

Comprehensive Study on Waste Minimization in Tote Bin Room: A Study on Food Manufacturing Industry

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ABSTRACT

Waste minimization is given priority among the main topics discussed in all kinds of industries today. As it directly influences to the cost and productivity, waste minimizations play an important role in modern industrial design. Similarly the food manufacturing industries too are highly concerned with minimizing wastage levels to meet the new industrial trends. Further, to minimize the production waste, many organizations have been conducting many programs to identify waste points and get actions to overcome them. For this research, section called Tote bin room in food manufacturing industry is considered. After identifying the causes that effects wastage in the sections, the actions that have to be taken to overcome are identified and feasibility of those actions has been discussed. Then, required modifications suggested by the employers with their experiences which were not normally highlighted are identified and tested in the section. Finally the research has found that the modifications suggested by experiences are more reliable to minimize the wastages in similar specific sections.

KEYWORDS: Food Manufacturing, Productivity Tote Bin Room, Waste Minimization

INTRODUCTION

As all other food processing industries over the world, dairy production is a very important industry that is engaged with food culture. Even only the dairy milk were used in prior time as the only variety, today with the changes of the human culture and behavior, people are not in the position to just satisfy with a single variety of product. Thus, different kinds of Dairy productions were conducted by different companies. Wastage in the productions processes is a common problem to whole Dairy production industries.

The factory where the research was conducted belongs to a company which is spread over the world. It is engaged in the dairy production.

In the mean time company has highly involved in the local community in supporting the livelihoods of the local community because of its long-term commitment to the local dairy sector as the country's largest collector of domestic milk.

Powdered milk plant functions as the largest plant with producing two base products called base milk powder and coconut milk powder. In order to conduct packing and mixing the products, Tote Bin Room has established parallel with powdered milk section.

Tote Bin Room is the place where products are stored bulk wise till they are started packing and loading to packing machines. The products are stored in the section till they are given filling permission. The filling permission is given after confirming the product quality by the Quality assurance section.

In the complete project of minimizing wastage, the research was conducted parallel to arrest the waste points and conduct treatments at Tote bin room.

The area included into tote bin room consists of powder loading machines called Tote Tilts and space to store powder bins.

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The Tote Tilts are used to maintain continuous supply to filling machines and filter the unauthorized particles in the products.

The research is conducted on minimizing wastage in the Tote Bin room. Inside the Tote Bin room, powder waste generation is a critical problem faced by the factory. This report is based on the research that was conducted to identify effectiveness and any other improvements gained by the modifications conducted with focusing acting against waste generation.

The primary objective of the research is to identify the points of waste and effectively evaluate the actions taken in order to minimize the production wastage. In order to eliminate waste, the company focuses on more targets as;

- Required more modifications to meet the zero waste policy
- Capability of reducing manpower used in the operations
- Reducing machine downtime as it helps company to work more time than the present
- Employer preference over job and responsibility

LITERATURE REVIEW

What is waste?

In general waste includes all items that people no longer have any use for, which they either intend to get rid of or have already discarded. Additionally, wastes are such items which people required to discard (Eionet, 2005).

But the earlier explanation is no longer valid in modern world as today it considered waste as another source of generating value in green production and other later metrologies.

Many items can be considered as waste. Wastes are mainly made out of households, commercial activities, agriculture, construction, demolition projects, mining and quarrying activities and from the generation of energy. With such

vast quantities of waste being produced, it is of vital importance that it is managed in such a way that it does not cause any harm to either human health or to the environment (Eionet, 2005).

There are a number of different options available for the treatment and management of waste including prevention, minimization, re-use, recycling, energy recovery and disposal.

What is waste minimization?

Waste minimization is a waste management approach that focuses on reducing the amount and toxicity of hazardous waste that is generated. Waste minimization techniques that focus on preventing waste from ever being created (source reduction), and recycling. There are three general methods of waste minimization:

- Source reduction: Reduce the reasonable materials and activities effects to waste
- Recycling; Reuse waste by reproducing or transforming into any other useful thing
- Treatment; Conduct activities to makes waste, not or less harmful to environment

Waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is also carried out to recover resources from it. Waste management can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each.

Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. Management for non-hazardous residential and institutional waste in metropolitan areas is usually the responsibility of local government

authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator. (Office of Environmental Health and Safety, 2005)

Why is waste minimization important?

