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Effective Machine Layout to Minimize the CM for T-shirt & Polo-shirt

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Abstract : *In this work we have studied about the production environment variables that may or may not affect the production process & costing of the product. No costing of a product can be prepared without CM (cost of making) & in order to calculate the CM efficiently we have to know about machine layout, or line balancing. Unquestionably, separate CM cost is calculated for different styles to find out the lowest possible costing value to get the order from the buyer in the competitive local & international market. Every manufacturer should exercise with appropriate line balancing based on the type of product to have the most effective line layout with maximum production along with the possible lowest man power involvement in production, which will ultimately ensure the maximum productivity, thus come lowest CM. So we have to employ effective line balancing to make the CM lowest & ensure business more lucrative as well.*
Keywords: *Cost of Making, layout, SMV*

I. INTRODUCTION

In modern competitive international market, it seems very arduous to grasp the commanding position apropos to the other competitors. We are conversant of that our maximal foreign currency comes from the Ready Made Garments Sector. However, if we lose the international market as well as buyer, our economy would be collapsed down very shortly. To buttress our economy and keep garment sector going on grandly, we have to grab buyers more than our competitive countries. In order to seize the overseas buyers, we have to offer the lowest rational price to them ensuring the revenue of the manufacturers. For executing this successfully, we have to ensure that the CM (Cost of Making) would be as less as possible. CM can undoubtedly be curtailed using best fitting machine lay out & line balancing with technical parameters as well as employing lowest man power for a particular process to increase the productivity under perfect production ambience. In this project, we have worked to find out the best process sequence along with proper line balancing & a way to abridge the CM for Tee-shirt and Polo-shirt production.

II. REQUIREMENTS TO FIND OUT THE OBJECT

We have taken the machine layout of standard T-shirt & Polo-shirt as sample product; with the intention of finding out the proper line layout and lowest CM for that particular type of garment. To find out what we need, we have to consider the following things first.

1. Determine SMV of the garment

SMV calculation:
Average time allowed for 1 cycle of an operation that would measure over a typical day if we had-a skilled worker-plenty of suitable work-output of correct level of quantity.

$$SMV = \frac{\text{Total required time to finish a process (sec)}}{60} + Allowance(15\%) \quad (minute)$$

2. Calculate average line efficiency (Line Balancing)

Example of line balancing:

Step 1: layout according to style:

Process #1	production	40 pcs by	1 m/c,	end production 40 pcs
Process #2	production	45 pcs by	1 m/c,	end production 40 pcs
Process #3	production	75 pcs by	1 m/c,	end production 40 pcs
Process #4	production	80 pcs by	1 m/c,	end production 40 pcs
Process #5	production	50 pcs by	1 m/c,	end production 40 pcs

Before balancing the production of line is 40 pcs

Step 2: layout according to style (after balancing):

Process #1	production	40 pcs by	2m/c,	end production 80 pcs
Process #2	production	45 pcs by	2 m/c,	end production 80 pcs
Process #3	production	75 pcs by	1 m/c,	end production 75 pcs
Process #4	production	80 pcs by	1 m/c,	end production 75 pcs
Process #5	production	50 pcs by	2 m/c,	end production 75 pcs

After line balancing per hour production is 75 pcs

III. CM MEASUREMENT FOR A PARTICULAR TYPE OF GARMENT:

After following all these steps we can finally find out the CM for a particular garment using the following formula

CM calculation using SMV

CM = SMV of the garment * Cost per SMV

To calculate the CM we need SMV of that particular garment & cost per SMV for that garment. As cost per SMV is confidential we are assuming the value of cost per SMV as "x".

Cost of making using SMV				
Sample	Factory	SMV	Cost per SMV	CM
T shirt	Oeco	5.77	X	5.77x
	Mondol	5.77	X	5.77x
	Aps	5.56	X	5.56x
Polo shirt	Oeco	15.46	X	15.46x
	Mondol	14.89	X	14.89x
	APS	13.32	X	13.32x

Table 1: CM of T-Shirt using SMV of different factory

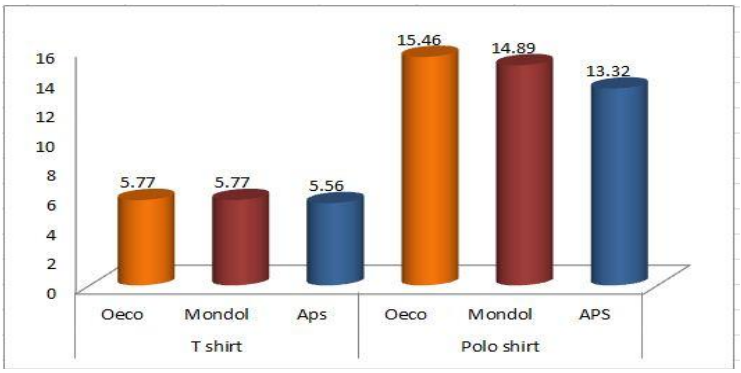

Figure 1: CM of T-Shirt using SMVof different factory

From the above graph it is clear that "APS Group" has the lowest CM for producing both T shirt &Polo shirt.

