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Modeling Laying Time of Gerber Machines in Cutting Department: A Study on Sri Lankan Apparel Industry

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Abstract

Providing the required cut panels to the sawing department on time, is the major task and responsibility of the cutting department of an apparel manufacturer. Therefore, the cutting process is one of the main value adding processes. Several functions are included in the cutting process; namely fabric laying, cutting and bundling of cut panels. Since other processes are depended on the fabric laying, it plays a crucial role. This study attempts to develop a model to determine the fabric laying time of Gerber machines used in the cutting department. First the factors that affect to the lay time are identified. The actual times taken for each of these factors are collected for non-woven trouser patterns for a period of month totaling 89 data points. Descriptive statistics, correlation analysis and multiple regression analysis are used to analyze the data. Overall, the results show that six factors out of identified seven are significantly useful in predicting total lay time. Particularly, the results of the regression analysis indicate that at a $\alpha=0.01$ level of significance, loading time, damage check time, joint time, preparation time, reverse time and cutting time are significantly contributing to total lay time. The regression model has an overall accuracy rate of 79.2 percent.

Keywords: Cutting Department, Cutting Process, Fabric Laying, Fabric Laying Time

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Introduction

The Textile and Apparel industry occupies a prominent position in Sri Lanka's industrial structure. It is the biggest employer in manufacturing sector and it is considered as Sri Lanka's number one foreign exchange earner. The Textile and Apparel industry is not merely a type of industry in Sri Lanka but it represents the major economic, political and social changes that took place in the country.

After the independence the government's held the rein of the country made attempts to initiate industrial activities. After the introduction of open economic policies in 1977 the outlook of the industry was totally changed within an export-oriented strategy. Since the late 1970s the industry gradually acquired the relative importance of traditional agricultural exports and became the highest export earner by the mid-1980s (Tennakoon, 1999). The total industrial exports account for approximately 77% of the total exports while textile and Wearing Apparel industry solely accounts for 67% of industrial exports.

Research Problem

At present laying process time is calculated using analytical estimating and mainly based on management decisions. The measurement is called SMV (Standard Minute Value). This calculated laying times is used by the production department to plan their production. This value must be accurate since otherwise lay plan will not tally with the plan of the production department. Then the cutting department will be unable to provide the required cut panels to the production modules in time. It is important to have an accurate system to calculate cutting process time in order to have a smooth flow of the work in the cutting department and also in the production department. Figure 1 illustrate the difference between actual lay time and calculated lay time (SMV).

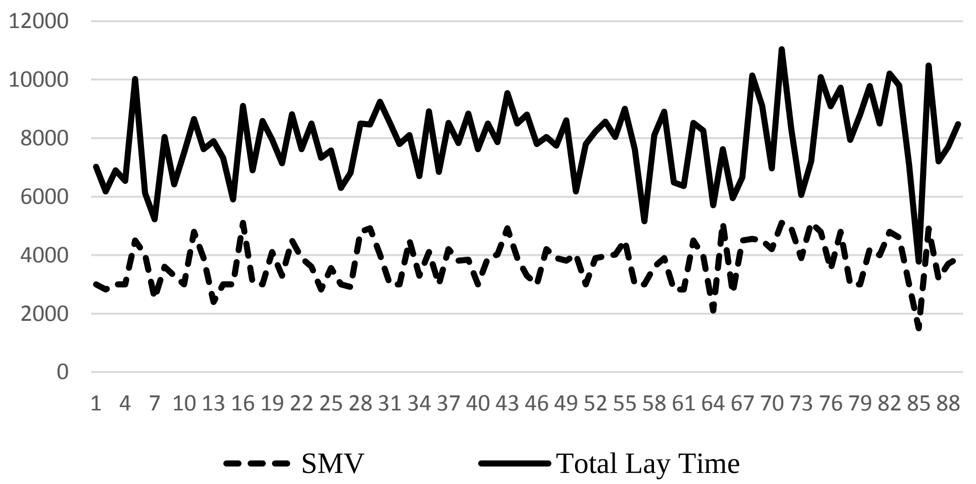

Figure 1- Difference between Actual Lay Time and SMV

According to the Figure 1 there is a considerable deviation in actual lay time and the SMV. In above figure X-axis represent the Observation number. Many times, SMV is lower than the actual lay time. The reason is that some significant factors may be neglected when measuring the SMV. The research is conducted to reduce the gap between SMV and actual lay time and to find the factors which affect to the total lay time.

