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Determination of Total Labor Cost Based on Time Driven Activities

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Time Driven Activity Based costing (TDABC) is a method for determining real costs. Though TDABC is a relatively latest innovation in cost accounting, it is rapidly being applied by companies across many industries, within administration and other organizations like institutions, finance or service sectors. In the light of current practices, this paper emphasizes to understand the need and importance of TDABC costing in the organizations. This is joined with management methods, an extensive range of uses, empowering utilization of TDABC information for a wide variety of company functions and operations such as process analysis, strategy support and time-based accounting, monitoring wastage and quality along with productivity management. Every departmental or sectional cost can be measured and unused resources can be identified easily. The objective of this research is to analyze cycle time to perform an activity and sectional unit cost determination. The focusing point is to minimize total labor cost by using TDABC in MATLAB programming.

Keywords: Resource Allocation, Activity Based Costing, Cycle Time, Labor Cost, Minimization of Total Cost

1. Introduction

The economic situation in today's World can be branded as enormously competitive and dynamic, both countrywide and globally. Changes in the business atmosphere, activated by increase of competition, technological origination, changes in directorial roles, national and international quality awards, changing of external demands have led to the creation of new management practices and methodologies considering the financial and nonfinancial data of organizations. The new environment requires important information about costs and performance within the company's activities, processes, products, services and customers.

Considering these environments, managers felt the necessity to reflect about their managerial techniques and simultaneously, they need to redesign their present accounting structures and techniques, particularly the managerial accounting procedures. Since managers base several and critical decisions on described costs

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(Cooper and Kaplan, 1988; Shim and Sudit, 1995), it seems essential to provide accurate and reliable cost information.

Therefore, the purpose of this thesis is to generate a suitable costing model for the Ventura Leather ware manufacturing Ltd, unambiguously the Accounts Payable and Business Funding Department, in order to aid the company to allocate in a more fitting and correct way the direct labor costs to its companies. The primary objectives of this paper Determination of total labor cost & time required to perform an activity in each section. Minimization of total direct labor cost to perform each activity.

From study of many papers and articles, their focusing point was to apply the activity based costing in different services center but we were trying to overcome by applying in production sector. Ventura Ltd. is one of the biggest companies in Bangladesh. It is a Leather Bag manufacturing company that produces many types of Leather Bag. It exports the Bag in globally.

Bearing in mind mainly the Ventura, it only produces many types of Bag to the focal business, to the benefit savings company. The main purpose in this thesis, as referred before, is to create a model that allows to correctly allocate the costs of each activity cost of a product in a first phase and in a second phase to monitoring and estimate the productivity, the costs, the profits, and other performance aspects in each section and therefore, the costs of each “worker.” So as to be able to gain our goal line we had to measure what was the best costing model to apply to this company and how to apply it, having in consideration this certain organization and the characteristics of Ventura Leather Manufacturing Ltd.

In our research we try to build a time driven activity-based costing (TDABC) model for a leather bag manufacturing industry, where many papers are applied this costing model in various service center with respect to time. Mainly cause for difference from other research. For that we took actual cycle time for every activity to manufacture a bag. Using unit labor cost and cycle time we find out required solution. Subsequently, it will be analyzed the methodology of the chosen costing model and the best way to apply it to the leather Bag Manufacturing. Therefore, it will be created a personalized costing model according to the characteristics of the company that will be obtained by doing main research (interviews and meetings) and subordinate research (books, documents, articles and others). The final part will consist of an analysis of the model created and a discussion of the future potentials and of the limitations and complications that were challenged while doing this research.

Seeing the structure of the paper, in the section 1 it can be found the introduction, in the second section it can be found the Literature Review, in the third section the methodology, in the fourth section experimental details and required solution by MATLAB software. Data analysis in the fifth section and in the sixth section the result and Conclusion.

2. Literature Review

Many works were done on the Time Driven Activity Based Costing in various service organizations, supply chain management, manufacturing company and Healthcare, etc. in globally and nationwide.

Kumar & Mahto (2013) worked on the study on Current Trends of Application of Activity Based Costing, this paper emphasizes to understand the need and importance of ABC costing in the organizations. This was joined with management methods, an extensive range of uses, empowering utilization of ABC information for a wide variety of company functions and operations such as process analysis, strategy support and time-based accounting, monitoring wastage and quality along with productivity management.

