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A STUDY TO INVESTIGATE THE EFFECTIVENESS OF THE IMPLEMENTED LEAN CONCEPT IN SELECTED APPAREL MANUFACTURING ORGANISATIONS IN SRI LANKA

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INTRODUCTION

All over the world apparel manufacturing is a labour intensive manufacturing process. Further, the capital investment required to manufacture apparels is low compared to many other industries. The apparel industry is regarded as one of the most dynamic industries in the world. The competition among the apparel manufacturing organisations is very high and their success or survival depends on their ability to respond to customer requirements. The present state of the global clothing industry could be characterised by low through put time, high work-in progress, higher quality, low cost, shorter product development, shorter delivery times, smaller order quantities etc. (Perera, 2006).

Presently Sri Lankan clothing manufacturers face greater competition from other developing countries in South and South East Asia such as India, Bangladesh, Pakistan, Indonesia, Cambodia, Laos and Vietnam. In addition to that China has also emerged as a dominant force in the global clothing industry with its massive supply capability (Kelegama, 2005).

The researchers, who carried out research on fully automating the apparel manufacturing process through projects such as TRAASS (Japan), $(TC)^2$(USA) and BRITE (Europe), have realised that fully automation of the sewing process is not possible due to many reasons. Once the attempt to fully automate the sewing process failed, researchers as well as apparel manufacturers looked for other ways to improve the productivity (Forche,1991) (Zoell, 2002). In this light, Sri Lankan apparel manufacturers opted to practice many manufacturing and organisational techniques or concepts to improve the productivity to be competitive in the dynamic apparel market. One such concept is the application of lean concept in Sri Lankan apparel manufacturing organisations.

The major objective of this study is to find out the effectiveness of the implementation of lean concept in selected apparel manufacturing organisations in Sri Lanka.

METHODOLOGY

1. A comprehensive literature survey was carried out to understand lean concept and the implementation of lean concept in apparel manufacturing organisations.
2. Three reputed export oriented apparel manufacturing organisations, which have implemented the lean concept, were selected for the research.
3. A seven year (07) period, starting from the year 2005 to 2011 was selected for the study. This seven year period covers three (03) years before the implementation of the lean concept (2005-2007), one (01) year of lean concept implementation (2008) and three (03) years after the implementation of the lean concept (2009-2011).
4. The necessary data was collected with the aid of production and activity sampling records of the selected apparel manufacturing organisations for the seven year period.

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5. The data was analysed to find out the effectiveness of implementation of the lean concept of the selected apparel manufacturing organisations.

DATA COLLECTION

The selected apparel manufacturing organisations were named A, B and C for the data collection and analysis purposes. The monthly efficiencies of each production module were calculated by using the daily efficiencies of each production module. By using the monthly efficiencies of each production module, the yearly efficiency of each apparel manufacturing organisation was calculated.

Similarly the contribution of the seven wastes such as over-production, waiting, transporting, inappropriate processing, unnecessary inventory, excessive motion and defects to the efficiency loss were also calculated. These were performed for the following three periods for the three apparel manufacturing organisations A, B and C.

Period 1: Three (03) years before the implementation of the lean concept (2005-2007)
Period 2: One (01) year of lean implementation (2008) and
Period 3: Three (03) years after the implementation of the lean concept (2009-2011).

ANALYSIS OF RESULTS AND DISSCUSSION

Apparel manufacturing organisation A during the years 2005 to 2011

Year	Efficiency (%)	Efficiency Loss (%)	7 wastes (%)	Other Factors (%)
2005	62.34	37.66	27	73
2006	63.28	36.72	40	60
2007	69.49	30.51	36	64
2008	67.78	32.22	26	74
2009	66.25	33.75	39	61
2010	64.15	35.85	44	56
2011	62.00	38.00	38	62

Table 1: Efficiency gained and losses of the organisation

As per the table 1, the average efficiency before the implementation is 65.04%. The efficiency during the implementation is 67.78%. The average efficiency after the implementation is 64.13%. As per the efficiency data, the apparel manufacturing organisation A does not show any efficiency improvement due to the application of lean concept.

Contribution of each waste to total 7 wastes	2005	2006	2007	2008	2009	2010	2011
Overproduction	1	3	3	3	3	3	3
Waiting	3	5	4	3	3	4	3
Transporting	2	1	3	2	1	2	3
Inappropriate	3	5	8	3	4	3	4
Unnecessary inventory	1	2	3	1	2	1	1
Excessive motion	3	6	5	3	3	5	3
Defects	14	18	10	11	23	26	21
Total	27	40	36	26	39	44	38

Table 2: Contribution of each waste to total 7 wastes in the organisation

As per the table 2, the average contribution of the 7 wastes after the implementation of the lean concept to the total efficiency loss is 40.3%. This is due to high percentage of defects generated after the implementation of lean concept.