CM using the M/C cost:

$$\mathrm{CM} = \frac{\text{Total No. of machine} * \text{Machine cost per day}}{\text{Production per Hour} * \text{Total working hour per day}}$$

In this case we will need the machine cost per day data to find out the CM for relevant garment, which is also a confidential data & it was not provided by the factory to us. So we are assuming that the "machine cost per day" is x.

Cost of making using M/C cost per Day							
	Factory	Total no. of machine	Machine cost per day	Production per hour	Total working hour	CM	CM * 1000(for chart)
T shirt	Oeco	16	X	148	11	0.0098x	9.8x
	Mondol	16	X	153	11	0.0095x	9.5x
	Aps	14	X	150	11	0.0085x	8.5x
Polo shirt	Oeco	34	X	121	11	0.0255x	25.5x
	Mondol	30	X	124	11	0.0220x	22.0x
	APS	27	X	104	11	0.0236x	23.6x

Table 2: CM of T-Shirt using machine cost of different factory

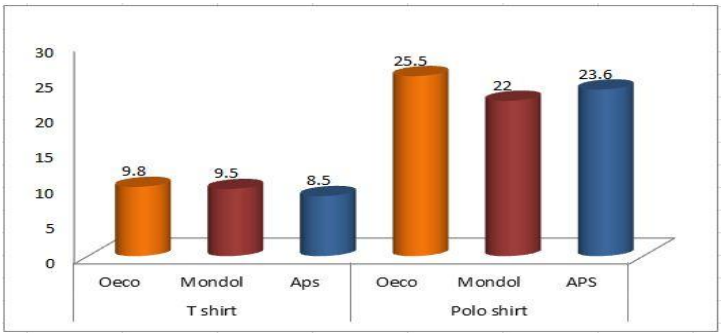

Figure 2: CM of T-Shirt using machine cost of different factory

In order to compare the data of the above table we have multiplied the CM with 1000 so that it be easier for us to compare them. Here we can see that the lowest CM is - of "APS Group" for the tee shirt& "Mondol Group" for Polo shirt.

CM calculation using Line cost:

$$\text{CM} = \frac{\text{Line cost per day}}{\text{Production per day}}$$

In this method we will use x in case of "line cost per day" to find out the CM of the product.

Cost of making using Line cost					
Sample	Factory	Production per day	Line cost per day	CM	CM * 10000(for chart)
T shirt	Oeco	1633	X	0.00061x	6.1x
	Mondol	1687	X	0.00059x	5.9x
	Aps	1653	X	0.00060x	6.0x
Polo shirt	Oeco	1337	X	0.000674x	7.5x
	Mondol	1365	X	0.00073x	7.3x
	APS	1146	X	0.00087x	8.7x

Table 3: CM of T-Shirt using line cost of different factory

Graphical chart of the above data:

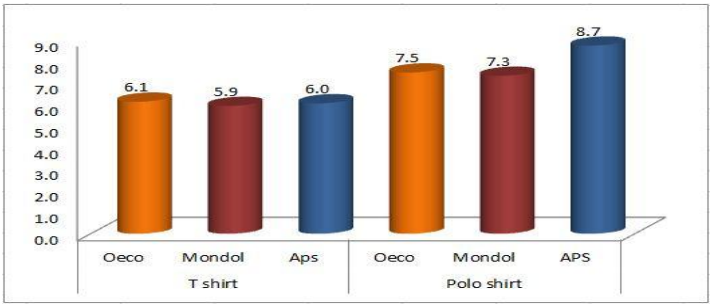

Figure 3: CM of T-Shirt using line cost of different factory

Here again to compare the data of the above table we have multiplied the CM with 10,000 so that it be easier for us to compare them. Comparing those data we can come to a conclusion that "Oeco Group" has lowest CM for T shirt& "Mondol Group" has the lowest CM for Polo shirt.

IV. DISCUSSION

Regarding T-shirt, Analyzing the table 1, 2 & 3 we can finally come to the conclusion that "APS group" has the lowest CM for producing T Shirt. On the other hand "Oeco Group" has the highest CM for T-shirt production. So the layout of "APS Group" can be more preferable than the other two layouts.

