

An Investigation on Downtime Minimization Techniques for Sri Lankan Textile & Apparel Industry

Nisayini K¹
Mr. Deegahawathura MMDR²

ABSTRACT

This research is focused on determining downtime minimization techniques, which would enable the organization to improve their productivity by utilizing man and machine factors at work. The research is concerned with some of the most important factors which cause for downtime such as labor absenteeism, machine breakdowns and style changes. This research is an applied research, used both quantitative and qualitative data. This research used both primary and secondary data resources to approach the research problem. A literature review was done to study the background of the research objective. A questionnaire was provided to operators to identify the causes for labor absenteeism. Also the managers, supervisors, operators and mechanics were selected and interviewed and the issues in relation to machine breakdown and style changes were discussed and identified. Finally, a comprehensive quantitative and qualitative analysis was performed to identify hidden points. The result of this research revealed several problems, with regard to downtime. Finally, effective solutions were identified based on the result of the analysis and feasibility study.

KEY WORDS: Downtime, Labor Absenteeism, Machine breakdown, Productivity, Style changes

INTRODUCTION

Garment industry has an important place in Sri Lanka's economy. It has become Sri Lanka's largest export industry since 1986. It is also the country's largest net foreign exchange earner since 1992. The contribution to the Gross Domestic Product (GDP) was 5.3 per cent in 2002 (Rupa Dheerasinghe, 2002).

Hands International (Pvt) Ltd is one of the leading garment companies in Sri Lanka. The company produces garment exclusively for exporting. It has two divisions as gloves and intimates. With more than 15 years experience the factory is situated in Sri Lanka, manufacturing and supplying quality products all over the world.

¹Graduate, Department of Industrial Management, Faculty of Applied Sciences, Wayamba University of Sri Lanka

²Senior Lecturer, Department of Industrial Management, Faculty of Applied Sciences, Wayamba University of Sri Lanka

Hands Intimates, the division where the research was carried out is a manufacturing, accessorizing & value addition unit of Hands Group of Companies. The products of this division are ladies, men's and kids underwear. They work on some of the leading brand names in intimate wear for global market.

RESEARCH PROBLEM

Table 1: Details of Downtime

Month (2009)	Total Worked Hours	Utilized Hours	Downtime Hours
June	42360	35370.60	6989.40
July	45021	35971.78	9049.22
August	50298	43960.45	6337.55
September	50548	41449.36	9098.64
October	54518	44977.35	9540.65
November	51435	42588.18	8846.82
December	50024	41820.06	8203.94

Downtime causes for significant problems for the company. Mainly it affects the productivity. The table 1 shows the gap between total worked hours and the utilized hours and shows that there is considerable amount of downtime or unused time at production flow. This unused time causes

for loss of production, downgrade and loss of valued customers. The main effect of the downtime is additional cost to the company. Therefore this research was carried out to identify the root causes of downtime at the production flow. Hence the management could be able to get rid of the problem and improve the productivity.

RESEARCH OBJECTIVE

The objective of this research was to identify the factors influencing downtime, major factors cause for major losses and propose techniques or strategies to avoid or minimize downtime.

LITERATURE REVIEW

Downtime costs millions of dollars each year in lost production, downgrade, and loss of customers (George Meek, 2006). It is important to identify the causes of downtime and correct those problems. Many facilities do not measure downtime and if they do, they often miss opportunities that can help the plant in larger ways than correcting one downtime event. Also downtime analysis helps to improve the productivity of the plant.

Labor Absenteeism

Absenteeism is said to be there when an employee fails to come work when he is scheduled to work. Excessive absenteeism involves a considerable loss to the enterprise because work schedules are interrupted and delayed, and management has to pay higher overtime wages to meet the delivery dates. In order to identify the causes and extent of absenteeism, proper records should be kept in respective departments for various causes of absenteeism with respect to age, sex, days of the week and classes of jobs. The evaluator of the personnel program should classify the data relating to absenteeism and try to analyze the various causes of absenteeism. Generally, the reasons accountable for absenteeism at work are

nature of work, poor working condition, absence of regular leave arrangement, accidents, poor Control, irregular transport facilities, lack of interest and miscellaneous causes include such factors as Alcoholism & Gambling Habits, bad weather, another job, personal business, friends visiting from distant locations, absence of strict discipline, willful disregard of rules, religious and social festivals, etc.