Waste minimization is important because it helps to protect the environment and it makes good business sense. Waste minimization saves money through avoided disposal costs, time through reducing time for treatments and recycling, creates safer working conditions for employees and protects human health and the environment

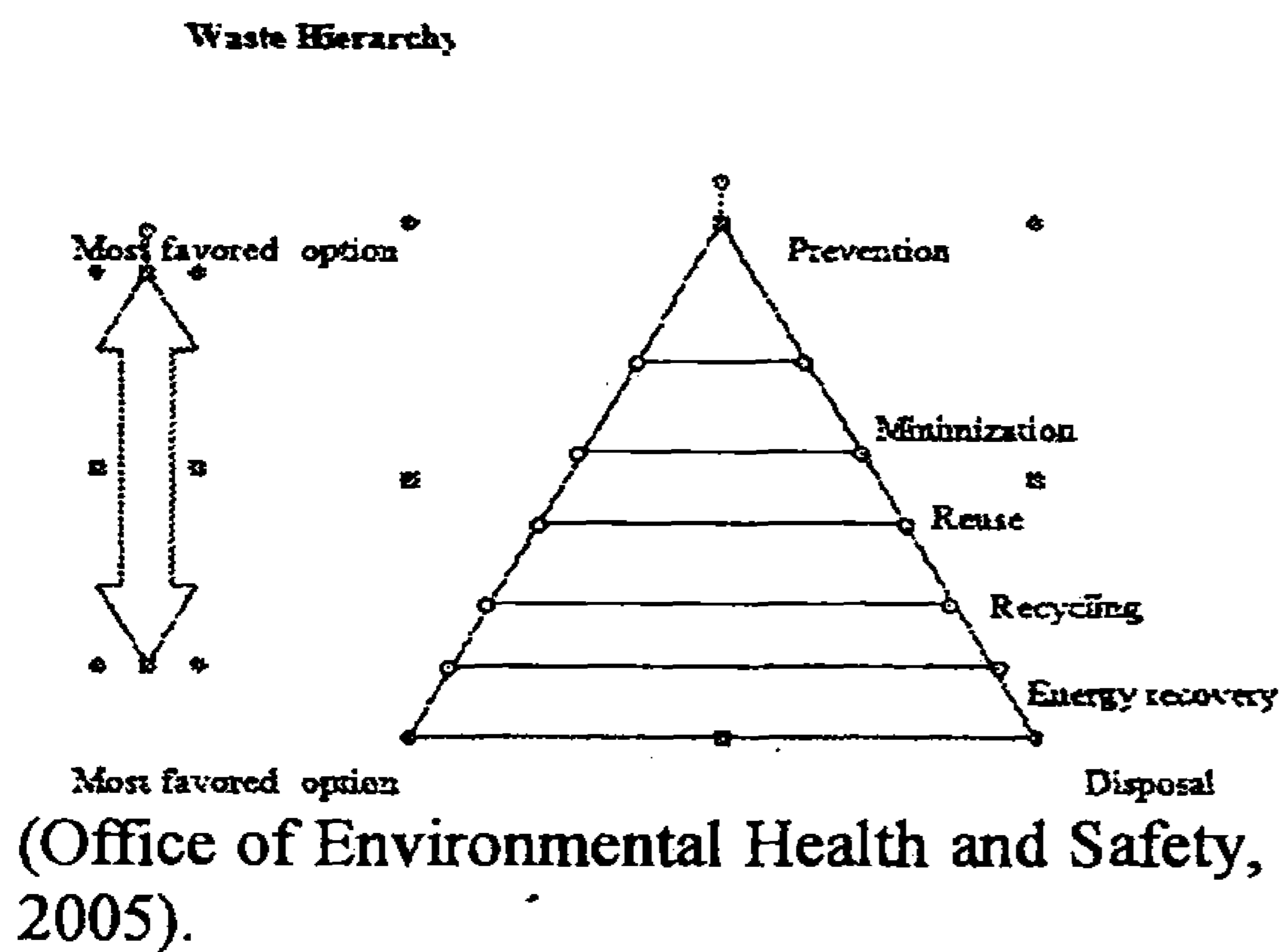


Figure 1: Waste Hierarchy

RESEARCH METHODOLOGY

According to the issues found, the research was designed as a model similar to 'Applied Research' type. Because this research would try to identifying problems in tot bin room and try to improve the productivity of work processes through giving feasible solutions.

The research was conducted in the following ways. They are,

- Data study: Study data were collected by the company itself on wastages and the records they maintained.
- Survey: Conducted a survey to identify the problems that are not discovered yet. This was done by having group and individual discussions with operators

and maintenance team. Self investigations were also used and take a part of the operations conducting at tote bin room.