Research Objectives

This research attempts to develop a model to determine the fabric laying times for a cutting department of an apparel manufacturing company. The model can be used to calculate the fabric lay time and it can be further used to develop incentive schemes for the cutting department.

Literature Review

According to the definition of Sarkar (2013) cutting process includes three major functions. The functions are, fabric laying (spreading), cutting and bundling of cut panels. Ganvir (2014) defines that, cutting system is a process which cut out the pattern pieces from specified fabric for making garments.

Spreading / Laying Process

Fabric spreading is very important part of the production process because it is the basic point for obtaining a high quality final product. According to Ganvir (2014), spreading is the process of unwinding large rolls of fabric onto long, wide tables in preparation for cutting each piece of a garment. The number of layers of fabric is dictated by the number of garments desired and the fabric thickness. Spreading can be done by hand or machine. Depending upon the fabric and cutting technology, up to 200 layers of fabric may be cut at one time. Fabrics that are more difficult to handle are generally cut in thinner stacks

Fabric Spreading Objectives

In his study Abu (2014) states that there are number of specific objectives a fabric spreading process must achieve. Some of the important objectives are as follows.

To place the number of plies of fabric to the length of the marker plan correctly aligned as to length and width and without tension.

1. To cut garments in bulk and saving in fabric through the use of multi garment maker plans and the saving in cutting time per garment that result from cutting many plies at a time.
2. To make every ply plain and flat.

Methodology

Literature Review relieved the factors affecting the total lay time. Accordingly seven factors were identified and the research framework employed in the study is presented in Figure 2. As depicted in the Figure 2, fabric length, loading time, joint time, reverse time, cutting time, damage checking time and preparation time are the independent variables in the model. The dependent variable is laying time. The data for fabric length and number of plies extracted from the company records and to collect the data for the remaining independent variables a data collection form was designed, using observation method the data were collected over a period a month starting from 09/11/2014 to 10/12/2014. All the times were measured in seconds.

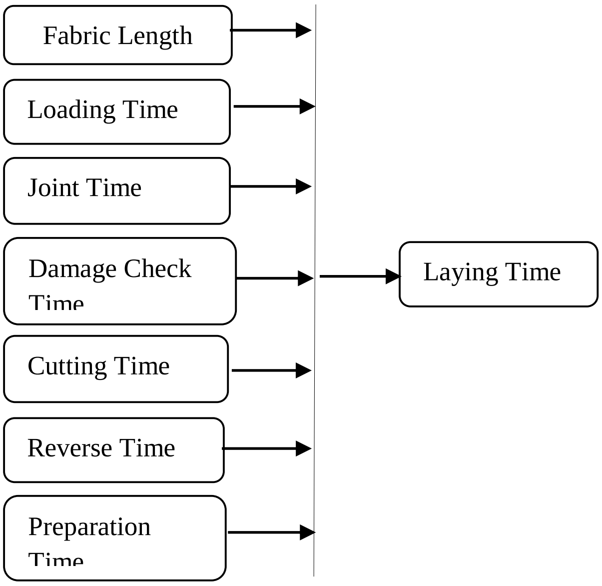

Figure 2- Research Framework

Data Collection and Analyzing

Based on the variables that were identified in the research model, the analysis was carried out and the summary of the results is given below.

To analyze the data, descriptive statistics (mean, median, mode, standard deviation etc.) are computed to describe the variables interested in. Further, a correlation analysis was performed to investigate the association of each independent variable with the dependent variable at bivariate setting. Finally at a multivariate level, that considers all the independent variables simultaneously, multiple regression analysis was performed to develop a model capable of predicting laying time.

Table 1: Summarize Values

Variable	Mean	Median	Mode	Std Dev.
Fabric Length	13.5	13.5	13.5	2.6177
Preparation Time	404.96	423	600	170.984
Loading Time	789.47	748	700	334.364
Joint Time	633.11	600	600	283.484
Damage Check Time	971.89	1054	1200	207.811
Plies	63.46	70	70	12.82
Reverse Time	831.94	908	930	169.448
Cutting Time	515.53	557	557	103.001
Lay Time	4157.64	4080	3840	956

Table 1 summarizes the values of the variables. According to table, reverse time and cutting time include more than one mode. As well as mean, median and mode values are equal for fabric length variable. The maximum length can be used for spreader machine is 20 inches according to the table.