When considering the cost of absenteeism on average,

$$\text{Added cost due to 1\% absenteeism} = \frac{\text{Non-productive man-hours}}{\text{Productive man-hours if no absences}}$$

$$\frac{1 \text{ man absent (1\% x 100 men) x 12 man-hours}}{100 \text{ men x 8 hours}}$$

$$= 0.015 = 1 \frac{1}{2} \%$$

(Construction Industry Cost Effectiveness Project Report, 1982)

Setup and Changeover Time

The main goal of set up reduction is to reduce machine downtime. Reducing set up time will boost the company's capacity, increase manufacturing flexibility and help increase overall output (Keberdle, 2008). While the operator or technician scurrying around to change tooling from one job to another, that machine operation is idle. The customer will continue to demand different features and options of products. It is impractical to make and hold these various products in inventory. Lot sizes will also decrease because the customers are also managing their businesses more efficiently. Therefore this leads to more lost production time between jobs. Thus through some proven methodology the organization can apply to reduce set up or changeover time. By reducing setup and changeover time the company can achieve benefits as shorter lead time and increased capacity, capital equipment purchases avoided or delayed, better quality/ more-consistent processes, lower manufacturing costs and improved

cash flow, fewer inventories, increased flexibility, better workforce utilization and less process variability (Keberdle, 2008).

Machine Breakdown

There are several types of maintenance. Daily maintenance is performed by maintenance department on each piece of equipment as indicated on the daily checklist (Stiemert, 2003). When considering the periodic maintenance, the maintenance schedule is carried out daily by maintenance personnel for equipment due for maintenance (Stiemert, 2003). Maintenance is performed on the equipment by maintenance personnel or other designated individuals as indicated on the instructions for each piece of equipment and this is known as perform maintenance (Stiemert, 2003). In record maintenance the maintenance is recorded by the person performing the maintenance on the appropriate log or checklist after the work is performed (Stiemert, 2003). Preventive maintenance is predetermined work performed to a schedule with the aim of preventing the wear and tear or sudden failure of equipment components and the exploratory maintenance helps to anticipate and prevent breakdowns (Industrial Accident Prevention Association, 2007).

RESEARCH METHODOLOGY

Research design refers to the distinctive and specific approach best suited to answering the research question. This research is an applied research since it investigates practical issues that have implication for work. This research is based on both qualitative and quantitative data.

This research has been design in several steps. The first step of this research was to analyze the processes with the aim of identifying causes for downtime. Then analyzed the root causes for the downtime of the critical process. The literature review and study of theories helps to provide with clear background of research problem. The

next step is data collection. First a sample was selected from the production flow. Among fifteen production lines, nine lines which worked on same style were selected and observed (Style - HOT PANT) to collect data. This research used both primary and secondary data. Secondary resources included data, which have already been collected for other purposes, but help identify solutions to the research problems (Malhortra, 2004). The secondary sources of data gathered from company records. The primary data was created specifically to address this research problem and to reach the objectives of this research (Malhortra, 2004). This research has used structured interviews, questionnaire and observation as primary data collection tools.

The questionnaire was designed specifically to measure the workers attitudes about their jobs and to investigate underlying causes for absenteeism. Structured interviews were conducted with randomly selected workers to identify the problems related to machine breakdowns and style changes. The total downtime hours (Idle Hours) and labor productivity were calculated, using company records.

Data analysis was carried out using statistical tools and this research mostly used descriptive statistics. With the use of pie chart the critical cause for downtime were identified. The questionnaire was designed using Likert scale with a five response scale and the answers were tabulated. By analyzing mean and standard deviation, the critical causes for labor absenteeism were identified. Through the qualitative analysis of interview results the causes for machine breakdown and setup and changeover time were identified. Also scatter diagram and correlation coefficient were used to show the relationship between productivity and downtime. As a result of analysis the root causes for downtime were identified and alternative solutions were provided.

DATA COLLECTION AND ANALYSIS

According to the research objective, data were collected in relevant to downtime of production lines and labor productivity. Also various reasons for downtime and the amount of downtime happened for each reason was noted. During the observation period, downtime of each lines were collected and the summary of is shown in Table 2.

Table 2: Downtime of Observed Period

Total Worked Hours	37468
Downtime Hours	6612
Downtime %	17.65%

During the observed period a data sheet was distributed to production lines and through that the causes for downtime were identified. A summary is shown in Table 3.