In data collection, the secondary data was referred, which was collected by the company itself about the waste of production. Total waste was calculated and they were recorded to get an idea about the saving due to modifications.

But the waste amounts were not measured separately. In order to overcome that problem, the formula was developed to calculate the cost of waste. To create the formula, it was used the cost at the stage of product and the amounts of total products handled inside the section. To calculate the general cost of waste production, the following equation was used.

$$\text{General Cost of (unit of production)} = \frac{\left(\left(\frac{\text{Cost of Product 1}}{\text{Product 1}} \right) \times \left(\frac{\text{Amount of Product 1}}{\text{Product 1}} \right) \right) + \left(\left(\frac{\text{Cost of Product 2}}{\text{Product 2}} \right) \times \left(\frac{\text{Amount of Product 2}}{\text{Product 2}} \right) \right) + \dots}{\text{Total amount of production}}$$

Equation 1: General Cost of product waste

As there were several products in production process, following table structure were used to summarize the data. The format was filled using equations 2 and equation 3.

Table1: Table of calculating the general cost of production waste in the section

Product	Amount of production in the date	Percentage of production in the date	cost of product at the point	Weighted cost of product
Product 1	***	****	****	****

$$\text{Average Cost of Waste} = \sum \text{Weighted cost of Product}$$

Equation 2: Average Cost of Waste

$$\text{Weighted cost of waste} = \left(\frac{\text{Percentage of production in the date}}{\text{date}} \right) \times \left(\frac{\text{Cost of product at the point}}{\text{the point}} \right)$$

Equation 3: Weighted Cost of Waste

General cost of waste production was used to check the feasibility of proposing modifications to minimize the total waste and to find the payback periods.

As the second method, self inspection was used. In order to conduct inspections, researcher involved with the operations which carried out inside the tot bin room and the waste point details were collected with the help of the employees. After identifying the issues and the reasons for these wastes at wastage points, employees who work in this section were interviewed to collect further information.

Initially, employers were interviewed informally with discussing about the conductance of the section and the problems. The result of the first interview was used to collect the details about the waste points. Further, this was conducted parallel to the self inspections.

Secondly, employees were interviewed formally after completing the modifications. The second interview was conducted to get the employee feedback on the modifications.

The next interview was conducted based on several questions and those questions were focused on main modified points. When preparing interviewing questions, highly affected modifications for reduce waste were concerned.

Through this study, evidences have been identified to get understand the possibilities whether to conduct or not to conduct the modifications for rest of the machines. Due to uncertainty of the effectiveness of the identification and the higher level of cost involvement, trial modifications were conducted to one machine and checked the effectiveness of the modifications with the help of employees.

Further improvements on working conditions or on working efficiency were identified regarding the modifications. Interview was used to get the user feedback on modification.

DATA PRESENTATION AND ANALYSIS

Through the initial inspections at the process of tot bin room, following issues were identified which cause for a waste.

- Broken nuts and bolts effects to waste
- Leaks of tilt gaskets
- Connector leakages
- Sieve leakages from the from the shifters
- Problems with Tote bin gaskets
- Problems with tote Tilts effect to waste

Secondly, following problems were also identified as root causes for the above wastage.

- The problems of Shifters
- Problems with Tilt gaskets
- Problems with bin gaskets
- Problems with Tote Tilts
- The broken parts of the machine

These results were used to give priorities for the modifications. Priorities were given by considering wastage by the point and the capability of control. And the modifications were conducted stepwise.

Among the above listed problems, the problem of shifter was identified as the major reason for wastage. The shifters were used to filter the products and to stop entering foreign bodies to the filling line as it makes heavy safety problems for final products. Due to the shape of the shifter, number of problems was encountered. They were

- Problems of cleaning: This problem was found due to the shape of the shifters. As the corners were not well open, the products were left at the corners and removed when cleaning

- Waste minimization is important because it helps to protect the environment and it makes good business sense. Waste minimization saves money through avoided disposal costs, time through reducing time for treatments and recycling, creates safer working conditions for employees and protects human health and the environment

Effects to spills: Due to the shape of the

shifters the high pressure was found at the corners of the shifters. Due to that pressure the products spill from the edges

- The shape of the sieves: Due to the shape of the sieve the products were spilt out from the shifters

As this was the major reason for the problem found, it was decided to modify the shifter. The nearly example for such modification was found in a newly implemented shifters in another production section. Thus, it was decided to follow those modifications for the shifters here.

