

## Productivity Improvement by Work Study Technique: A Case on Leather Products Industry of Bangladesh

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### Abstract

In Bangladesh, leather and leather products sector plays a vital role for economy development. Productivity improvement can be helped to enrich profit of a leather products industry by minimizing excess work and developing new method for particular operation. Now a day, productivity improvement is a popular topic for any kinds of industry. So that improving productivity is one of the main concerns of leather products industries. Work study is most important tools that can help to increase productivity in leather products industry. Hence, this study helps to identify the bottleneck and suggest appropriate system to improve productivity. For this purpose, method study has been carried out by applying questioning techniques concept where recording and critical analysis of all related information has been performed in particular production line. As a result considerable amount of work content is reduced in the new improved method. Then time study has been taken by stopwatch and determined the basic time for all operation sequences and the capacity of each workstation per day has been calculated. By applying method study and work measurement in the industry at production line-Surma for ladies bag, productivity has been improved by 12.71%.

**Keywords:** Production; Productivity improvement; Work study; Method study; Work measurement; Leather products; Application in assembly line

### Introduction

In Bangladesh, Leather and leather products sector plays a significant role for the economic development of the country. The industry has contributed to export earnings, foreign exchange earnings, employment creation, poverty alleviation and the empowerment of women. Bangladesh earned \$1.16 billion from the leather sector in the year of 2015-16, which was the second highest contributor to national exports after RMG. To sustain the positive growth, it is necessary to ensure the proper utilization of resources. Financial growth of any industry largely depends on minimizing excess work and productivity improvement. To minimize excess work and improving productivity at first we should realize the production term. Production is any process or procedure developed to transfer a set of input into a specified set of output in proper quality and quantity thus achieving the objectives of an industry. Production helps to create products by the transformation of raw materials [1]. The production system of leather products industry can be shown by the following diagram (Figure 1).

Productivity is the ratio between output of wealth and the input of resources used in the process of production [2]. Productivity measurement turns a comparison of outputs to inputs normally by calculation of a productivity index [2,3].

$$\text{Productivity} = \frac{\text{OUTPUT}}{\text{INPUT}} \quad (1)$$

Productivity can be used to measure the extent to which a certain output can be extracted from a given input [4]. Productivity measurement is the important for any kinds of industry. Increasing productivity is one of the major issues for enhancing more profit from same kinds of resources. Productivity improvement helps to satisfy customer and reduce time and cost to develop, produce and deliver products [5]. Productivity includes effective relationship to performance measure for method utilization, method output, product prices, and work in process inventory levels and on time delivery [6]. Productivity is considered to be a growth of profit [7].

Productivity improvement can be done by sorting of elimination, repairing of ineffective process, simplifying the method, optimizing the system, reducing variation, maximizing turnout up quality or responsiveness and reducing set-up time. Productivity can be also achieved by increasing the value-added content of products [8], or by decreasing the unit cost of production or decreasing the work content of the production, or line balancing of the production line or by a combination of all [3,9,10]. Productivity improvement is the continuous improvement process of any types of activities [3,11]. In this study, productivity improvement gained through reducing work content by implementing new methods in assembly line of a specific leather product (i.e. leather ladies Bag).

To the best of our knowledge there are no studies on how to apply work study technique in leather products industry for productivity improvement although one study fund in shoe manufacturing industry [12]. Productivity improvement through work study technique is necessary for increasing profit as well as proper utilization of labor of an industry [6]. Leather products industry is one of the most significant exports earning industry of Bangladesh. This paper helps to implementing work study technique in assembly line of leather products industry for increasing productivity. The novel contribution of this paper is to find out the method for improvement of productivity in leather products industry.

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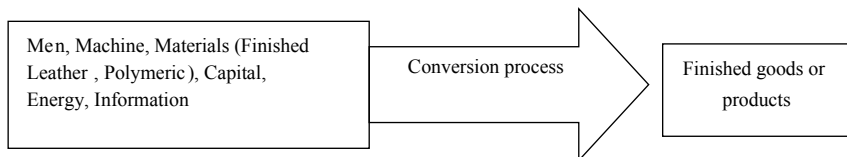


Figure 1: Production system (Jain and Aggarwal, [1]).

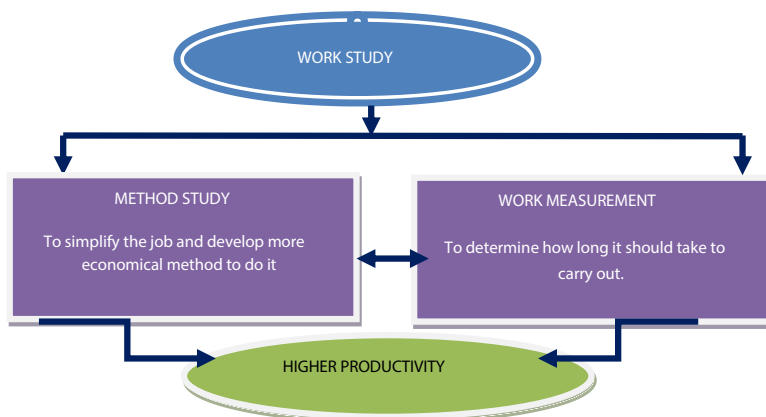


Figure 2: The diagram shows how work study helps in increasing productivity (Jain and Aggarwal, [1]).