Nur et al (2014) worked on the study of Using Activity Based Costing to Measure Customer Profitability: Customer Specific Selling and Marketing Expenses Analysis "An Application Study in an Industrial Company" The objective were to determine the costs and profitability for a sample of customers in an industrial company by using activity-based costing and compared the results with traditional costing data. They were analyzed the Customer Specific Selling and Marketing Expenses to achieve this purpose by determining the customer's costs, then to determine customer's profitability. The results were shown that six variables, i.e. the product handling, order taking, delivery vehicles, rush deliveries, Annual tourist program for customers, and visits to customers influences on the profitability contributed by customers.

Cattrysse et al (2014) worked on Time Driven Activity-Based Costing Systems for Cataloguing Processes. This worked was shown two parameters, an estimation of time required to perform an activity and the unit cost per time of supplying capacity that they had been documented with regard to TDABC in libraries; all of them being oriented to analyze specific library activities such as inter-library loan acquisition and circulation processes. The primary focus of this paper was to describe TDABC implementation in one of the most important library processes, namely cataloguing. In particular, original and copy cataloguing were analyzed to establish the applicability and usefulness of TDABC to perform cost analysis of cataloguing processes.

Popesko (2013) worked on Specifics of the Activity-Based Costing applications in Hospital Management. The primary objective of the paper was to outline the methodology of the ABC application in hospitals. First part of the paper was analyzed the ways of ABC implementation in published foreign studies. Second part describes the individual steps in ABC application and discusses the differences in the application procedures between the manufacturing and hospital organization.

Gonzalez (2014) worked on Time Driven Activity-Based Costing for Healthcare Provider Supply Chain Processes. In this research, they were developed a Time- Driven Activity Based Costing (TDABC) supply chain cost management tool for healthcare providers. A TDABC management system can be provided healthcare providers with valuable product and process supply chain cost information by investigating logistics activities, resource consumption and time drivers. Based on prior expertise, existing literature, and

a field study conducted with a 200-bed, not-for-profit hospital, a healthcare provider supply chain (HPSC) TDABC approach and supporting spreadsheet-based tool were developed to support cost measurement and management within the HPSC.

Soewarno et al (2017) worked on measuring customer profitability through time driven activity based costing. They were investigated Customer Profitability, and Analysis was conducted with the aim of knowing the level of profitability every customer type possesses and classifying them as profitable or non-profitable customers. A case study had been conducted in a five-star hotel located in the Special Region of Jogjakarta resulting a profit recognized under TDABC system that traditional method used as the hotel's costing system failed to do so and more proper data on costs and profitability of customers.

Ducrocq et al (2010) were worked on Time Driven Activity Based Costing (TDABC). Their study was shown that, while TDABC offered a partial solution to these issues, it still has some inherent weaknesses. Apart from the hesitation as to whether to use standard costs or actual costs, the measurement of time, which forms the basis of the method, also appears problematic. Homogeneity and maintaining it over time had not been given much consideration either, in spite of their importance for obtaining reliable costs. There is nothing new about calculating the cost of capacity and the deviation revealed by TDABC was only a deviation in business volumes. The quality of the data processing applications remains an essential factor in alleviating the complexity of the method. When it was come down to it, the real purpose of TDABC could be to monitor labor time.

Terungwa (2013) was worked on Time Driven Activity Based Costing and Effective Business Management: Evidence from Benue State, Nigeria. This paper was shown at the practicability of implementing time-driven activity-based costing system (TD-ABC) in service businesses like hotels in Benue State and analyzes profitability of its varying customers. This research was carried out to establish if the application of TDABC in service-oriented businesses in Makurdi metropolis of Benue State will enhance their performance in terms of profitability. Regarding the goal of this study. The researcher was also chosen one sampled hotel and studied its Restaurant using questionnaires, interviews to get data for this work. The result showed that using TD-ABC system, in comparison with their existing method provides more data on cost and profitability of customers served and that the application level of TDABC in Nigeria almost non-irrespective of the fact that it was a better costing tool. The result also revealed a profit of N 1, 441, 808 rather than a loss as previously reported by the business for the same period using their costing method. Which means TD-ABC gave better opportunity to analyze cost of operation.

Soekardan (2016) was worked on An Analysis of Activity Based Costing: Between Benefit and Cost for Its Implementation. This research was discussed how the importance of adopting activity-based costing for the company in order to carry out its business strategy. One objective was to implement activity-based costing cost efficiency by cutting costs incurred for non-value-added activity. But the phenomenon was shown that there are still many companies/organizations are not interested in adopting the

activity-based costing. This article was also outlined the advantages and limitations in adopting activity-based costing for the company.

Roodhooft et al (2009) were worked on the study of Time-driven activity-based costing in an outpatient clinic environment: Development, relevance and managerial impact. Healthcare managers were continuously advised to provide better patient services at a lower cost. To cope with these cost pressures, healthcare management needs to improve its understanding of the relevant cost drivers. Through a research, they were shown how to perform a time-driven activity-based costing of five outpatient clinic's departments and provide evidence of the benefits of such an analysis.