RESULT AND DISCUSSION

Modification Cost Evaluation

The average cost of waste is Rs.15,182.45.

The average cost to modify a machine

Shifter modification = Rs. 115,000.00

Tilt gasket replacement =Rs.3,850.00

Tilt modifications = Rs.1,500.00

Other modification = Rs.2,000.00

Total cost of modifications =Rs.122,350.00

As there were eleven Tilt machines were there the expected total cost for the project is

$$= \text{Rs. } 122,350.00 \times 11$$

$$= \text{Rs. } 1,345,850.00$$

At the first target of the project, it was targeted to minimize the waste by fifty percent with the modifications conducted. Therefore it was assumed as the waste will reduce by fifty percent and check the feasibility of the project. In order to check the feasibility the recovery period was considered.

Thus;

Targeted saving due to modification per week = Rs.15182.45 × 50/100

$$= \text{Rs. } 7591.23$$

The recovery period

$$= 1345850.00 / 7591.23$$

$$= 178 \text{ weeks}$$

$$= \text{Approximately } 3 \text{ years \& } 6 \text{ months}$$

Based on above calculations, it takes nearly three years and six months to recover the expenses of the modifications. Even the

recovery period was high, the project was accepted due to long-run process conductance in that section and as it helps to meet accepted quality standards.

By considering the overall analysis, it was found that the conducted modifications effects to reduce the waste at the section. But, it is required to reevaluate whether it was able to meet the secondary objectives of the research.

- Required more Modifications

It was not able to identify any more modifications than the previously identified modification with the shifter. Therefore it can be taken as evidence to conform that the conducted modifications have met the primary objective.

- Capability of Reducing Manpower

Due modifications, presence of two employees were become compulsory for the section. That was emerged with the shifter modifications. As it was not possible to fix a shifter by a single person that requirement was emerged.

- Reducing Machine Downtime

Even the employees found it easy to work with new modifications; it was not shown any significant sign of reducing the time taken to fulfill work in the section. Therefore, that requirement was also not fulfilled with the research.

- Employer Satisfaction over Job and Responsibility

Even the time reduction was not met, there were signs of increasing the employee satisfaction with the conducted modifications. As it reduced employee responsibilities, it was easier for them to work than earlier.

As they are still using the old machines which were installed at the establishment of the factory, some of those machines need major modifications. But due to fix types of the machineries and the heavy expenses to conduct modifications, the management is reluctant to go for major modifications. Therefore, approved examples were required to conduct modification in order to minimize the waste.

Wastage and productivity has inverse relationship and by reducing wastage productivity can be improved. Therefore, this research was conducted to identify the capabilities of minimizing wastage through minor modifications. As the problems with the sections were identified, there was an uncertainty of the effectiveness of the actions to be taken. Therefore it was conducted to one machine and checked the effectiveness of the modifications with the help of employees.

According to the analysis results of interview, the modifications had been accepted by the employees and highlighted few more required developments. But with meeting the company policies and regulations those modifications were cancelled by the management.

While considering the problem emerged while conducting the research, the major problem was the time taken to conduct modifications. As they have to follow an agreed procedure to do some piece of work, it was impossible to speed up the work more than that.

According to the results, the tested modifications were capable enough to overcome the present problems and these modifications fit to any kind of product handled inside the factory. As a result of research findings, organization was able to achieve expected targets.

Due to the modifications conducted, the production wastages were minimized to a certain level. And that level of reduction is acceptable. But all modifications have not answered the questions in the same way. When consider the modified adjusters, only few people were used that devices. Thus, it was very difficult to get a clear idea on it as they were not familiar with that modification. This implies that the conducting modifications should not be complex. Any of the employees should be able to handle them. Therefore proper plan should be conducted to overcome such situations.

When considering reducing down time, the research has not well answered the problems. As the research discovered, the cleaning time was not changed much due to modifications but the cleaning was found easy and it implies without a plan focused specially on reducing cleaning time. It is difficult to achieve number of goals exactly through common modifications.

While considering the recovery period of the expenditure, this kind of project was not much successful as it takes long period to recover the cost. But due to comply with the organization policies and the reputation gain by the organization, the effect of the recovery period was able to be ignored.

CONCLUSION

This article concludes the modifications based on the knowledge gain through experiences are effective on reducing the wastage to an acceptable level. Also it helps to increase the commitment of the employees over their work place. But to gain the maximum benefits through the modifications, organization should be planned to make it familiar to the employees especially when the modifications are complex.

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