## Materials and Methods

### Literature review of work study

Work study is the investigation process, by means of a consistent system of the work done in a industry, in order to attain the best possible use of the men, machines, materials, available in the building at present [13].

Method study [14] and Work Measurement is the two major segment of work study [1]. Figure 2 helps to understand the two basic parts of work study method. Work study then aims at examining the method associate activity is being disbursed, simplifying or modifying the tactic of operation to unnecessary work or the wasteful use of resources and fixing a time commonplace for plying the activity [15]. The relation between productivity and work study so evident. To appreciate how work study helps to reduce costs and reduce the time of certain activity, it is necessary to examin more closely what the time consists of [4,16]. It is used to systematically study and improve human working condition by considering all factors that affect the working efficiency and conditions. Work study helps to systematically reduce the work content in an assembly line.

This method is subdivided into two categories which are method study; used to modify method or develop new method and work measurement which is basically time study of each operation with the help of stopwatch [17].

The application of method study and work measurement is widely used tools in manufacturing industry as well as different fields [18-22]. Literature reveals that in different sector like health sector this method is also used [23,24] shows the improvement of the bottleneck process in a lamp assembly line by applying the work study method, ECLS, and line balancing. The result shows the improvement for both product and operator. The reduction in production time resulted in better productivity in system [25,26] studied the manufacturing process in

the automobile industry both before and after the improvement had been made, by using an operation process chart. In this research, we use the work study method for productivity improvement in particular assembly line by selecting a products in leather products industry with the help of management personnel. We try to balancing line and reduction of work content by critical analysis and time study [27]. For research work, the particular assembly line is selected for observing each operation with time study for productivity improvement.

The basic steps of work study are exposed by Figure 3. We use this conceptual chart for analysis particular production line with selecting particular products. For this research purpose, we select a Leather ladies bag for critical analysis and time study. After collecting observes time of each operation, we compute the standard time for each operation including rating and two types of allowance.

### Research methodology

Step by step procedure is the most important for improving productivity through work study method to reduce work content to particular products .Here is given key steps of this case study. We try to develop a conceptual framework for our work. This frame helped to accomplish our research work in systematic way.

In this study, at first we selected a leather products industry with specific products. After that we selected a specific production line for accomplishing our study. We observed all the particular operations with the help of stopwatch. After observing all the operations, identified the existing problem by critical questioning technique. After identifying problems, we developed new method or process [28] for particular products. When our proposed method applied to this particular assembly line, the productivity has been improved. Our contributed research objectives are:

