The Impact of Lean Manufacturing Tools Towards the Process Improvement:A Study Based on Reduction of Touchpoints of Apparel Warehouse Label Quarantine Process

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INTRODUCTİON

A warehouse is a service facility which plays a major role in the Supply Chain Management System in an organization. It generates value through its own warehouse practices which creates a competitive advantage to the firm in manufacturing as well as distributing the finished goods (Wiseman, 1988). Internal and External factors such as accurate order fulfillments and delivery, shorter order cycle time, layout design, storage assignment methods, routing methods as well as new trends in manufacturing and warehouse systems, changes in throughputs, customer higher expectations on fast, impact on the warehouse operations in achieving warehouse productivity, to provide better customer service and reduce the lead time and cost (De Koster, 2007, Perera and Kumarage 2013). Due to the inefficiencies and ineffective logistics practices in Sri Lankan warehouse operations such as higher lead time (Dheerasinghe, undated), slotting techniques (Lakmal and Wickramarachchi 2011), impact to the productivity of the warehouse and it generates a significant amount of cost to the Supply chain nearly 23% of GPD. (Central Bank report 2009). Therefore, it is need of the hour to draw attention towards the improvement in Sri Lankan warehouse practices in terms of reduction of cost and lead time in the warehouse practices. Lean manufacturing, six sigma and TQM are few aspects that can be used to improve the warehouse practices in both manufacturing and services organizations. (Furterer,and Elshennawy, 2005, Goh and Xie 2004).

According to Garcia (2003) successful application of Lean techniques generated more benefits especially in reducing lead time (the unnecessary time part of the order-to-delivery processes), order picking time, and the time for material handling in warehouses practices. Further, it is clear that those advantages can be achieved through the reduction of Non value-added activities and improvement of the warehouse velocity and flow. Also, Phogat (2013) highlighted that the application of lean in

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warehousing make successful in eliminating waste and generating more value to the customer. (Nystuen 2002) experienced the generating variety of benefits through applying lean manufacturing such as reduction of travel time by 90% and reduction of inventory by 82% and lead time by 11% which can have the possibility to make competition in the market place.

Further in Sri Lankan context lean manufacturing successfully applied in the apparel sector to optimize the warehouse process (Silva *et al.,* 2011 and Wijethunga 2013) successfully by reducing the dock to dock inventory from 30 days to 15 days significantly with the cash cycle on inventories. Therefore, this research article focuses on improving the warehouse process by reducing the touch points (places or points where the human involvement in the process) of the system through the application of the Lean manufacturing tools to improve the flow of the warehouse operations to meet the organizational and customer requirement. Human touch points in a process will make process lengthier one. This study focuses on reducing the human involvement process to improve the process by eliminating unnecessary over process using lean manufacturing tools.

AİM OF THE RESEARCH

Based on organization performance data it is clear that cycle time of the Label Quarantine process is higher and it contributes one of the major types of Muda (waste) of over processing. Based on it the main objective of the study is to improve the Label Quarantine process by reducing its touch points of the warehouse by applying lean manufacturing tools.

THEORETİCAL FOUNDATİON

Lean thinking is a set of methodologies which aim for maximizing the value of the product, based on value addition of the process and elimination of waste. All its principles line on minimizing various types of waste “Muda” in Lean term throughout the entire process of the value chain. Also it is an integrated Socio-technical system to achieve its major objectives of elimination of waste (Shan and Ward 2001). Waste or the Muda is considered fewer than seven forms such as transport, Inventory, Motion, Waiting, Overproduction, over-processing and defect. Out of this seven waste types over processing is considered for the study.

METHODS

This study is a qualitative and quantitative mixed study in nature. Both qualitative and quantitative data are used for this study. Primary data and secondary data are used for the study. Interviews with responsible authorities, direct observations (shop floor visits, OHNO Circle), Kaizen suggestions from brainstorming methods are used to gather Primary data in a qualitative manner. Standard Operation Procedures and system generated documents are used as Secondary data in a quantitative manner.

Population and Sample and Sample selection

All the number of Label Quarantine process (LQ) of the warehouse in the financial year starting from January 2019 to March 2019 at MAS Slimtex Division Kuliyapitiya are considered as populations of the study to reach the study objectives. Among the all LQ processes carried out during this three months, 2426 number of LQ processes are considered for the sample. And it is nearly 50% of the total number of LQ process. Sample of 2426 of LQ processes are drawn by using Simple Random sampling method under Statistical sampling methods. Direct observation method is used in order to gather the number of activities perform in the process.

25 number of employees are interviewed and Kaizen suggestions are taken by using Kaizen Suggestions forms and brainstorming methods which generate qualitative data. This was taken by using a Simple Random Sampling method. 2426 invoice system records are taken randomly using Simple random sampling method to identify the touch points of the LQ process. Four types of international labels such as VSS, GAP, M&S, Lasenza are considered. These four types of brands have higher cycle time in LQ process this organization. These required materials components in a garment received items from each category is considered for the study. Labels and their categories are as follows in table 1.