Lahutta & Wroński (2015) were worked on the topic of Customer Profitability Analysis with Time Driven Activity Based Costing. The Case Study of Polish Laboratory Diagnostics Market's Enterprise. The purpose of the paper was the identification and analysis customer groups in researched enterprise, which was allowed for the verification of hypotheses posed in the case study. The first part of the article contains the characteristics of the researched company and describes the Time Driven Activity Based Costing method used to determine customer profitability. The primary aspect of the paper presents research results and cost analyses were conducted in the case study using Time Driven Activity Based Costing. Authors were structured profiles of the researched enterprise's customers and present the accumulated income deriving from the service using a whale curve. The last part of the research was contained the analysis of the chosen client from each predetermined in the study profitability group. Authors were also provided the interpretation of characteristic costs from each group.

3. Methodology

Time Driven Activity Based Costing is the update process of Activity Based Costing. Mainly it is derived based on time. Some steps are required to measure total cost of production per Leather ware bag. Firstly time is calculated by the regression equation from different activities and unit cost also calculated respect to time. Operations time is taken between lower-upper ranges using Monte Carlo random number generator. MATLAB, LINGO software are used mainly to perform our calculation and generating value. Time ranges are not very differentiable. So, random number are used to minimize total labor cost. Mainly, from the study of research papers, authors are measured the total cost using TDABC not any production sector. Also, we use this method in different production section.

3.1 Mathematical Statement

The time spent by each activity and it respective cost; the percentage of used capacity by department, activity, client; the cost of adding additional capacity; and others indicators.

Total cost, J=$t_{jk}c_j$

Where, c_j=cost per unit time
t_{jk}=Time required to perform an activity

$$t_{jk} = (\beta_0+\beta_1 x_1+ \beta_2 x_2+\ldots\ldots\ldots\ldots\ldots\ldots +\beta_i x_i)$$

Where,
β_0= The standard time to perform the basic activity
β_i= The estimated time for the incremental activity *i*
Xi= The quantity of incremental activity *i.*

Unit cost is calculated by the equation-

$$\text{Unit cost} = \frac{\text{Supplied capacity cost}}{\text{Practical capacity of supply}}$$

Linear programming is a method to achieve the best outcome (such as maximize profit or minimize cost) in a mathematical model whose requirements are represented by linear relationships. Linear programming is special case of mathematical optimization.

$$\text{Min, } z=\sum C_i t_i$$
$$\text{Subject to, } LL< t_i <UL$$
$$t_i \geq 0$$

where,
C_i= Unit cost per minute
t_i = Total time to perform an activity
LL=Lower limit of particular activity time
UL=Upper limit of particular activity time

4. Experimental Setup

In the modern era many numbers of simulation, complex program and other calculation are performed in a short time. So, experimental setup is an important factor. To perform the required solution, some software like Office, Lingo and MATLAB are used. These software are installed of all the required features.

In Lingo software optimization can be performed in given objective function but it has some limitations. MATLAB is used to solve the objective function.

4.1 Selecting the Proper Iteration Method in MATLAB Software

In MATLAB many problems can be solved as like the required solution also determined in range of any interval. We need to solve the many iterations from many random numbers. Random numbers help to decide easily any problematic experiment because

the required value can be produced. By calculating sample mean of required time to perform an activity in each function. Total time is used as interval constraints.
Determining the solution for each activity for a particular Bag Model. The total cost equation is used for getting desired value.

5. Analysis of Mean Time from Sample Time

Primary data were collected from Ventura leatherware bag manufacturing company Ltd. Sample data was taken to calculate mean value. We were trying to take more data as sample in respect to accuracy. Each day we were taken three datas. For a particular operation, we calculate mean.

5.1 Total Time Calculation by using Time Equation

Each section has many operations. Cutting sections has handle cutting, body cutting, gusset cutting etc. For every section, total time is calculated by using time equation. Equation is.

Total time for Cutting = {handle cutting time *(number of operation) +
body cutting time * (number of operation) +
gusset cutting time *(number of operation) +
shoulder cutting time *(number of operation) +
bottom part cutting time *(number of operation) +
zipper part cutting time *(number of operation) +
dogslip cutting time *(number of operation) +
Puller handle potti time *(number of operation) +
gusset loop lining leather time *(number of operation) +
key ring magnet leather time *(number of operation) +
key logo leather dogslip time *(number of operation) +
bit shoulder potti time *(number of operation) +
handle loop time *(number of operation) +
emboss logo time *(number of operation) +
handle loop potti time *(number of operation) +
gusset potti time *(number of operation) +
small buckle time *(number of operation) +
big buckle time *(number of operation)}

Data Analysis for mean and Total time to perform an activity:

Particular section data is taken and calculated total time bellow for Model RD 16161. From mean total time is calculated bellow.