1. Analyze the production system with the help of work study technique for productivity improvement.

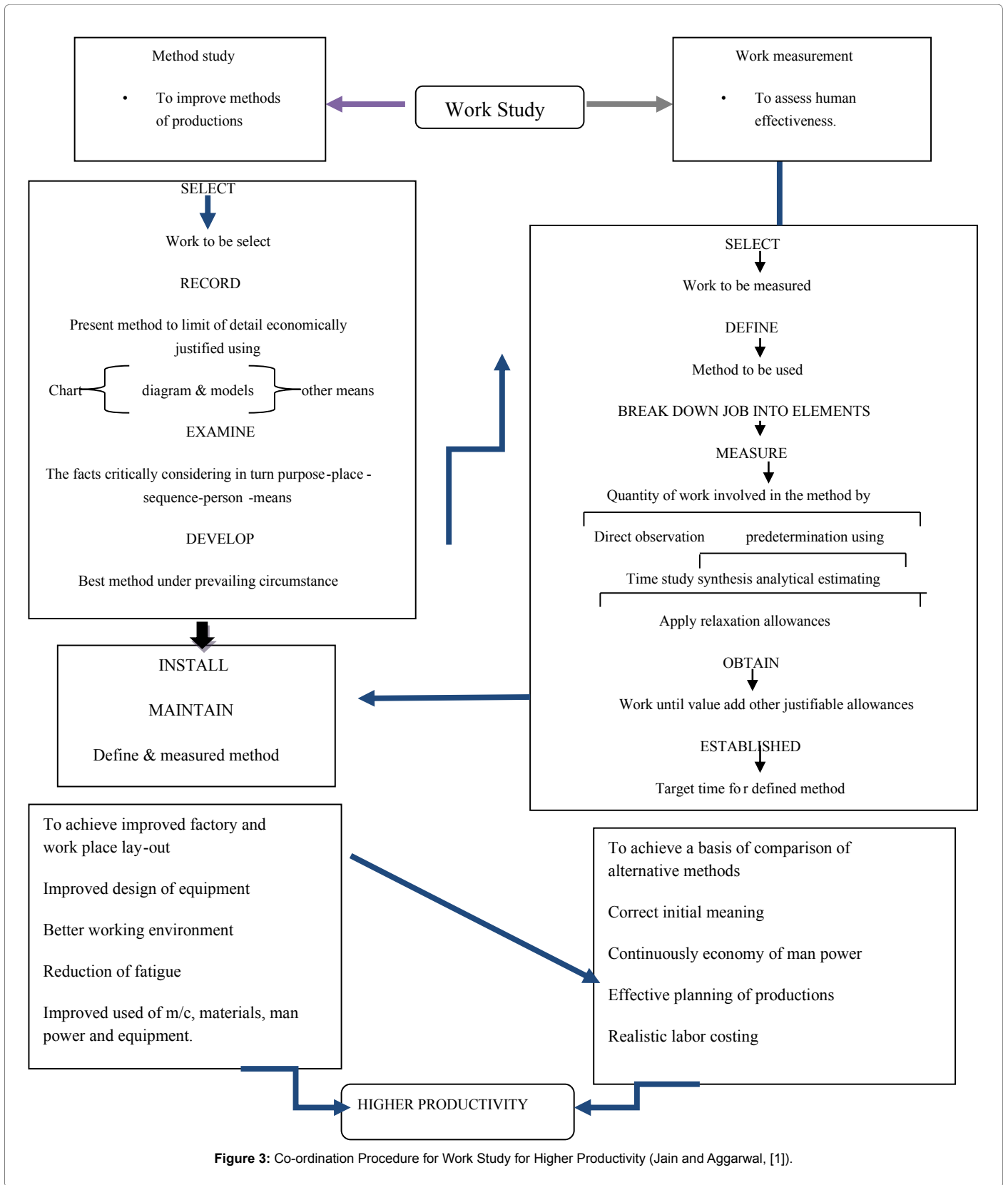


Figure 3: Co-ordination Procedure for Work Study for Higher Productivity (Jain and Aggarwal, [1]).

- Identify the existing problem in a particular production line and develop new system with the help of critical analysis.

## Solution Methodology

In this research, we used some terminology for research purpose. Here is given that terminology for analyzing data.

### Observe time

The time taken to perform an operation or combination of operations obtained by means of direct measurement [29].

### Selected time

The time chosen as being representative of a group of times for an operations or group of work by calculating mean, median or mode.

### Rating

Rating is the assessment of the worker's performance rate of working relative to the observer's concept of the rate corresponding to standard pace. The commonly used rating scale in use is shown in Table 1 [16].

### Basic time

Basic time is the irreducible minimum time theoretically required to produce one unit of output. The time for carrying out an element of work at standard rating [16].

$$\text{Basic Time} = \frac{\text{Observed Time} \times \text{Observed Rating}}{\text{Standard Rating}} \quad (2)$$

### Standard time

Standard time is the total time in which a job should be completed at standard performance [16].

$$\text{Standard Time} = \text{Basic Time} + \text{Allowances} \quad (3)$$

For allowances, we consider 15% relaxation allowances and 3% contingency allowances.

### Relaxation allowances

Relaxation allowance is an addition to the basic time intended to improve the worker with the opportunity to recover from the physiological and psychological effects of carrying out a specified operation and to allow attention to personal needs. The amount of allowance depends on the nature of the work. Generally Relaxation allowance is 15% of basic time, has been added to calculate standard time from basic time [30].

### Contingency allowances

A contingency allowance is a very small amount of time that may

be included in a standard time for time study. In this study, we consider 3% contingency allowance of basic time to calculate standard time [30].

$$\text{Efficiency} = \frac{\text{Minutes Output}}{\text{Minutes Input}} \quad (4)$$

$$\text{Increasing efficiency} = \left[ \frac{(\text{The efficiency of proposed line} - \text{Present efficiency})}{\text{Present efficiency}} \right] * 100 \quad (5)$$

$$\% \text{ of work content reduction per piece} = \left[ \frac{(\text{Present work content / piece} - \text{proposed content / piece})}{\text{Present work content / piece}} \right] * 100 \quad (6)$$

$$\text{Increasing productivity (at 100\% capacity)} = \left[ \frac{(\text{Proposed std output} - \text{Existing output})}{\text{Existing output}} \right] * 100 \quad (7)$$

## A Real Case Study

### Data collection and calculations

For practical implementation of our research framework, we select Picard Bangladesh Ltd for real life implementation. Picard Bangladesh Ltd. is a Bangladesh-Germany joint venture leather products industry which produces quality products. Picard Bangladesh Ltd. is a one of the big leather products industry of Bangladesh which produces lots of small and large leather goods like wallet, card case, ladies bag, ladies purse, travel bag, and varieties types of products. For this research work we select a ladies bag for observing each operation along with time study. After observing all the operations along with time study, we fund 60 operations for manufacturing of selected ladies bag. There are about 60 operations for our research products. We compute observe time for all of these existing operations. The existing sequential operations are shown in Table 2 and Picture 1.

We observe five times for each operation for taking time for particular operations. After taking observe time, it converted to basic time with particular rating for each worker by using equation (2). After that we transferred this basic time with adding allowance to standard time by using equation (3). We consider two types of allowance for calculating standard time which is relaxation allowances and contingency allowances. We consider the 8 h working time for each worker.

The graphical representation of capacity of each station is shown in Figures 3-5.

### Proposed line

After studying all of those operations, we fund some problem which is improved during proposed method implication to our research work. We have done some critical operations for productivity improvement

Rating scale	Description
0	No Activity
50	Very slow, clumsy, fumbling movements, operative appear half-asleep, with no interest in the job
75	Steady, deliberate, unhurried performance, as of a worker not on Piecework but under proper supervision, looks slow, but time not being intentionally wasted while under observation
100	Brisk. Business-like performance, as of an average qualified worker on piecework, necessary standard quality and accuracy standard rate achieved with confidence
125	Very fast, operative exhibits a high degree of assurance, dexterity and co-ordination of movement, well above that of an average works
150	Exceptionally fast, requires intense effort and concentration and is us-likely to be kept up for long periods, a performance achieved only by a few outstanding workers

Table 1: Rating scale (Kanawaty, [16]).