Regarding Polo Shirt, table 1, 2 & 3 give us information for the most suitable machine layout for the Polo Shirt production. All of the formulas give us a result focusing on the exact layout for Polo Shirt production. The "Mondol Group" has the minimum CM for producing Polo Shirt on the other hand the "Oeco Group" has the highest CM cost for the process. So the layout of "Mondol Group" is more suitable one for Polo Shirt production.

V. CONCLUSION

Admittedly, garments sector of our country is developing very rapidly, more factories & industries are being built to advocate the increasing global demand. Personnel & the authority of these factories have to produce product with rational price to survive in the global market against the giant competitors. To grab the authoritative position over the comprehensive RMG market, there is no way but find out the way to produce products more professionally & certainly offer the products to the buyer with possible lowest price. Antecedently, there is no other way but analyzing the manufacturing process to get the highest productivity with the lowest expenditure which will ensure not only the lowest cost of making and maximum profit for the manufacturer but also enormous revenue for our beloved country.

REFERENCES

[1] Data from IE Department,APS Group
[2] Data from IE Department , Mondol Group
[3] Data from IE Department , Oeco Group
[4] www.chrmglobal.com [Date: 03/11/2015]
[5] www.onlineclothingstudy.com [Date: 016/12/2015]
[6] Prof M A Kashem, *Garments & Technology* (Gronthonir 2009)
[7] M A Sayeed, *Production Plannig & Control* (2014)

APPENDIX

Table4: Comparison of T- Shirt Making Process from Different Factory

	OEKO-TEX						APS						MONDOL GROUP					
Sl.	Operation	Hel. / M/c	No.	Task Time (sec)	SMV	Trg./ Hr	Operation	Hel. / M/c	No.	Task Time (sec)	SMV	Trg/ Hr	Operation	Hel. / M/c	No.	Task Time (sec)	SMV	Trg/ Hr
1	Back & front Matching	HP	1	17	0.33	184	Back & front Matching	HP	1	18	0.35	174	Back & front Matching	HP	2	19	0.36	165
2	Shoulder join	O/L	1	13	0.25	241	Shoulder join	O/L	1	12	0.23	261	Shoulder join	O/L	1	11	0.21	285
3	Neck rib tuck	S/N	1	11	0.21	285	Neck rib tuck	S/N	1	12	0.23	261	Neck rib tuck	S/N	1	13	0.25	241
4	Neck joint	O/L	1	16	0.31	196	Neck joint	O/L	1	17	0.33	184	Neck joint	O/L	2	19	0.36	165
5	Back tape joint	F/L	1	16	0.31	196	Back tape joint	F/L	1	15	0.29	209	Back tape joint	F/L	1	14	0.27	224
6	Lbl joint mark	HP	1	10	0.19	313	Lbl joint mark	HP	1	9	0.17	348	Lbl joint mark	HP	1	9	0.17	348
7	Back tape t/s+ Lbl joint	S/N	1	19	0.36	165	Back tape t/s+ Lbl joint	S/N	1	18	0.35	174	Back tape t/s+ Lbl joint	S/N	2	21	0.40	149
8	Neck t/s	F/L	1	15	0.29	209	Neck t/s	F/L	1	14	0.27	224	Neck t/s	F/L	1	15	0.29	209
9	Sleeve hem	F/L	1	19	0.36	165	Sleeve hem	F/L	1	16	0.31	196	Sleeve hem	F/L	1	18	0.35	174
10	Sleeve matching	HP	1	15	0.29	209	Sleeve matching	HP	2	18	0.35	174	Sleeve matching	HP	1	16	0.31	196
11	Sleeve join	O/L	2	30	0.58	104	Sleeve join	O/L	2	28	0.54	112	Sleeve join	O/L	2	27	0.52	116
12	Side Seam	O/L	2	36	0.69	87	Side Seam	O/L	2	34	0.65	92	Side Seam	O/L	2	35	0.67	89
13	Sleeve in tuck	S/N	1	15	0.29	209	Sleeve in tuck	S/N	1	16	0.31	196	Sleeve in tuck	S/N	1	18	0.35	174
14	Press tack	S/N	1	17	0.33	184	Press tack	S/N	1	16	0.31	196	Press tack	S/N	1	15	0.29	209
15	BTM hem	F/L	1	13	0.25	241	BTM hem	F/L	1	12	0.23	261	BTM hem	F/L	1	13	0.25	241
16	Thread trimming	HP	3	39	0.75	80	Thread trimming	HP	2	35	0.67	89	Thread trimming	HP	3	38	0.73	82
			22		**5.77**				**20**		**5.56**				**23**		**5.77**	