Table 3: Causes of Downtime

Causes	Downtime(Hours)
Labor Absenteeism	3764.16
Machine Breakdowns	46.75
Style Changes	432.70
Rework	227.50

The focus of the research is to identify downtime minimization techniques. When the downtime increases the productivity of the company goes down. Therefore it is important to show the relationship between productivity and downtime. With the company data the labor productivity was calculated. To check the correlation between downtime and labor productivity, Karl Pearson correlation coefficient was applied. Pearson correlation of Labor Productivity and Downtime is -0.796. Furthermore the following scatter plot shows the relationship of productivity and downtime.

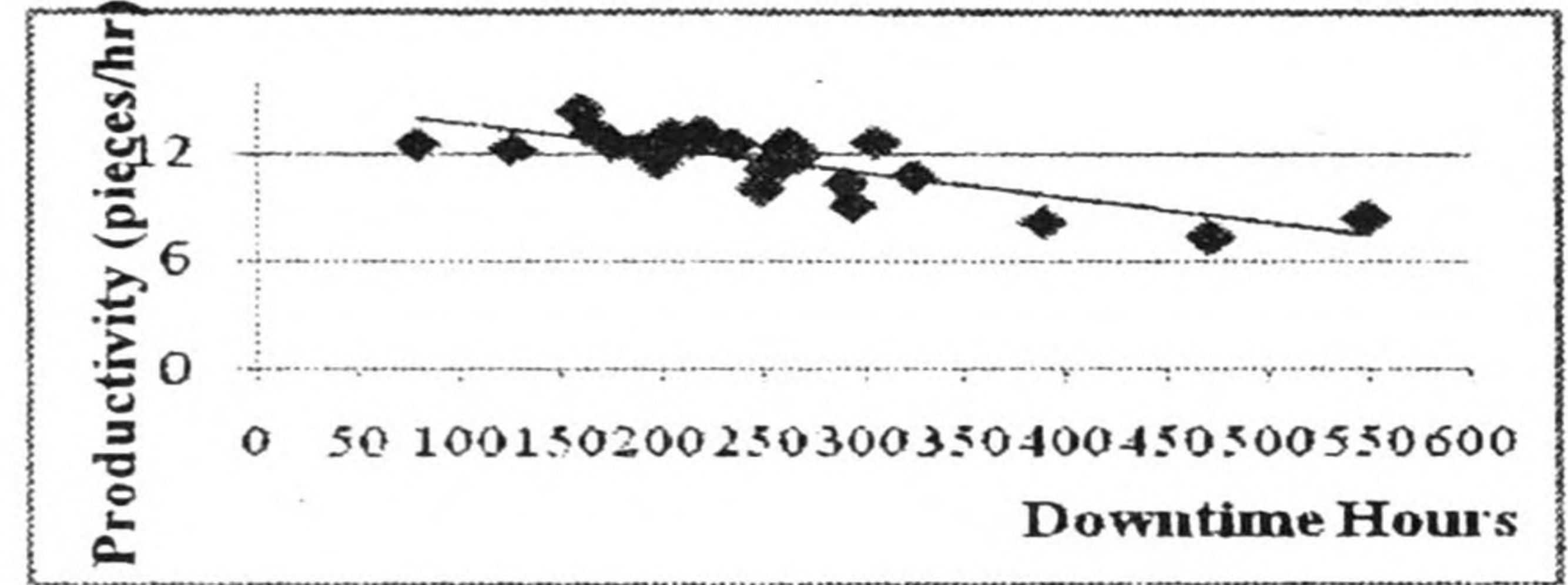


Figure 1: Scatter Plot of Labor Productivity Vs Downtime

The following pie chart shows the causes for downtime with their percentage.

