 3- What is the situation of the Company for providing possibility of the TPM executing conditions?
- 4- Is there any meaningful different between 5S and Ergonomics?
- 5- Is there any meaningful different between 5S and possibility of TPM executing?
- 6- Is there any meaningful different between Ergonomics and possibility of TPM executing?

4. Data Analysis

First, descriptive static was used for studying the characteristics of statistical sample (see the result in table 1) and analyzing the situation of the each area. Then T test and Pearson Correlation method were applied to see that if there are any meaningful different between the variables of study or not.

Table 1: Result of descriptive statics of the studied population company.

Characters	Sex		Age			Educations			Experience			
	Male	Female	Up to 30	31to 40	elder than 40	Diploma	Degree	Master	up to 7 years	to 12 years 8	13 to 15years	More than 16
Number	44	-	12	18	14	13	25	6	10	12	11	11
Percentage	100	-	27	41	32	29	57	14	23	27	25	25

RQ1- Principle of 5S shows that the IDEM Company in observing and executing the all quintuple dimensions has been successful. The related results to 5S have shown in Table 2.

RQ2- The result in Table 3 shows that the company has a good performance in implementation of Ergonomics. Also the company has an average performance in using of portable tools, design of work station and providing environmental factors and welfare facilities. In general, it can be said that the company has an acceptable performance in mentioned areas.

RQ3- The result in Table 4 illustrates that the company has a successful effort in providing of TPM execution conditions possibility.

RQ4- Table 5 using T test shows that in $\alpha = \%5$ with $df = n_1 + n_2 - 2$, the critical value will be equal to $t = 1/86$. Because of the calculated $t = 0.89$ is smaller than the critical value, so the H_0 hypothesis (there is not any meaningful difference between 5S and Ergonomics) accepted.

RQ5- Table 6 shows the result of Pearson correlation test between 5S and TPM. With 95% confidence and with $df = n-2$, the critical value of $r = 0.87$ obtained and because of the calculated $r = 0.91$ is bigger than the critical value, therefore the H_0 hypothesis (there is not any meaningful relation between 5S and TPM) rejected. In other word there is a meaningful relation between 5S and TPM.

RQ6- Table 7 demonstrates the result of Pearson correlation test between Ergonomics and TPM. With %95 confidence and with $df = n-2$, the critical value of $r = 0.87$ obtained and because of the calculated $r = 0.89$ is bigger than the critical value, therefore the H_0 hypothesis (there is not any meaningful relation between Ergonomics and TPM) rejected. In other word there is a meaningful relation between Ergonomics and TPM.

Table 2: Result of 5S in IDEM Company

5S principles	Available scores	Total Mean of gained scores	Total Percentage of Mean scores	Analysis
Seiri	0-20	16	80	Very good
Seition	0-20	15	75	Very good
Seiso	0-20	15	75	Very good
Seiketsu	0-20	16	80	Very good
Shitsuke	0-20	16	80	Very good

Table 3: Result of Ergonomics in IDEM Company

Ergonomics areas	Available scores	Total Mean of gained scores	Total Mean Percentage of gained scores	Analysis
Transporting and holding of material	1-25	16	64	Good
Using of portable tools	1-25	15	60	Average
Designing of work station	1-25	14	56	Average
Safety of equipments	1-25	16	64	Good
Providing environmental and welfare facilities	1-25	15	60	Average

Table 4: Possibility areas of TPM execution

Possibility areas of TPM execution	Available scores	Total Mean of gained scores	Total Mean Percentage of gained scores	Analysis
Matching of goals and policies with TPM	1-25	17	68	Good
Small group activities	1-25	15	61	Good
Education & Training	1-25	15	61	Average
Protection of equipments	1-25	17	68	Good
Safety and environmental and Ecology cares	1-25	16	65	Good

Table 5: T test between 5S and Ergonomics

Calculated t	α	Meaningful level	result
0.89	0/05	000.0	rejecting of H_1

Table 6: Pearson correlation test between 5S and TPM

Calculated t	α	Meaningful level	result
0.91	0/05	000.0	rejecting of H_0

Table 7: Pearson correlation test between Ergonomics and TPM

Calculated t	α	Meaningful level	result
0.89	0/05	000.0	rejecting of H_0

5. Discussion of Findings

Regarding the researches activity, the following results can be mentioned as research findings:

1. The company has been successful in observing and implementation of the 5S principles. Analyzing the 5S areas have shown that the company emphasizes on improvement and cleanness of work place and executed as a systematic plan.