Table 5: Comparison of Polo Shirt Making Process from Different Factory

Sl. no	OEKO-TEX						APS						MONDOL GROUP					
	Operation	Hel/ M/c	Req. no.	Task Time (sec)	SMV	Trg. /Hr	Operation	Hel. / M/c	Req no	Task Time (sec)	SMV	Trg/ Hr	Operation	Hel. / M/c	Req. no.	Task Time (sec)	SMV	Trg / Hr
1	Back & Front Part matching	Hel.	2	24	0.46	130	Back & Front Part matching	Hel.	1	18	0.35	174	Back & Front Part matching	Hel.	1	24	0.46	130
2	Shoulder join	O/L	1	22	0.42	142	Shoulder join	O/L	1	19	0.36	165	Shoulder join	O/L	1	18	0.35	174
3	Plkt side OL & Mark	O/L	2	30	0.58	104	Plkt side OL & Mark	O/L	1	20	0.38	157	Plkt side OL & Mark	O/L	1	18	0.35	174
4	Placket attach mark	Hel.	1	20	0.38	157	Placket attach mark	Hel.	1	16	0.31	196	Placket attach mark	Hel.	1	17	0.33	184
5	Plkt attach	S/N	2	26	0.50	120	Plkt attach	S/N	1	22	0.42	142	Plkt attach	S/N	1	23	0.44	136
6	Plktlinning attach	Hel.	1	16	0.31	196	Plktlinning attach	Hel.	1	18	0.35	174	Plktlinning attach	Hel.	1	18	0.35	174
7	Plkt mark	Hel.	1	20	0.38	157	Plkt mark	Hel.	1	22	0.42	142	Plkt mark	Hel.	1	21	0.40	149
8	Plkt rolling T/S(Lower)	S/N	2	26	0.50	120	Plkt rolling T/S(Lower)	S/N	1	24	0.46	130	Plkt rolling T/S(Lower)	S/N	1	25	0.48	125
9	Plkt rolling T/S(Upper)	S/N	1	20	0.38	157	Plkt rolling T/S(Upper)	S/N	1	18.2	0.35	172	Plkt rolling T/S(Upper)	S/N	1	20	0.38	157
10	Plkt end tack	S/N	2	26	0.50	120	Plkt end tack	S/N	1	24	0.46	130	Plkt end tack	S/N	1	23	0.44	136
11	Collar Make	S/N	2	38	0.73	82	Collar Make	S/N	2	36	0.69	87	Collar Make	S/N	2	38	0.73	82
Sl. no	**OEKO-TEX**						**APS**						**MONDOL GROUP**					
	Operation	**Hel/ M/c**	**Req. no.**	**Task Time (sec)**	**SMV**	**Trg. /Hr**	**Operation**	**Hel. / M/c**	**Req no.**	**Task Time (sec)**	**SMV**	**Trg/ Hr**	**Operation**	**Hel. / M/c**	**Req. no.**	**Task Time (sec)**	**SMV**	**Trg / Hr**
12	**Collar turn over**	**Hel**	**1**	**22**	**0.42**	**142**	**Collar turn over**	**Hel**	**1**	**20**	**0.38**	**157**	**Collar turn over**	**Hel**	**1**	**21**	**0.40**	**149**
13	Collar edge cut	O/L	2	25	0.48	125	Collar edge cut	O/L	1	24	0.46	130	Collar edge cut	O/L	2	27	0.52	116
14	Collar join cut mark	Hel.	1	20	0.38	157	Collar join cut mark	Hel.	1	22	0.42	142	Collar join cut mark	Hel.	1	23	0.44	136
15	Collar join to body	S/N	2	36	0.69	87	Collar join to body	S/N	2	38	0.73	82	Collar join to body	S/N	2	39	0.75	80
16	Collar neck excess cut	O/L	1	18	0.35	174	Collar neck excess cut	O/L	1	15	0.29	209	Collar neck excess cut	O/L	1	16	0.31	196
17	Neck piping	F/L	1	18	0.35	174	Neck piping	F/L	1	17	0.33	184	Neck piping	F/L	1	17	0.33	184
18	Neck piping T/S with size LBL	S/N	2	33	0.63	95	Neck piping T/S with size LBL	S/N	2	35	0.67	89	Neck piping T/S with size LBL	S/N	2	38	0.73	82
19	SLV open hem	F/L	1	19	0.36	165	SLV open hem	F/L	1	18	0.35	174	SLV open hem	F/L	1	18	0.35	174
20	Care Label Make	S/N	1	24	0.46	130	Care Label Make	S/N	1	20	0.38	157	Care Label Make	S/N	1	16	0.31	196
21	Sly gathering	S/N	1	23	0.44	136	Sly gathering	S/N	1	20	0.38	157	Sly gathering	S/N	1	21	0.40	149