SI No.	Name of the operations	Observed times in centiminutes					Selected Time	Rating	Basic Time	Standard Time	Manual or m/c	Man power	Capacity/ Day@ 100% efficiency
		1	2	3	4	5							
1	Cutting all leather	566	560	490	545	550	542	80	434	513	M/c	1	94
2	Cutting all PVC, lining, Reinforcement	273	262	279	269	275	271	80	217	256	M/c	3	563
3.	Inspection and Numbering	108	118	120	111	115	114	80	91	107	Manual	2	897
4	Spitting leather	33	37	34	29	35	34	80	27	32	M/c	1	1500
5	Skiving leather, rabus and PVC	240	250	235	246	238	242	85	206	243	M/c	3	592
6	Sewing back part Face to face	40	37	32	42	35	37	80	30	35	M/c	1	1371
7	Double way tap attaching to back joining and hammering	105	110	100	120	118	111	85	94	110	Manual	2	873
8	Double stitching to back part	22	23	27	19	25	23	80	18	21	M/c	1	2286
9	Gluing on back leather and foam and back top folding 8 mm from the edge by both way tape	230	221	225	235	218	225	80	180	212	Manual	2	453
10	Gluing on back trim part and back part rabus and folding top and below 8 mm from edge	208	230	220	227	223	223	80	178	210	Manual	2	457
11	Setting back and back trim part by Both way tape attach on back zipper#5 part leather and attach zipper	188	192	180	178	185	185	85	157	185	Manual	2	519
12	Back zipper #5 lining attach with back and back trim part by both way tape	45	40	42	44	39	42	80	34	40	Manual	1	1200
13	Back zipper #5 lining stitching by flat bed sewing m/c	112	101	99	114	108	107	85	91	107	M/c	1	449
14	Marking Logo position and Logo fitting on Front leather and tape attach	129	126	123	139	138	131	85	111	131	Manual	2	733
15	Gluing on front Leather and rabus and foam and folding top 8 mm from edge	259	275	250	265	269	263	85	224	264	Manual	4	727
16	Marking magnet position on inner front trimming part and fixing	58	65	60	67	60	62	85	53	63	Manual	2	1524
17	Gluing On front inner trimming part and PVC and folding 8 mm from edge	177	170	167	188	185	177	80	142	168	Manual	3	857
18	Both way tape attach on front inner trimming part and lining attaching	67	52	57	64	61	60	85	51	60	Manual	2	1600
19	front inner trimming part and lining stitching	21	18	23	26	20	22	85	19	22	M/c	1	2182
20	Setting front and inner trimming part by both way tape	122	115	120	119	117	119	85	101	119	Manual	2	807
21	Front and inner trimming part sewing 2.5 mm from top edge	89	93	97	85	95	92	80	74	87	M/c	1	552
22	Marking magnet position on inner Back trimming part and fixing	65	69	67	70	61	67	85	57	67	Manual	2	1433
23	Gluing on back inner trim part and PVC and folding 8 mm from edge	167	156	163	160	159	161	80	129	152	Manual	1	315
24	Both way tape attach on Back inner trimming part and lining attaching	73	67	69	71	77	72	85	61	72	Manual	2	1333
25	Back inner trimming part and lining sewing	18	21	19	24	20	21	80	17	20	M/c	1	2400
26	Setting back and inner trimming part by both way tape	132	135	137	129	142	135	85	115	135	Manual	2	711
27	Back and inner trimming part sewing 2.5 mm from edge	76	82	87	79	84	82	80	66	77	M/c	1	623
28	Gluing on gusset and EVA and top folding	211	201	209	200	204	205	75	154	182	Manual	2	527
29	Gluing on loop and gusset and zipper with help of mark and attach loop and zipper on gusset and attach lining	240	257	249	253	263	252	80	202	238	Manual	3	605
30	loop and gusset and zipper stitching	45	53	41	56	49	49	75	37	44	M/c	1	1091
31	Preparation of piping	240	244	256	252	260	250	80	200	236	M/c	2	407
32	Both way tape attach on middle-1 and lining attaching	69	52	57	64	54	59	85	50	59	Manual	2	1627
33	middle-1 and lining stitching	23	20	26	25	27	24	85	20	24	M/c	1	2000
34	Marking magnet position on front middle-1 and fitting magnet	95	87	92	89	91	91	85	77	91	Manual	2	1055
35	Both way tape attach on middle-2 leather and lining attaching	76	67	79	72	78	74	80	59	70	Manual	1	686
36	middle-2 leather and lining stitching	24	21	27	19	22	23	85	20	24	M/c	1	2000
37	Marking magnet position and fitting magnet	100	93	91	87	94	93	85	79	93	Manual	2	1032
38	Piping stitching with front part with middle-1 and back part with middle-2	320	322	329	334	337	329	75	247	291	M/c	1	165
39	Handy pocket attaching with middle-1 by adhesive with help of marking	120	112	109	117	125	117	75	88	104	Manual	2	923
40	Handy pocket stitching with middle-1	89	79	75	82	71	79	80	63	74	M/c	1	649