Table 1: Data in Cutting Section

Cutting	Mean for day 1	Mean for day 2	Mean for day 3	Mean for day 4	Mean for day 5
handle cutting (2)	30.72	32.00	33.33	34.83	31.33
body cutting (2)	34.35	31.67	34.83	35.33	39.00
gusset cutting (2)	27.83	29.00	30.67	37.50	31.93
shoulder cutting	30.95	31.00	32.33	35.33	34.33
bottom part cutting	26.14	26.83	31.53	34.00	25.67
zipper part cutting	26.07	28.00	28.67	27.33	26.20
dogslip cutting (2)	24.59	27.00	31.00	33.67	28.00
Puller	2.00	2.67	3.10	3.03	2.67
handle potti (2)	33.07	33.00	35.00	39.33	28.67
gusset loop	21.15	21.33	21.33	28.00	28.33
lining leather (4)	14.50	12.67	17.00	18.17	21.00
key ring	10.83	12.67	16.00	12.60	11.00
magnet leather (2)	11.83	12.33	14.33	13.00	11.33
key logo leather	9.00	11.00	8.93	11.33	10.67
dogslip (3 parts)	19.00	22.67	24.67	23.00	21.33
bit shoulder potti	14.50	15.50	19.00	20.67	15.60
handle loop(2)	17.00	17.67	20.67	22.67	24.00
emboss logo	10.37	12.67	13.33	11.00	11.33
handle loop potti	11.00	12.33	12.33	13.33	11.70
gusset potti (4)	62.33	65.33	71.33	57.67	73.00
small buckle (4)	11.33	14.00	13.00	18.67	17.00
big buckle (2)	10.17	17.00	17.67	15.00	18.67
total in sec	458.74	488.33	530.07	545.47	522.77
total in min	7.65	8.14	8.83	9.09	8.71

Table 2: Data in Splitting Section

Splitting	Mean for day1	Mean for day2	Mean for day3	Mean for day4	Mean for day5
gusset part (2)	6.25	6.83	8.40	7.00	8.00
front part	6.68	6.50	8.77	9.00	9.67
back part	6.75	7.00	12.00	10.00	10.00
Sbottom part	4.75	5.67	9.00	9.27	10.00
magnet leather (2)	11.25	11.67	12.50	13.00	13.67
magnet potti(2)	6.25	7.00	6.83	9.00	8.00
handle (2)	8.65	9.00	11.67	12.33	10.33
handle potti (4)	9.25	11.67	10.33	12.33	12.67
top leather (2)	21.00	22.67	19.33	23.33	25.33
lining top (2)	15.00	21.33	18.97	18.67	22.67
Puller	2.25	3.33	2.70	3.33	3.67
shoulder	12.25	13.33	12.33	15.33	12.33
Dogslip	10.50	12.67	14.00	10.00	12.67
total in min	120.83	138.67	146.83	152.60	159.00
total in min	2.01	2.31	2.45	2.54	2.65

Table 3: Data in Skiving Section

Skiving	Mean for day1	Mean for day2	Mean for day3	Mean for day4	Mean for day5
handle potti (4)	33.20	33.00	38.67	35.67	36.67
gusset part (2)	33.00	34.67	34.00	34.17	39.33
handle (2)	17.09	16.67	21.00	22.00	20.33
back part	20.33	18.33	24.00	23.00	22.33
front part	20.67	20.33	24.00	22.33	23.67
gusset potti (4)	23.17	21.00	19.67	21.00	19.00
Bottom	11.33	12.00	12.00	13.33	13.33
zipper upper part	10.07	13.33	13.67	11.00	12.93
Shoulder	16.33	14.33	16.00	16.00	20.67
Dogslip	11.00	14.67	14.33	13.50	13.47
Binding	7.00	7.83	7.83	10.00	10.33
Rabush	11.00	11.67	10.33	11.83	13.67
dogslip potti (2)	11.00	13.33	13.00	14.67	14.33
handle loop potti	12.86	11.33	13.00	14.67	13.33
long shoulder potti	12.67	16.33	13.67	13.67	15.33
foam (2)	8.67	10.00	9.67	9.27	12.00
emboss logo (2)	9.00	8.67	11.67	11.67	10.67
total in sec	268.38	277.50	296.50	297.77	311.40
total in min	4.47	4.63	4.94	4.96	5.19