2. The results obtained from analyzing the Ergonomics' areas demonstrated acceptable level of productivity and economical development which leads to profitability and continuing industrial unit's life.

Also the company has a great attention to health, safety and welfare of their workers and outstanding endeavor to recognize the main factors of incidents, reforming the work place and finally increasing the man power productivity.

3. ISO studied areas of TPM illustrated that the company is ready for implementing of TPM, furthermore factors like; safety, arrangement and engineering of the work place, equipments efficiency and performance improvement must be considered.

4. About 5S and Ergonomics, the results obtained from T test has shown that there is not any meaningful difference between them and their mission are reconstructing, reforming, improving and promoting the work place both technically and non- technically that are the goals of industrial units.

5. The Pearson correlation test discovered that there are meaningful relations between 5S and TPM and between Ergonomics and TPM. This means that the words like; safety, industrial hygiene and controlling pollutions are relative in each three methods.

6. Suggestions

Considering the obtained results of this research the following suggestions presented:

1. Suggestions about organizing the work place based on 5S principles:

1.1. Making accessible of organizing rules and workers participating in creation of right habit for obeying the rules and provided needed educations.

1.2. All machines and inventories needed to located according to special layout and it is better that have a particular layout plan for each one.

1.3. Clarifying the workers responsibility in a group for cleaning the selected areas and making it competitive for workers who are successful get the rewards.

2. Suggestion for Ergonomics:

2.1. Doing medical checkup periodically for workers who are facing with extra noisy conditions to determine being necessary or not necessary of using controls for diminishing amount of dangers.

2.2. Decreasing allowable work time for workers who are working in extra noisy conditions.

2.3. Preventing workers facing with dangerous material and harmful radiations through the training and others experiences.

2.4. Preparing suitable trainings regarding workers educations.

3. For TPM execution:

3.1. Make it clears of goals and polices for employers through the TPM education and authorization for employers participation in planning and making changes.

3.2. Providing needed conditions for recruiting of expert people and holding of seminars and training work shop for managers and employers.

3.3. Coordination of quality control of products with managing of equipments and providing necessity budget and financial support.

3.4. Organizing technical and safety classes for increasing the employers' knowledge and using alarming texts on billboards that installed in general places, also irritant pictures which reminds bad days for people who ignore safety and set a penalty and punishment for guilty people.

7. References

- [1] M. R, Tavakkoli. Designing and implementation of TPM in Babakan Textile Company. *Tehran, 2nd national conference of NET*. 2003.
- [2] M. Araghi. Work place and Productive Human. *Journal of Tadbir, Tehran*, 2004, No 146.
- [3] H. Hirano. *Organizing the work place based on 5S principle*. Translated by Aal Khorshid. Shiraz, Mighat Nour publication. 2002.
- [4] T. Suzuki. *New Directions for Total Productive Maintenance*. Cambridge, Massachusetts, 1992.
- [5] J. Heizer, and B, Render. *Operations Management* .7th edition. Pearson Prentice Hall, 2004.
- [6] Kh. Alhassan, And A. Metcalf . The role of Total Productive maintenance in business excellence, *Total Quality Management*, vol 1.1, (2000) No. 4, 5& 6, S596- S601.
- [7] R. K.. Davis. *Productivity improvements through TPM: The philosophy and application of Total Productive Maintenance*, New York: Prentice Hall, 1995.
- [8] J. L., Coetzee. Aholistic approach to maintenance Problem. *Journal of Quality in maintenance engineering*, (1999), Vol.5, No.3.PP.276-280.
- [9] R. V., Krejcie, and D. W. Morgan Determining sample size for research activities. *Educational and Psychological Measurement*. (1970). 30, 607-610.
- [10] M. R., Hafezniya. *Introduction to research methodology in human science*. 2nd ed. Tehran, SAMT publication. 2003