Table 1: Label brands and their requirement materials components in a garment

Brands	VSS	Gap	M&S	Lasenza
Customer requirement material component in a garment.	LEBAL	LEBAL	LEBAL	LEBAL
	PT	PT	PT	PT
	HS	HS	HS	TAB
	STK	STK	HU STK	STK
	BOW	BOW	BOW	
	RING	RING	RING	
		IN CARD	UPC	
		ID	BUTTON	
		LR-STK		

Inclusive and exclusive criteria of the study

Following inclusive and exclusive criteria are considered when drawing the sample for the study.

Table 2. Inclusive and exclusive criteria of the sample selection

Inclusive Criteria	Exclusive criteria
Only LQ process is considered among overall warehouse process.	Documentation system is not considered. Only the operations process considered
Only over processing is considered under lean seven types of waste as LQ process has longer cycle time.	Warehouse employees are selected for the sample and other departments employees are not considered for Kaizen and brainstorming methods.
Different data collections are used to identify the touch points of the system.	Limited only to the Lean tools of Process mapping, Kaizen suggestions and Fishbone diagram as Researchers need to get more descriptive data from experienced employees and these tools provide clear idea about the process and easy to filter the various suggestions and identify the root causes among other Lean tools.

Data analysis

To reach the study objectives descriptive data analysis (Touch points, and SOP activities percentages) and Content and Pattern Matching Technique are used. Lean manufacturing tools such as process mapping, Kaizen system, Fish bone diagram, are used in order to find the root causes and analyze the ideas and suggestions obtained qualitatively. By using Content and Pattern Matching Technique all the qualitative data obtained from Brainstorming and interview methods are analyzed.

RESULTS

After receiving the labels, until they store properly in the warehouse twenty-five process activities are currently curried out based on SOP (Standard Operations Procedure). Customer requirement component in a garment Categories of each Labels should be gone through each twenty-five activities. These activities are going to be improved by reducing touch points and shorter the cycle time. Diagram no 01 highlights each twenty-five activities should be performed for the labels before storing them in the warehouse.

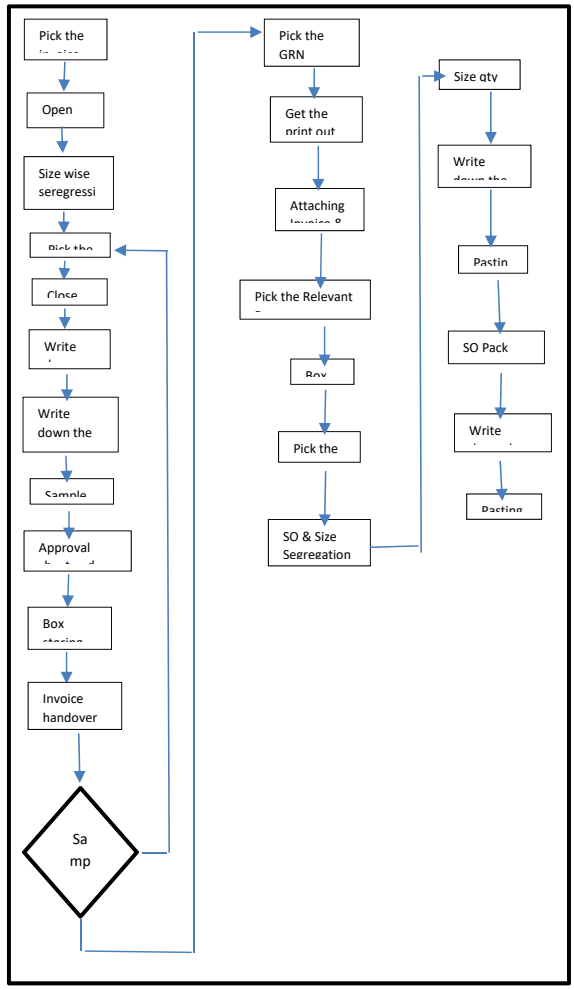
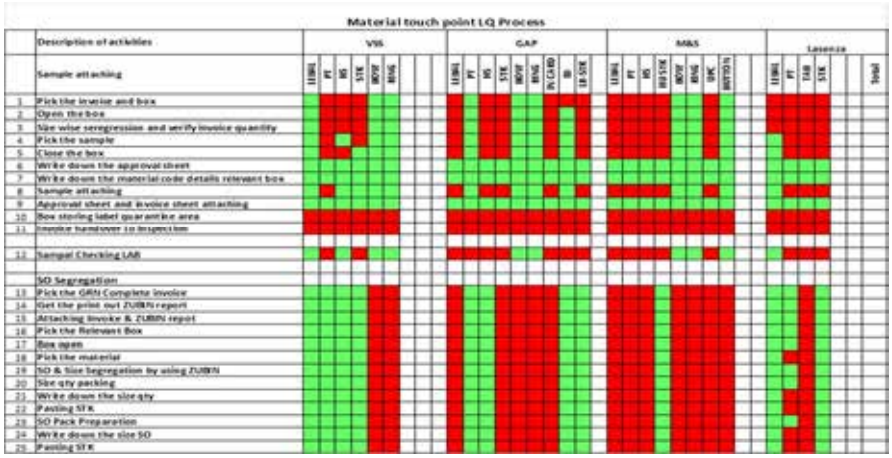