41	Middle zipper attaching with middle with middle-2 lining	257	247	243	251	254	250	80	200	236	Manual	2	407
42	Middle zipper and middle-2 lining stitching	105	98	108	112	102	105	75	79	93	M/c	1	516
43	Middle-2 lining attaching with middle-2 leather by false stich	93	91	87	86	83	88	80	70	83	M/c	1	578
44	Middle-2 lining and middle-2 leather stitching	78	71	82	74	79	77	85	65	77	M/c	1	623
45	Gluing on bottom part and PVC and lining attaching on bottom part	149	156	148	158	150	152	85	129	152	manual	2	632
46	Piping stitching with bottom part leather	107	113	99	114	100	107	75	80	94	M/c	1	511
47	Gusset stitching with front and back part	425	437	439	420	423	429	80	343	405	M/c	1	119
48	Bottom stitching with upper	200	192	188	194	199	195	80	156	184	M/c	1	261
49	Belt joining by stitching	90	87	82	86	89	87	85	74	87	M/c	1	552
50	Adhesive apply on leather and hamaring	128	123	131	139	129	130	85	111	131	Manual	2	733
51	Gluing on full belt and stitching by die fixed sewing m/c	211	199	204	212	209	207	85	176	208	M/c	2	462
52	Belt attaching on bag by sewing	80	84	77	83	79	81	80	65	77	M/c	1	623
53	Binding on the leather joining edge by die fitting sewing m/c	104	112	107	102	99	105	85	89	105	M/c	1	457
54	Gluing on full pullar and stitching by cnc m/c and embossing	110	119	124	115	120	118	85	100	118	M/c	3	1220
55	Puller attaching on bag	120	117	115	123	119	119	80	95	112	Manual	1	429
56	Edge coloring	59	54	51	49	57	54	75	41	48	Manual	1	1000
57	Thread burning and cleaning and polishing	389	361	379	357	385	374	80	299	353	Manual	3	408
58	Staffing	79	73	69	81	82	77	75	58	68	Manual	1	706
59	Final checking	120	127	118	131	128	125	80	100	118	Manual	1	407
60	Price tag attaching and packaging	233	227	220	229	240	230	80	184	217	Manual	1	221
Total									6787	8004		97	

Table 2: Existing operations for ladies bag in centiminutes.



Picture 1: Different view of the sample article.

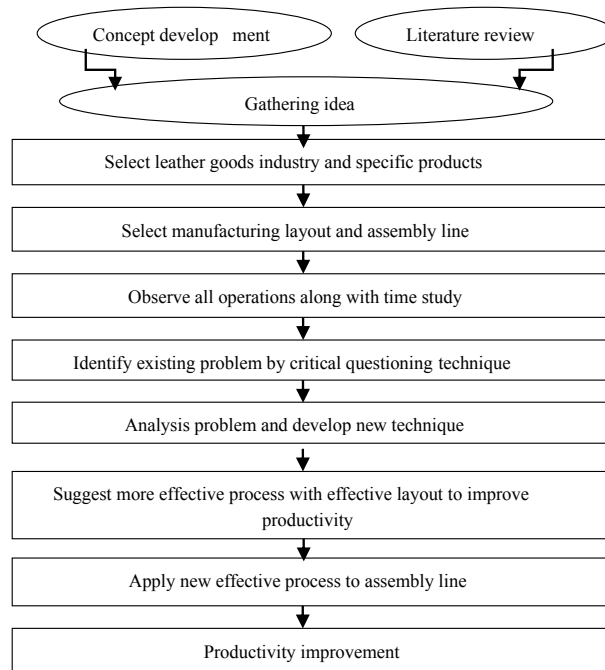


Figure 4: Conceptual Framework of research.