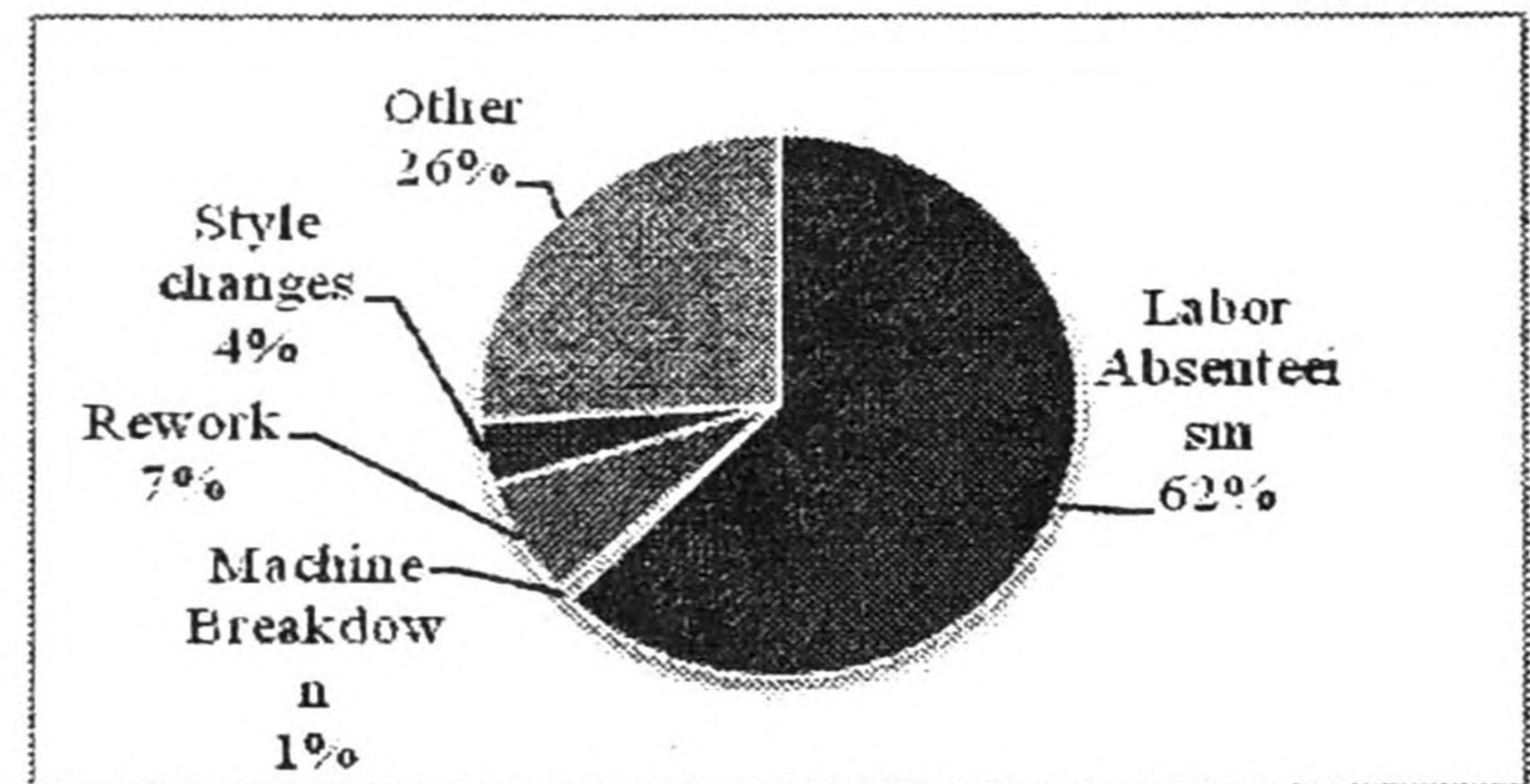
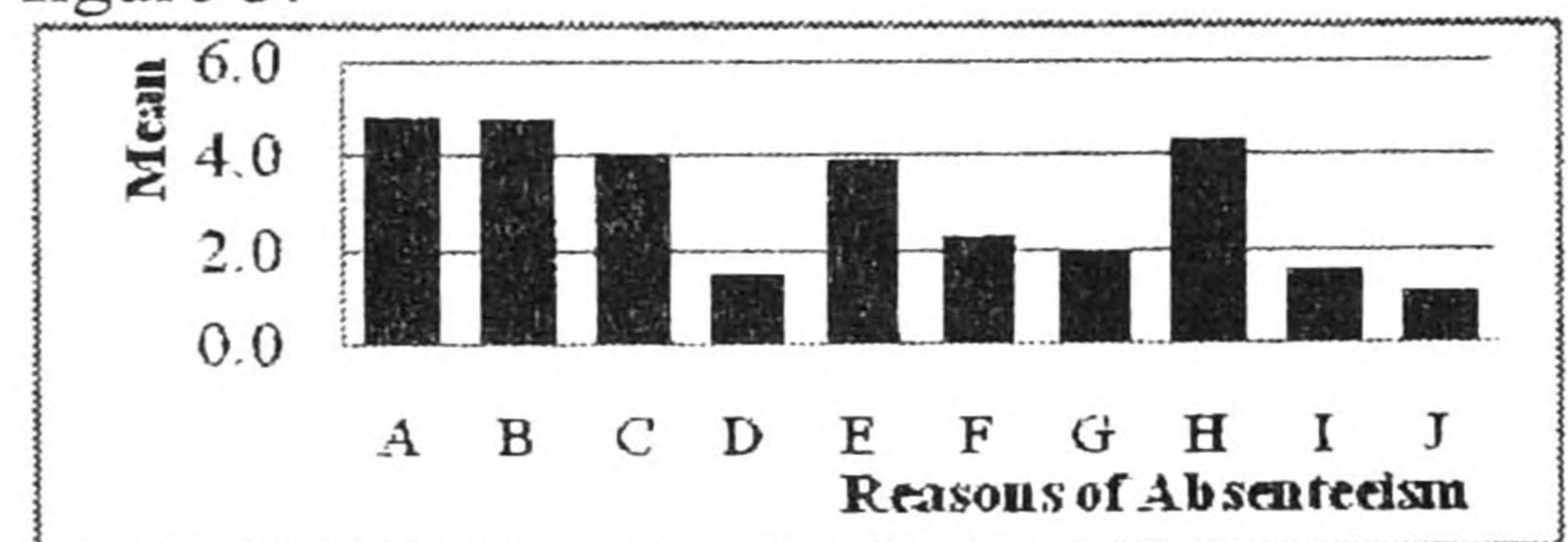