According to the correlation testing, it has been identified that all independent variables are significance at 0.01 level, which means that there is a linear relationship between independent and total lay time at 90% of confidence. The results that were taken from multiple linear regression. Stepwise method is used to get the final results and results were shown in Table 2.

Table 2: Multiple Linear Regression

Summary of the Findings		
R^2 Value	0.792	
ANOVA Table sig. value	0.000	
Variables	Coefficients	Sig. Value
(Constant)	236.251	.000
Loading Time	1.059	.000
Damage Check Time	2.254	.000
Joint Time	.884	.000
Preparation Time	.827	.000
Reverse Time	.943	.000
Cutting Time	1.095	.000

At the α=0.01level of significance, there exists enough evidence to conclude that the Loading Time, Damage Check Time, Joint Time, Preparation time, Reverse Time, Cutting time variables are not zero and, hence, these variables are useful to predict the total lay time. As well as constant is useful to predict the total lay time.

Furthermore at the α= 0.01 level of significance, there exists enough evidence to conclude that at least one of the predictors is useful for predicting total lay time; therefore the model is useful for predicting the lay time.

The coefficient of multiple determination is 0.792(R^2); therefore, about 79.2% of the variation in the total lay time is explained by independent variables. The regression equation appears to be very useful for making predictions since the value of R^2 is 0.792.

Accordingly that the final model can be written as,

Total lay time = 236.251 + 1.059*(Loading time) + 2.254*(Damage check time) + 0.884*(Joint time) + 0.827*(Preparation time) + 0.943*(Reverse time) + 1.095*(Cutting time)

Results and Discussion

According to the analysis some factors affect to the total lay time. Therefore, total lay time can be controlled by manipulating the affecting factors. Since all factors are positively affected to the model, reduction of them will decrease the total lay time.

Following paragraphs discuss some remedial actions that can be taken to reduce the total lay time.

- *Training the Operators:*

Operators are one of the valuable resources in apparel manufacturing. Therefore, attempts must be taken on developing operator skills where it necessary. A low skilled operator will consume higher resources (time) and give less output. That means total lay time can be either increased or decreased according to the skill level of the operator. In cutting department the fabric type can't be changed, but the way of handling can be trained. As an example, damage check time contributes significantly to the total lay time. Therefore the operator who check the damages, must have high skill level.

- *Training for Supervisors:*

Supervisor must be trained with fundamental management skills and communication skill. Their main job is providing instruction, transferring information. Line supervisors must be equipped with good communication with spreader machine operators and helpers. Since the line supervisors must be responsible of preparing required lay sheets and checking the fabrics shrinkages.

- *Installing Better Equipment:*

Installation of better equipment in the production process reduces the number of breakdowns. Having properly working machines not only enables operators in achieving SMV but also increase their motivation and productivity.

- *Better Operator Allocation:*

Each operator has different set of skill (operations they generally perform well) and different efficiencies at work. Allocating the most suitable operator to the process reduces the time, which required to perform the task. If low skilled operators are assigned to high content operations, the lay time can be increased. Before allocating operators to specific operations their skill level should be considered.

Conclusion

This study attempted to investigate the factors affecting the fabric lay time of Gerber machines and to develop a model to better predict the lay time. The results indicate that among the identified seven factors, six are useful in predicting the total lay time.

However, in interpreting the results of the study, a few limitations were noted. First, all the times were measured in seconds, thus the possibility of rounding to the nearest second though it was mili seconds. Second, it was identified that there are confounding variables affecting to the identified independent variables.

The above highlighted limitations suggest possible areas of for future research. For example, the proposed model can be further improved by using devices capable of

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measuring time in mili or nano seconds. Further, factor analysis can be performed to incorporate the impact of confront variables.

References

Abu., M.D. (2014), Fabric Spreading Requirements & objects, retrieved from, http://textileapex.blogspot.com/2014/03/fabric-spreading-objects-requirements.html#sthash.cqWejRJm.dpuf

Ganvir, K., (2014), Spreading and Cutting Machines, retrieved from www.reliableplant.com /Read/11785/overall-equipment-effectiveness on November, 2014

Sarkar, P., (2013), Textiles and garment manufacturing industry, retrieved from http://www.onlineclothingstudy.com/2013/05/garment-manufacturing-process-flow-chart.html

Tennakoon, P.T., (1999), Apparel Industry – Future Scenario, Economic Review June/July 1999, Peoples Bank.