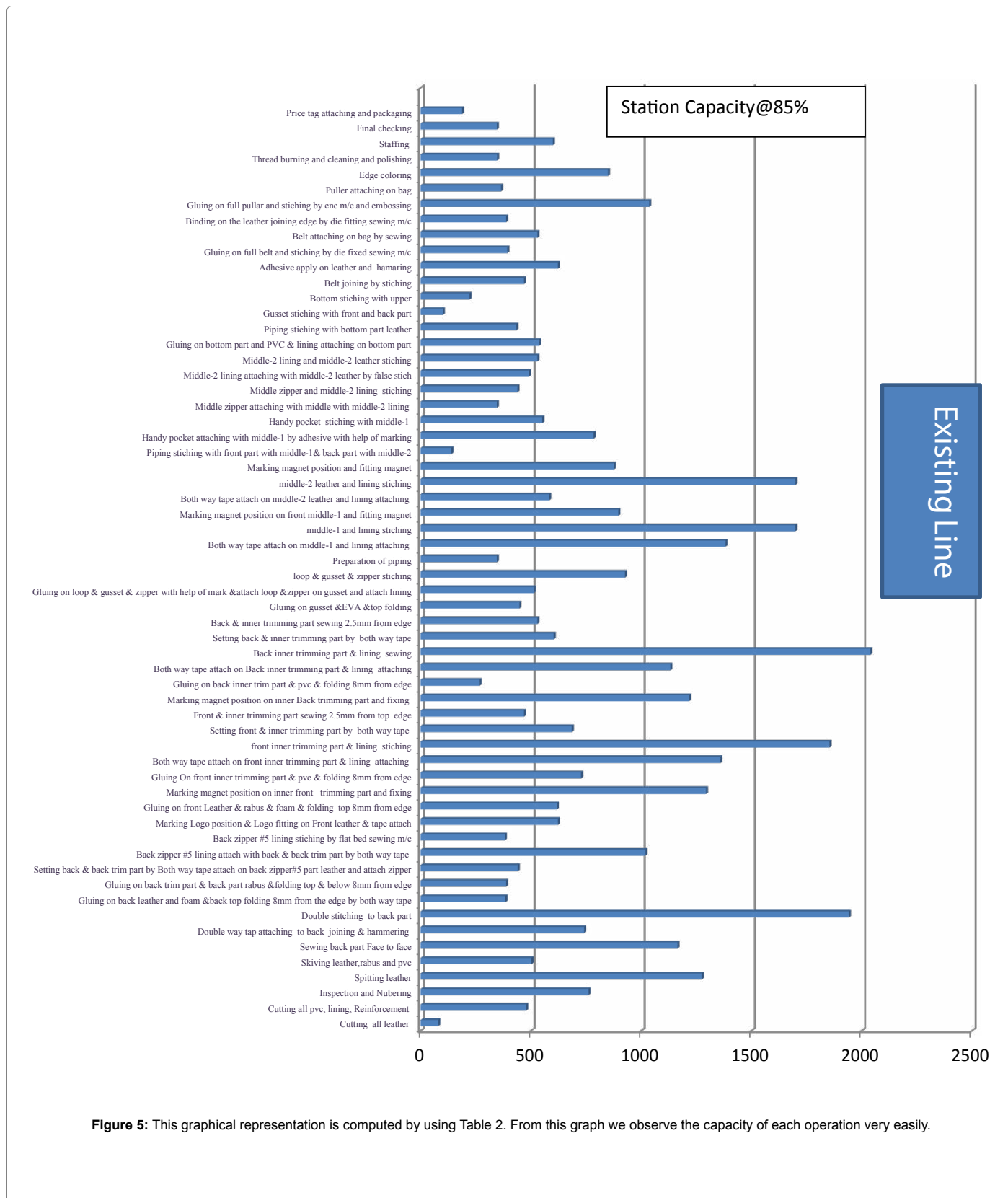


Figure 5: This graphical representation is computed by using Table 2. From this graph we observe the capacity of each operation very easily.

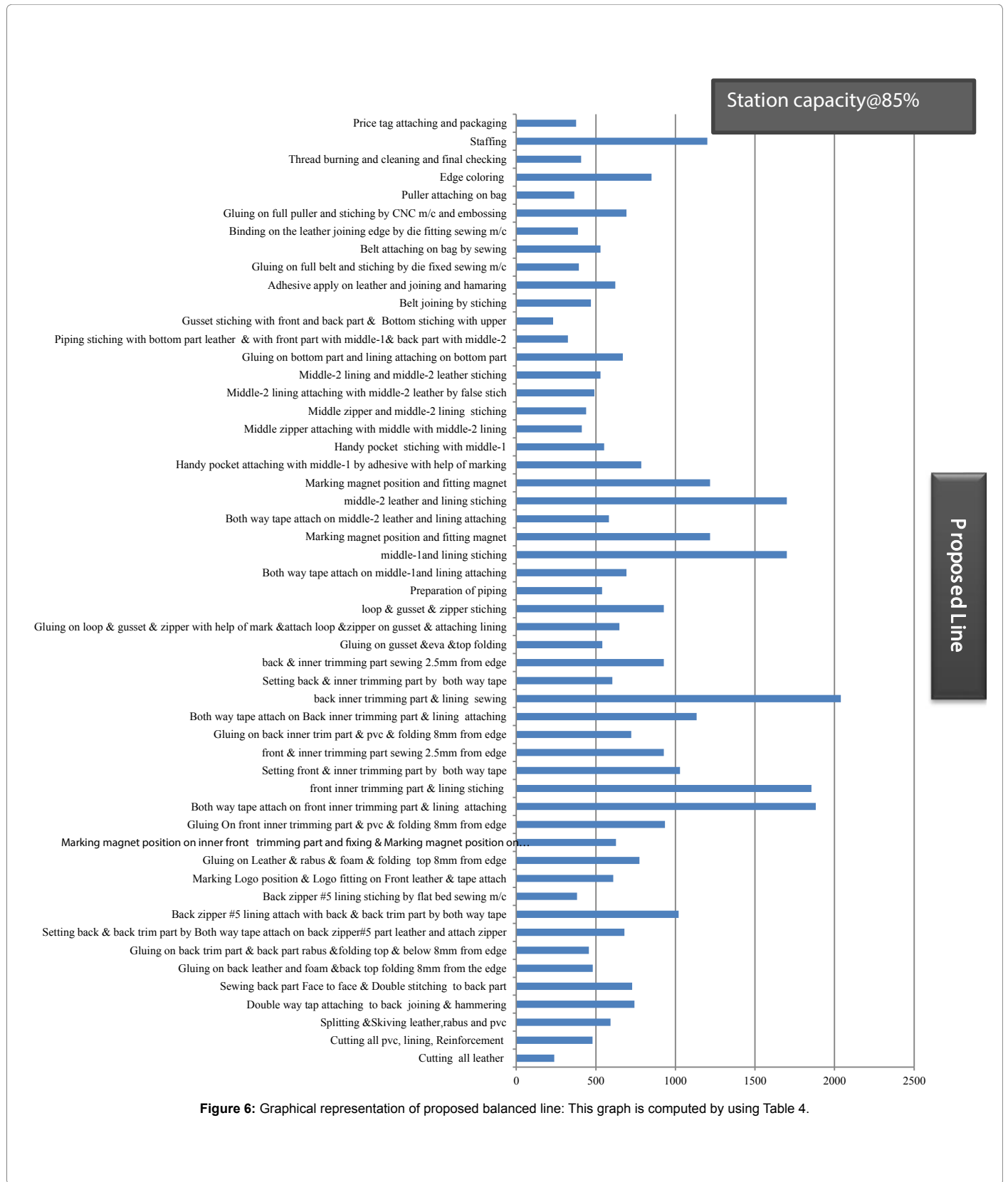


Figure 6: Graphical representation of proposed balanced line: This graph is computed by using Table 4.