Figure 2: Causes of Downtime

The chart explains that, 62% of downtime occurred due to labor absenteeism. Therefore in next step the reasons of absenteeism were analyzed to identify which reasons severely cause for absenteeism through the results of questionnaire. The results are indicated in figure 3.



A Sickness	F Poor Working Conditions
B Personal Reasons	G Poor Working Environment
C Long Working Hours	H Absence of Regular Leave Arrangements
D Lack of Interest in Job	I Industrial Accident
E Monotonous Job	J Irregular Transport

Figure 3: Absenteeism Causes Analysis

RESULTS AND DISCUSSION

According to the scatter plot (See figure 1) the downtime and productivity has negative relationship. As a result it can be concluded that higher downtime causes for lower productivity. Therefore it is important to find the causes of downtime. Through the data analysis, it can be concluded high percentage of the idle time can be taken place due to absenteeism (62% of total downtime). Table 4 shows the critical factors which cause for labor absenteeism in descending order of importance. Other than absenteeism there are so many other causes for downtime such as rework, style changes, machine breakdown and some other miscellaneous causes. The rework factor was not analyzed further since the company implemented a method for reducing rework throughout the research period. So it is pointless to consider that factor further.

The other factor includes miscellaneous causes. This contains the factors of downtime which are not frequent. Also contains factors which time values are difficult to obtain. So this research did not consider those factors even they have higher percentage value. Also the duration for the research was not enough to analyze all factors intensely.

Table 4: Causes of Absenteeism

Reasons	Mean	SD
Sickness	4.9	0.36
Personal Reasons	4.8	0.41
Long Working Hours	4.1	0.76
Monotonous of Job	3.9	1.26

Through the qualitative analysis of interview result the causes of machine breakdown and style changes were identified since they are frequent events at the production flow. Higher internal activities and poor planning cause for setup and changeover time. Maintenance procedure and recording system is there but those are practically not happen and no one follow them properly.

When considering reduction of absenteeism, an incentive provides an

employee with a boost to their motivation to avoid unnecessary absenteeism. The incentive program should be created especially for particular company. Also the frequency of the program should be considered when developing the program. Absenteeism is essentially related to individual behavior and can be better tackled through guidance and counseling. If the workers will be given proper education and orientation with respect to absenteeism, it can be reduced. Effective supervision also helps to reduce absenteeism. Absenteeism will be at low level if the supervisors are able to win the confidence of workers. Workers absent to work due to monotonous of job as well. Job rotation program helps to tackle this problem. Job rotation can keep the employee interested in his work. Employee does not feel "stressed" out from the job; work does not become monotonous and creates multi-skilled workers. Working long hours affects the health and well-being of employees and this cause for absenteeism. Overtime can be the most economical way to meet various shortages. However the company has to think about the well-being of employees while considering the profit. Therefore it is very important to develop an effective plan for overtime. Planning should include assessing the reasons for overtime and evaluating alternative methods of eliminating or coping with it other than preparation of an annual budget for overtime.