Table 4: Data for Gluing Section

Gluing	Mean for day1	Mean for day2	Mean for day3	Mean for day4	Mean for day5
handle loop rabush	21.52	23.67	24.33	25.00	26.67
middle potti	80.00	89.33	82.67	75.00	81.33
handle potti	21.89	23.67	27.00	25.67	23.00
bottom rabush attach	30.00	33.67	34.00	32.60	31.33
key ring	14.00	19.33	23.00	20.00	22.00
top leather (2)	12.55	12.67	14.33	13.67	13.33
long shoulder potti +pvc	40.33	36.67	42.00	38.33	42.00
gusset potti (4)	34.88	33.00	38.00	38.33	39.67
handle potti (4)	28.50	33.17	35.33	36.33	33.00
Puller	2.33	2.67	2.67	2.33	2.73
Zipper	8.33	8.00	8.67	7.67	8.67
Dogslip	13.00	9.67	12.33	13.00	14.00
front part	82.67	91.67	83.00	83.67	86.33
back part	72.33	78.00	81.33	75.33	78.67
gusset part (2)	61.67	78.33	71.00	75.67	77.67
top leather (2)	39.67	44.33	47.00	41.67	47.33
lining top (2)	7.59	8.00	8.00	8.40	8.33
mobile pocket	9.00	10.33	9.67	9.33	8.43
straight pocket	9.00	10.67	10.00	10.67	10.67
foam rabush setting	25.15	24.33	26.33	24.67	24.67
total in sec	614.41	671.17	680.67	657.33	679.83
total in min	10.24	11.19	11.34	10.96	11.33

Table 5: Data in Net Cutting Section

Net cutting	Mean day1	Mean day2	Mean day3	Mean day4	Mean day5
lining top (2)	29.85	29.33	32.33	35.33	35.67
Bottom	15.00	19.33	21.33	16.67	19.67
puller	8.67	10.33	10.33	10.17	9.93
Dogslip	15.39	21.00	18.00	15.67	16.63
gusset potti (4)	88.00	103.67	84.67	88.00	92.67
top leather (2)	20.79	28.00	26.00	27.67	30.67
gusset part (2)	32.89	42.33	38.00	39.33	45.00
pvc (2)	16.67	18.00	16.33	22.00	20.00
back part	22.37	25.00	21.67	27.00	28.00
front part	24.33	31.67	28.33	25.67	25.67
Shoulder	19.00	22.00	24.33	23.33	23.67
total in sec	292.95	350.67	321.33	330.83	347.57
total in min	4.88	5.84	5.36	5.51	5.79

Table 6: Data in Folding Section

Folding	Mean day1	Mean day2	Mean day3	Mean day4	Mean day5
gusset part (2)	70.48	78.67	73.67	87.00	76.00
top leather (2)	14.00	13.33	12.33	13.33	13.33
mobile pocket	8.00	6.67	8.33	7.67	7.80
straight pocket	8.67	8.33	9.33	9.00	9.00
dogslip primering (3p+1c)	86.07	89.33	89.43	99.33	85.33
long shoulder (3p+1c)	67.78	63.00	59.00	71.00	74.00
small buckle glue+D ring	50.48	56.67	56.00	60.67	59.00
big buckle glue+D ring	82.44	77.67	79.33	78.33	84.67
dog slip hardware setting	63.81	57.00	63.33	61.20	59.67
lond shoulder hardware setting	47.00	49.67	63.33	55.67	66.00
total in sec	498.72	500.33	514.10	543.20	534.80
total in min	8.31	8.34	8.57	9.05	8.91

Table 7: Data in Primer Section

Primer	Mean for day1	Mean for day2	Mean for day3	Mean for day4	Mean for day5
magnet leather	10.00	11.00	12.67	11.33	12.67
MK logo	6.00	6.00	6.27	6.67	5.67
zipper leather	8.23	9.00	9.33	12.00	10.33
handle (2)	11.62	11.33	13.00	12.33	15.00
small buckle (2)	16.67	16.67	20.33	22.00	23.67
big buckle (4)	31.23	34.33	36.67	36.00	34.00
gusset (2)	21.85	22.33	25.33	17.00	22.67
front part	11.33	12.33	12.67	11.67	14.00
back part	12.08	12.00	13.80	12.00	14.00
top leather	16.67	20.00	23.33	17.67	20.00
lining top	12.22	14.33	15.33	17.00	13.67
magnet potti	9.00	8.33	10.33	10.33	11.33
key ring	9.82	8.00	9.67	9.00	8.00
magnet leather	9.17	8.33	8.00	9.33	9.23
MK logo	3.67	4.67	5.67	5.33	5.67
zipper leather	9.00	8.33	9.67	9.33	10.67
handle (2)	12.17	13.33	15.93	16.00	13.33
small buckle (2)	17.22	18.67	18.00	19.00	14.67
big buckle (4)	36.81	43.00	48.67	47.67	37.67
gusset (2)	20.33	23.67	21.33	27.33	24.67
front part	11.00	12.33	15.00	13.00	13.67
back part	12.00	12.67	14.67	12.00	14.33
top leather	22.29	23.00	25.00	26.00	27.00
lining top	12.33	16.00	15.67	17.00	16.00
magnet potti	7.93	8.33	8.00	8.00	8.67
key ring	10.00	9.00	12.00	12.67	10.30
total in sec	360.64	387.00	426.33	417.67	410.87
total in min	6.01	6.45	7.11	6.96	6.85