Apparel manufacturing organisation B during the years 2005 to 2011

Year	Efficiency (%)	Efficiency Loss (%)	7 wastes (%)	Other Factors (%)
2005	65.39	34.61	32	68
2006	66.34	33.66	31	69
2007	66.53	33.47	29	71
2008	60.01	39.99	38	62
2009	61.59	38.41	36	64
2010	49.63	50.37	32	68
2011	64.10	35.09	37	63

Table 3: Efficiency gained and losses of the organisation

As per the table 3, the average efficiency before the implementation is 66.09%. The efficiency during the implementation is 60.01%. The average efficiency after the implementation is 58.44%. As per the efficiency data, the apparel manufacturing organisation B too does not show any efficiency improvement due to the application of lean concept.

Contribution of each waste to total 7 wastes	2005	2006	2007	2008	2009	2010	2011
Overproduction	4	3	3	3	3	3	3
Waiting	3	2	7	4	4	2	3
Transporting	5	4	2	1	4	1	4
Inappropriate processing	1	3	2	5	4	3	5
Unnecessary inventory	5	2	1	2	1	5	1
Excessive motion	1	2	3	4	2	4	2
Defects	13	15	11	15	18	14	19
Total	32	31	29	38	36	32	37

Table 4: Contribution of each waste to total 7 wastes in the organisation

As per the table 4, the average contribution of the 7 wastes after the implementation of the lean concept to the total efficiency loss is 35%. This is due to high percentage of defects generated after the implementation of lean concept.

Apparel manufacturing organisation C during the years 2005 to 2011

Year	Efficiency (%)	Efficiency Loss (%)	7 wastes (%)	Other Factors (%)
2005	43.42	56.58	34	66
2006	50.08	49.92	46	54
2007	57.93	42.07	28	72
2008	63.26	36.74	41	59
2009	63.30	36.70	38	62
2010	62.55	37.45	32	68
2011	61.98	38.02	45	55

Table 5: Efficiency gained and losses of the organisation

This organisation began its operations in the year 2005. As per the table 5, the average efficiency before the implementation is 50.48%. This value is very low compared to other two organisations. This organisation has shown approximately 7% increase in the efficiency in the years 2006, 2007 and 2008. After the implementation it does not show any significant improvement in efficiency.

Contribution of each waste to total 7 wastes	2005	2006	2007	2008	2009	2010	2011
Overproduction	3	4	3	3	3	3	3
Waiting	2	5	2	4	3	2	3
Transporting	4	2	4	3	2	2	4
Inappropriate processing	3	1	2	7	3	2	1
Unnecessary inventory	5	3	1	3	1	1	3
Excessive motion	7	5	3	5	5	3	4
Defects	10	26	11	16	21	19	27
Total	34	46	28	41	38	32	45

Table 6: Contribution of each waste to total 7 wastes in the organisation

As per the table 6, the average contribution of the 7 wastes after the implementation of the lean concept to the total efficiency loss is 38.33%. This is due to the high percentage of defects generated after the implementation of lean concept.

CONCLUSIONS

It is clear that no improvement in the efficiency levels of the selected manufacturing organisations can be seen after the implementation of the lean concept. Actually the efficiencies of all the manufacturing organisations have been reduced as a result of the implementation of the lean concept. In the apparel manufacturing organisation A, the average efficiencies before, during and after the implementation are 65.04%, 67.78% and 64.13% respectively. In the apparel manufacturing organisation B, the average efficiencies before, during and after the implementation are 66.09%, 60.01% and 58.44% respectively. In the apparel manufacturing organisation C, the average efficiencies before, during and after the implementation are 50.48%, 63.26% and 62.61% respectively. As the apparel manufacturing organisation C began its operations in the year 2005, the average efficiency before the implementation is very low.

All three manufacturing organisations show higher average increase of defects after the implementation of lean concept. In addition to that the apparel manufacturing organisation A shows a marginal average increase in the over production after the implementation of lean concept. The apparel manufacturing organisation B shows a marginal average increase in the inappropriate processing and excessive motion. The apparel manufacturing organisation C does not show any increase other than the defects. Therefore, it is clear that the major reason for reduced efficiencies in all three apparel manufacturing organisations even after the implementation of the lean concept is the increase of the defects.

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