Setup and changeover time can be reduced by converting internal activities to external activities where possible. Internal activities are those that can only be performed when the process is stopped, while External activities can be done while the last style is being produced, or once the next style has started. That means, before feeding a new style, do all the possible work. If there are additional machineries, the company can get ready for new style before starting it. However this is not possible at all time. Therefore, machines can be pre-setup only for critical setups which

take too much of time. New styles sometimes can have different or critical operation than older. Therefore too much of time can be spent for line feeding. It is better if it is possible to train or practice operators on those operation before starting the new. When there is a repeated style, assign the style to the lines which have experience in same style. Therefore the changeover time will be reduced since the operators familiar with that style. Another solution is close-up plan. Close up plan is a plan which should be designed before starting a new style. This allocates time for the operators for the setup and changeover to new style. If the line works according to this pre-plan it should be able to control the time.

The downtime due to machine breakdown can be reduced by following the maintenance procedure and proper recording system. Under maintenance both daily and periodic maintenance should be considered.

Other than these causes another major problem is that not exposing the downtime in real time. A key principle of manufacturing states that if you don't measure it, you can't correct it. Hence this is one of the grounds for any type of downtime. The simplest method to track downtime is where an operator simply fills in a log book noting what happened, what was done, and how long they were down.

All the above solutions were not feasible for implement since the company is not feasible in all areas. To reduce downtime first of all it is important to create awareness among workers on downtime. The awareness can be created by tracking and exposing downtime. This will not require additional cost or additional workers. It can be implemented by the supervisors and also does not require special training. Controlling labor absenteeism is very important to this company. This can be done through proper attendance policy and effective supervision and it is a benefit to the company since it does not need additional money, additional workers. Through proper training to workers, the

setup and changeover time can be reduced without any additional cost and workers. Proper planning also helps the organization to reduce downtime. As mentioned earlier the machine downtime can be reducing by following maintenance procedure without additional cost.

CONCLUSION

This research paid attention on identifying downtime minimization techniques. A root cause analysis was conducted and as a result the factors cause for downtime was identified. Labor absenteeism is the critical factor which highly cause for downtime of the selected organization. Moreover, machine breakdowns and setup and changeover time were considered as the causes for downtime in this research.

The major causes for labor absenteeism were sickness, personal reasons, long working hours and monotonous of job within the organization. The absent due to illness and personal reasons are unavoidable. However, by some effective ways, it is possible to get them back to work as fast as possible. Effective supervision and good attendant policy will help the organization to reduce absenteeism. The changeover time cannot be avoidable totally. However it can be reduce by proper planning of style and manning pre setups. The downtime due to machine breakdown can be reduced by following the daily and periodic maintenance procedure. Also proper recording system is important to keep track on breakdown.

The company can avoid production bottlenecks if they can control downtime. This research found the most important root causes of downtime which were happen at the production flow of the company. In addition, best effective solutions for those problems were recommended. If the company concentrates on these factors properly, they can control the downtime to great extend. However this cannot be achieved alone by the effort of management.

Therefore the support and involvement of each and every worker is salient in this exercise.

REFERENCES

BOOKS

- Malhotra, N.K. (2004). Marketing Research: An Applied Orientation, 4th Edition, Upper Saddle River, NJ: Prentice Hall

ONLINE CITATIONS

- Charles F. Keberdle, CPIM (2008) "Reducing Machine Setup & Changeover Time" Online available at w3.manuvis.com/wp.../reducing-machine-setup-white-paper.pdf (Retrieved November 25, 2009)
- Construction Industry Cost Effectiveness Project Report (June, 1982) "Absenteeism and Turnover" Online available at www.curt.org/pdf/149.pdf (Retrieved November 10, 2009)
- George Meek, Evergreen Engineering Inc., (January 17, 2006) "Up-Time and How to Reduce Downtime" Online available at cmms-software.com/articles/Up-Time.pdf (Retrieved December 20, 2009)
- Industrial Accident Preventive Association (2007) "Preventive Maintenance" Online available at www.iapa.ca (Retrieved November 10, 2009)
- Neal D. Stiemert (February, 2003) "Preventive Maintenance" Online available at www.qcinspect.com/article/prevmain.htm (Retrieved November 28, 2009)
- Rupa Dheerasinghe (2002) "Garment Industry in Sri Lanka Challenges, Prospects and Strategies" Online available at www.sljol.info/index.php/SS/article/view/1246/1141 (Retrieved December 15, 2009)