Table 8: Data in Color Section

Color	Mean for day1	Mean for day1	Mean for day3	Mean for day4	Mean for day5
magnet leather	8.00	9.00	8.00	9.33	9.33
MK logo	3.02	4.00	3.17	4.10	3.33
zipper leather	4.83	5.33	4.67	5.67	5.87
handle (2)	10.33	12.00	11.00	13.33	13.00
small buckle (2)	13.33	15.00	14.00	14.33	14.33
big buckle (4)	37.17	41.67	39.00	37.67	39.67
gusset (2)	21.55	23.33	19.33	25.00	27.00
body part	21.67	22.33	22.00	26.67	24.00
bottom part	9.74	8.33	8.33	11.00	10.67
top leather	11.87	12.67	12.87	12.33	15.67
lining top	12.33	13.00	13.67	12.67	13.00
magnet potti	9.67	9.33	11.20	11.00	10.33
key ring	11.00	12.33	12.33	13.33	13.33
back belt (2) tenas+ color	37.67	45.00	42.33	41.67	37.33
total in sec	212.18	233.33	221.90	238.10	236.87
total in min	3.54	3.89	3.70	3.97	3.95

Table 9: Data in Sewing Section

Sewing	Mean for day1	Mean for day2	Mean for day3	Mean for day4	Mean for day5
long shoulder	63.67	75.67	78.67	62.33	76.33
lining top (2)	17.13	24.67	19.00	21.00	20.33
handle hand	122.00	131.67	134.67	134.33	130.67
dogslip	40.13	47.00	47.67	47.67	40.67
total in sec	242.93	279.00	280.00	265.33	268.00
total in min	4.05	4.65	4.67	4.42	4.47

Table 10: Data in Grinding Section

Grinding	Mean day1	Mean day2	Mean day3	Mean day4	Mean day5
long shoulder	11.86	14.00	12.33	15.00	14.00
small buckle (2)	11.33	11.67	12.00	13.67	12.67
big buckle (4)	22.33	23.67	26.23	27.67	26.33
handle (2)	15.67	15.67	15.67	19.00	17.67
bottom part	11.83	12.17	13.00	12.33	11.67
key ring	7.00	8.33	8.00	7.67	8.67
gusset (2)	21.00	21.00	23.00	21.33	24.33
zipper leather	11.81	12.33	14.00	12.50	14.00
magnet leather	7.40	8.67	8.27	8.33	8.67
magnet potti	6.67	8.33	7.67	7.67	7.60
back belt (2)	8.00	11.00	10.00	11.00	12.67
total in sec	134.90	146.83	150.17	156.17	158.27
total in min	2.25	2.45	2.50	2.60	2.64

Table 11: Data in Sew Burning Section

sew burning	Mean for day1	Mean for day2	Mean for day3	Mean for day4	Mean for day5
magnet leather	12.07	13.00	12.67	13.00	13.67
magnet potti	11.19	12.33	11.33	12.33	11.67
small buckle (2)	10.00	11.67	12.33	14.67	12.67
big buckle (4)	21.67	22.33	23.00	24.33	24.67
key ring	25.26	28.33	32.00	34.33	35.33
back belt	11.10	12.67	11.67	12.67	10.00
Dogslip	5.94	7.33	6.20	8.00	8.00
mobile pocket + MK logo sewing	44.13	43.67	50.67	41.67	44.67
magnet attach	16.33	21.33	17.67	15.33	19.00
total in sec	157.69	172.67	177.53	176.33	179.67
total in min	2.63	2.88	2.96	2.94	2.99