Name of the critical operation	Existing Line		Proposed Line	
	Existing method	Std. Time/piece	Suggested method	Stand. Time/piece
Gluing on back leather and foam and back top folding 8 mm from the edge	Through gluing on leather is generally done by brush. The using brush to apply adhesive need more time.	212	Due to small component we could use water based adhesive by spraying m/c. By using this types of method of applying adhesive is more quicker than existing method	170
Inspection and Numbering	Inspection and numbering done in cutting.	107	Should be avoided it in cutting section	0
Gluing on back trim part and back part rabus and folding top and below 8 mm from edge	Through gluing on leather is generally done by brush. The using brush to apply adhesive need more time. Due to curve of top need more time.	210	We could use spraying method to apply adhesive. For curve of top folding we could use quicker method to save time.	179
Gluing on front Leather and rabus and foam and folding top 8 mm from edge	Through gluing on leather is generally done by brush. The using brush to apply adhesive need more time.	264	Due to small parts we could use spraying method to apply adhesive and if we use this method save time.	211
Gluing On front inner trimming part and PVC and folding 8 mm from edge	To manufacture this article use brush to apply adhesive. This method need more time than spraying method.	168	To manufacture this article we could use spraying method to apply adhesive to save time.	123
Front and inner trimming part sewing 2.5 mm from top edge	To attach front and inner top part generally use cylinder bad sewing m/c. Due to curve of top need more skilled worker and more time.	87	If we could use CNC m/c to stitch top curve due to small component and it save time to improve productivity.	44
Gluing on back inner trim part and PVC and folding 8 mm from edge	To manufacture this article use brush to apply adhesive. This method need more time than spraying method.	152	To manufacture this article we could use spraying method to apply adhesive to save time.	113
Back and inner trimming part sewing 2.5 mm from edge	To attach front and inner top part generally use cylinder bad sewing m/c. Due to curve of top need more skilled worker and more time.	77	If we could use CNC m/c to stitch top curve due to small component and it save time to improve productivity	44
Gluing on gusset and EVA and top folding	To manufacture this article use brush to apply adhesive. This method need more time than spraying method.	182	To manufacture this article we could use spraying method to apply adhesive to save time.	151
Gluing on bottom part and lining attaching on bottom part	To manufacture this article use brush to apply adhesive. This method need more time than spraying method.	152	To manufacture this article we could use spraying method to save time.	122
Edge coloring	Here there is no raw edge but still the use edge coloring for manufacturing defect	48	Most be avoided this for this article due to there is no raw edge present here.	--
Staffing	To save the article they use paper which need more time then use poly bag use.	68	If we could use poly bag to shape the article. This will be time saver method for this article.	34

Table 3: Critical analysis of operation.

to these specific products. Table 3 shows the critical operations which is done during implementation our research framework.

After line balancing of this product, we get higher productivity [31,32]. The calculation of proposed line balancing is shown in Table 4.

The graphical representation of proposed balanced line is also shown in Figures 5 and 6.

## Results and Discussion

The present production of existing production line is 240 pieces -bag/day. The working hours for this company are 8hr. In this production line the total number of worker is 97. So, that according to equation (1) the average productivity of this production line is approximately 2.5 pieces of bag per day. In this production line, the available working time is 48000 cent minutes. So, that work content for per pieces of bag is 8004 cent minutes. Standard output at 100% efficiency is 582 pieces bag per day. After all, the efficiency calculation is computed by using equation (3) is 41.23%.

In this research, using proposed line that can increase productivity to 12.71% from previous existing line. In earlier the work content per piece was 80.04 minutes. After line balancing and critical analysis the work content was 71.03 minutes. So, that the work content reduced

to 9.01 minutes after line balancing and critical method work. In this proposed line the standard output at 100% efficiency was 656 pieces bag per day. Input of this proposed line was 582 pieces bag per day. By using equation (6) the productivity improved to 12.71%.

Our proposed method helps to increase productivity to 12.71% with reduction of work content and line balancing.

## Conclusions and Recommendation

Productivity improvement is an important issue in leather products industry. The profit earning of leather products industry largely depends on productivity improvement. This study shows the way of finding gap of production process and operations. By implementing work study and method study and established new effective process for particular operation, we have to able to increase productivity. Especially this study shows the improvement of productivity in assembly line [33] of leather products manufacturing industry. The line balancing is the key point to increase productivity to particular products. For the sake of limitation we could not apply this technique to all products. For reducing work content to improve productivity, Lean manufacturing concept [34,35] could be used for our work. This study shows the productivity improvement by reduction of work content and line balancing. Further research could be done by using combination of lean and work study technique.