Table 12: Data in Assembly Section

Assembly	Mean day1	Mean day2	Mean day3	Mean day4	Mean day5
mobile pocket sewing	45.22	59.33	59.67	54.33	51.67
straight pocket side sewing	53.15	54.67	49.67	54.67	54.67
zipper attach	25.04	34.00	29.00	27.67	29.33
zipper leather sewing	25.40	32.67	26.00	28.00	29.00
zipper sewing for mobile	63.33	69.67	75.33	74.67	64.67
sew burning+ gluing	48.00	56.67	54.33	59.67	61.33
zipper sewing	66.56	71.00	69.67	69.67	62.67
gusset potti+lining part sewing	43.97	50.00	40.00	44.67	42.33
lining top+lining attach	21.74	20.67	23.00	23.33	23.33
zipper+lining foam attach	129.00	146.33	130.67	140.33	140.33
zipper binding (2)	13.00	13.33	14.00	14.00	14.00
magnet potti sewing	12.04	12.33	13.67	13.00	13.00
puller sewing	7.67	7.67	8.33	8.33	7.33
magnet leather sewing	12.15	12.00	14.00	13.67	12.33
magnet leather+magnet potti sewing	10.67	10.67	12.00	12.67	10.27
key ring sewing	32.67	32.67	32.00	38.33	42.67
key sewing	8.27	6.67	8.33	8.00	8.00
gusset tag	21.67	23.00	23.67	25.67	24.33
gusset buckle sewing	21.86	24.67	21.00	21.00	23.17
body part making (2)	21.67	22.00	23.33	26.00	24.33
bottom part marking	12.46	12.67	13.00	13.00	13.83
gusset part marking (2)	12.33	11.00	12.30	12.80	12.00
lining part marking (2)	12.71	12.00	13.00	13.33	12.67

Table 12: Data in Assembly Section (Continued)

Assembly	Mean day1	Mean day2	Mean day3	Mean day4	Mean day5
gusset potti sewing	191.60	224.33	215.00	220.33	217.33
big buckle +belt sewing with body (2)	148.00	144.67	152.67	139.00	155.67
sew burning +gluing	362.50	390.00	372.33	365.00	392.67
front part hardwaring	75.07	71.67	76.67	81.67	66.67
top leather magnet hardwaring	42.25	42.67	48.67	50.00	46.67
gusset gluing+folding	86.83	102.00	107.33	88.00	97.00
body part punching (4)	34.61	32.67	34.33	37.00	40.67
gusset part hardware	23.33	20.67	24.00	22.33	23.33
body+bottom part hardware	143.33	150.67	155.67	147.67	146.67
gusset part attach	73.84	85.33	84.67	73.67	84.33
gusset part sewing	34.67	34.67	35.00	37.33	36.33
gusset making sewing	62.29	66.33	51.67	50.67	62.00
sew burning +gluing	248.33	252.00	235.00	258.00	260.00
mobile pocket binding	12.03	12.33	14.67	91.33	14.00
straight pocket binding	13.34	13.00	13.10	13.33	14.67
gusset marking punch	123.33	118.00	119.00	129.00	124.33
puller setting	17.50	22.00	24.67	26.67	24.67
bag side sewing	110.00	120.00	122.33	108.67	116.67
body+bottom sewing	87.00	86.33	101.33	100.00	83.00
body +lining gluing	143.67	148.67	161.33	141.00	144.00
whole body sewing	74.33	80.67	81.67	77.00	66.00

Table 12: Data in Assembly Section (Continued)

Assembly	Mean day1	Mean day2	Mean day3	Mean day4	Mean day5
body + lining sewing	154.00	153.67	158.33	151.33	161.33
body part marking sewing	64.50	64.00	69.67	71.33	70.67
body part marking punch	45.00	47.00	40.33	54.33	49.67
punching hole color	84.00	92.00	79.33	87.00	72.00
lock ring punch +attach	184.26	176.67	177.00	187.00	162.67
body cleaning	509.33	534.33	481.00	517.00	503.00
hardware assembly	43.00	36.00	38.00	37.67	39.67
IPQC	166.29	166.00	160.67	169.00	179.33
Shaping	379.15	390.00	375.00	405.00	395.33
Packing	94.73	99.33	92.67	101.33	83.33
Total Assembly Time in sec	4552.68	4773.33	4669.07	4835.47	4710.93
Total Assembly Time in min	75.88	79.56	77.82	80.59	78.52

5.2 Unit Cost Calculation

Unit cost is determined for calculating the total from each section or department. It was mainly performed by the ratio of supplied capacity cost and Practical capacity of supply resources (in minutes).

$$\text{Unit cost} = \frac{\text{Total Direct Labor Cost}}{\text{Practical capacity (in min)}}$$

Table 13: Data for Measuring Unit Cost in Each Section

SL No	Operations	Number of Worker(a)	Salary per Worker(b)	Total Direct Labor Cost(a*b)	Practical Capacity (in min)	Unit Cost/min Tk
1	Cutting	4	4400	17600	50400	0.35
2	Splitting	4	4600	18400	50400	0.37
3	Skiving	5	4800	24000	63000	0.38
4	Gluing	7	4900	34300	88200	0.39
5	net cutting	2	4500	9000	25200	0.36
6	Folding	4	4300	17200	50400	0.34
7	Primer	6	4800	28800	75600	0.38
8	Color	6	4700	28200	75600	0.37
9	Sewing	12	5200	62400	151200	0.41
10	Grinding	1	4900	4900	12600	0.39
11	sew burning	2	4700	9400	25200	0.37
12	assembly	21	5000	105000	264600	0.40

5.3 Optimum Solution for Total cost by Using Linear Programming

Mainly we have determined required solution for cost function. For higher profit cost should be minimized. In respect to time, our objective function to be minimized. Time is the important factor for minimizing total cost. So, time is taken as interval, that's help to reduce cost. The objective function is bellows.

Min, $Z=C_1t_1+C_2t_2$
$+C_3t_3+C_4t_4+C_5t_5+C_6t_6+C_7t_7+C_8t_8+C_9t_9+C_{10}t_{10}+C_{11}t_{11}+C_{12}t_{12}$

$$7.65 < t_1 < 9.09$$
$$2.01 < t_2 < 2.65$$
$$4.47 < t_3 < 5.19$$
$$10.24 < t_4 < 11.34$$
$$4.88 < t_5 < 5.84$$
$$8.31 < t_6 < 9.05$$
$$6.01 < t_7 < 7.11$$
$$3.54 < t_8 < 3.97$$
$$4.01 < t_9 < 4.67$$
$$2.25 < t_{10} < 2.64$$
$$2.63 < t_{11} < 2.99$$
$$75.88 < t_{12} < 80.59$$
$$t1, t2, t3, t4, t5, t6, t7, t8, t9, t10, t11, t12 \geq 0;$$

where,
C_1= Unit cost per minute in Cutting Section.
C_2= Unit cost per minute in Splitting Section.
C_3= Unit cost per minute in Skiving Section.
C_4= Unit cost per minute in Gluing Section.
C_5= Unit cost per minute in Net Cutting Section.
C_6= Unit cost per minute in Folding Section.

C_7= Unit cost per minute in Primer Section.
C_8= Unit cost per minute in Color Section.
C_9= Unit cost per minute in Sewing Section.
C_{10}= Unit cost per minute in Grinding Section.
C_{11}= Unit cost per minute in Sew Burning Section.
C_{12}= Unit cost per minute in Assembly Section.
And t_1, t_2,t_3, t_4, t_5, t_6,t_7, t_8, t_9, t_{10},t_{11}, t_{12} are the average time interval in each day.

Optimal solution is performed in MATLAB for random number in time interval.

6. Result and Discussion

Results were calculated by MATLAB software. Our program was not very complex that helps to formulate in a short time and easy method. We were taken some random numbers to calculate required value. For every section we calculate the total time, unit cost for the different models of Leather Bag.

Table 14: The Minimum Value for an Activity in Different Model

Bag Model	Total Direct Labor Cost (Tk)
RD16161	52.46
NA32746E	45.06
NB64746E	33.86
NC28746E	40.88

In this research, we learned many different costing systems that helped increase our existing knowledge. We faced some problems to reach our objective value. We overcame it by using MATLAB. Now a day in many organizations uses the modern Time Driven Activity Based Costing System.

From the results, total direct labor cost per Bag varied in their respective model. For minimizing total cost, cycle times were used in this research. In future, value-added time can be used for further research.

7. Conclusion

Newly invented TDABC helps to reduce the cost and decision making for a company manager. In today competitive production and marketing companies are focusing on improving effectiveness and minimizing their organizational cost. Turning efficiency, TDABC is more efficient tool from the Traditional and ABC costing system. The ultimate objective of the research in this area should be defining the general methodology for the TDABC application on the organization wide level. Deeper level of knowledge in the

area could facilitate the managers to use the limited resources more effectively and save the increasing costs of direct labor.

In the modern competitive era TDABC will be the best model for optimization. TDABC can be used both commercial and non-commercial sectors. In Health care, production, library, transportation TDABC can be widely used for unused capacity, price determination and customer profitability problem. TDABC system application had been proven to be more accurate since its result of a higher profitability and information of unused capacity in every main activity. In future, it can be considered to measure the different sectional cost. This research was not minimization problem actually. It was the random number generation to measure the total labor cost that was our limitation. In future, uncertainty can consider for more accurate value of costing.

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