Sl. No	Name o the Operation	Sleeted Time	Rating	Basic Time	Standard Time	M/c/Manual	Man Power	Capacity/Day @ 100% efficiency	Capacity/Day @ 85% efficiency
1	Cutting all leather	542	80	434	513	M/c	3	281	239
2	Cutting all PVC, lining, Reinforcement	271	80	217	256	M/c	3	563	479
3	Splitting and Skiving leather, rabus and PVC	276	85	253	275	M/c	4	698	593
4	Double way tap attaching to back joining and hammering	111	85	94	110	Manual	2	873	742
5	Sewing back part Face to face and Double stitching to back part	60	80	48	56	M/C	1	857	728
6	Gluing on back leather and foam and back top folding 8 mm from the edge	180	80	144	170	Manual	2	564	480
7	Gluing on back trim part and back part rabus and folding top and below 8 mm from edge	190	80	152	179	Manual	2	536	456
8	Setting back and back trim part by Both way tape attach on back zipper#5 part leather and attach zipper	120	85	102	120	Manual	2	800	680
9	Back zipper #5 lining attach with back and back trim part by both way tape	42	80	34	40	Manual	1	1200	1020
10	Back zipper #5 lining stiching by flat bed sewing m/c	107	85	91	107	M/c	1	449	382
11	Marking Logo position and Logo fitting on Front leather and tape attach	67	85	57	67	Manual	1	716	609
12	Gluing on Leather and rabus and foam and folding top 8 mm from edge	210	85	179	211	Manual	4	910	774
13	Marking magnet position on inner front trimming part and fixing and Marking magnet position on inner Back trimming part and fixing	129	85	110	130	Manual	2	738	627
14	Gluing On front inner trimming part and PVC and folding 8 mm from edge	130	80	104	123	Manual	3	1171	935
15	Both way tape attach on front inner trimming part and lining attaching	60	85	51	60	Manual	2	1600	1882
16	front inner trimming part and lining stiching	22	85	19	22	M/c	1	2182	1855
17	Setting front and inner trimming part by both way tape	119	85	101	119	Manual	3	1210	1029
18	front and inner trimming part sewing 2.5 mm from edge	46	80	37	44	M/c	1	1091	927
19	Gluing on back inner trim part and PVC and folding 8 mm from edge	120	80	96	113	Manual	2	850	723
20	Both way tape attach on Back inner trimming part and lining attaching	72	85	61	72	Manual	2	1333	1133
21	back inner trimming part and lining sewing	21	80	17	20	M/c	1	2400	2040
22	Setting back and inner trimming part by both way tape	135	85	115	135	Manual	2	711	604
23	back and inner trimming part sewing 2.5 mm from edge	46	80	37	44	M/c	1	1091	927
24	Gluing on gusset and eva and top folding	170	75	128	151	Manual	2	636	541
25	Gluing on loop and gusset and zipper with help of mark and attach loop and zipper on gusset and attaching lining	200	80	160	189	Manual	3	762	648
26	loop and gusset and zipper stiching	49	75	37	44	M/c	1	1091	927
27	Preparation of piping	240	80	192	227	M/c	3	634	539
28	Both way tape attach on middle-1 and lining attaching	59	85	50	59	Manual	1	814	692
29	middle-1 and lining stiching	24	85	20	24	M/c	1	2000	1700
30	Marking magnet position and fitting magnet	67	85	57	67	Manual	2	1433	1218
31	Both way tape attach on middle-2 leather and lining attaching	74	80	59	70	Manual	1	686	583
32	middle-2 leather and lining stiching	23	85	20	24	M/c	1	2000	1700
33	Marking magnet position and fitting magnet	67	85	57	67	Manual	2	1433	1218
34	Handy pocket attaching with middle-1 by adhesive with help of marking	117	75	88	104	Manual	2	923	785
35	Handy pocket stiching with middle-1	79	80	63	74	M/c	1	649	552
36	Middle zipper attaching with middle with middle-2 lining	210	80	168	198	Manual	2	485	412
37	Middle zipper and middle-2 lining stiching	105	75	79	93	M/c	1	516	439
38	Middle-2 lining attaching with middle-2 leather by false stich	88	80	70	83	M/c	1	578	491
39	Middle-2 lining and middle-2 leather stiching	77	85	65	77	M/c	1	623	530
40	Gluing on bottom part and lining attaching on bottom part	121	85	103	122	Manual	2	787	669
41	Piping stiching with bottom part leather and with front part with middle-1 and back part with middle-2	427	75	321	378	M/c	3	381	324
42	Gusset stiching with front and back part and Bottom stiching with upper	560	80	448	528	M/c	3	273	232
43	Belt joining by stiching	87	85	74	87	M/c	1	552	469
44	Adhesive apply on leather and joining and hamaring	130	85	111	131	Manual	2	733	623
45	Gluing on full belt and stiching by die fixed sewing m/c	207	85	176	208	M/c	2	462	393

46	Belt attaching on bag by sewing	81	80	65	77	M/c	1	623	530
47	Binding on the leather joining edge by die fitting sewing m/c	105	85	89	105	M/c	1	457	388
48	Gluing on full puller and stitching by CNC m/c and embossing	118	85	100	118	M/c	2	814	692
49	Puller attaching on bag	119	80	95	112	Manual	1	429	365
50	Edge coloring	54	75	41	48	Manual	1	1000	850
51	Thread burning and cleaning and final checking	425	80	340	401	Manual	4	479	407
52	Staffing	39	75	29	34	Manual	1	1412	1200
53	Price tag attaching and packaging	230	80	184	217	Manual	2	442	376
	Total				7103		97		

**Table 4:** Proposed balanced line for ladies bag (Time in Centiminutes)

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