Figure 1: Process of Label LQ to storing them

Table 3 highlights the present performance of the process activities include touch points of the process which can be eliminated to improve process. This table was constructed based on the data collected through the direct observations and system generated documents Invoices obtained from the time period the time period.

Table 3: Touch point in the current process.



Material touch point LQ Process

	Description of activities	VSS							GAP								M&S								Lavenia					
	Sample attaching	LINE1	PT	HS	STK	BOFF	BNG		LINE1	PT	HS	STK	BOFF	BNG	PV CARD	ID	LD-STK	LINE1	PT	HS	RD STK	BOFF	BNG	DPC	BATSTA	LINE1	PT	TAB	STK		Total
1	Pick the invoice and box																														
2	Open the box																														
3	Size wise seregression and verify invoice quantity																														
4	Pick the sample																														
5	Close the box																														
6	Write down the approval sheet																														
7	Write down the material code details relevant box																														
8	Sample attaching																														
9	Approval sheet and invoice sheet attaching																														
10	Box storing label quarantine area																														
11	Invoice handover to inspection																														
12	Sampel Checking LAB																														
	SO Segregation																														
13	Pick the GRN Complete invoice																														
14	Get the print out ZUBN report																														
15	Attaching invoice & ZUBN repot																														
16	Pick the Relevant Box																														
17	Box open																														
18	Pick the material																														
19	SO & Size Segregation by using ZUBN																														
20	Size qty packing																														
21	Write down the size qty																														
22	Pasting STK																														
23	SO Pack Preparation																														
24	Write down the size SO																														
25	Pasting STK																														

In table 3, all the activities should be performed before storing in a warehouse are listed in the first column and red color cells indicates the touch points which are identified as the activities generating the longer of the process and increase the cycle time. These red color activities are the critical human touch points and green color cells should not be performed under Customer requirements. This study is addressing the reduction of red color cells and make improvements Average percentages of the touch points related to the SOP are highlighted under figer no 2. Under SOP 25 activities should be carried out and the these required all activates are no performing to the each labels and their requirements.

Quantitative data Analysis

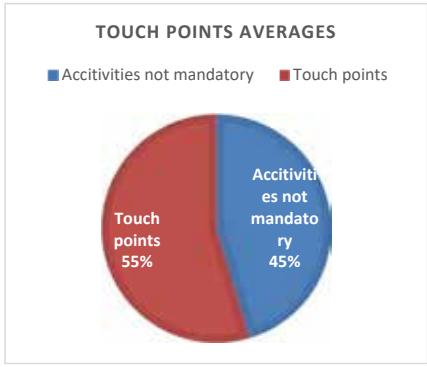


Figure 2: Touch points amount relevant to the SOP

It is revealed that there are higher averages in touch points in the current system. And it is recorded as 55% of the considered sample. It provides background to improve the process by reducing the touch points in LQ process. Diagram no 03 highlights touch point percentages relevant to the considered brands.

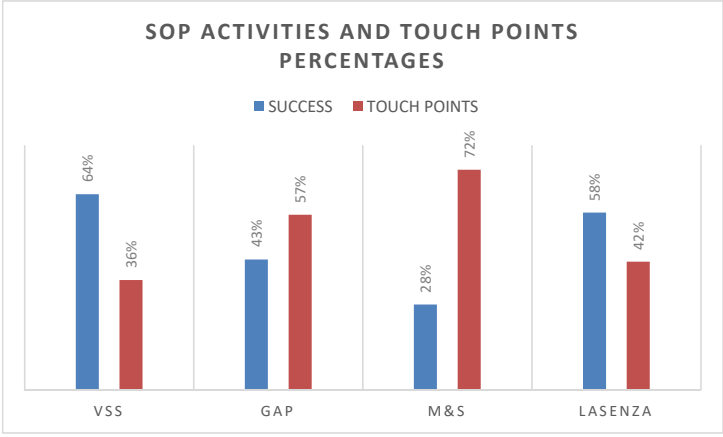


Figure 3: Average Touch point percentages relevant to the considered brands

According to diagram no 03 there are high touch points available for the M&S Brand and Less touch points available with the VSS brand.

Qualitative data Analysis

Figure 4 highlights the cause and effect diagram which is constructed based on the interviews and KAIZEN suggestion.

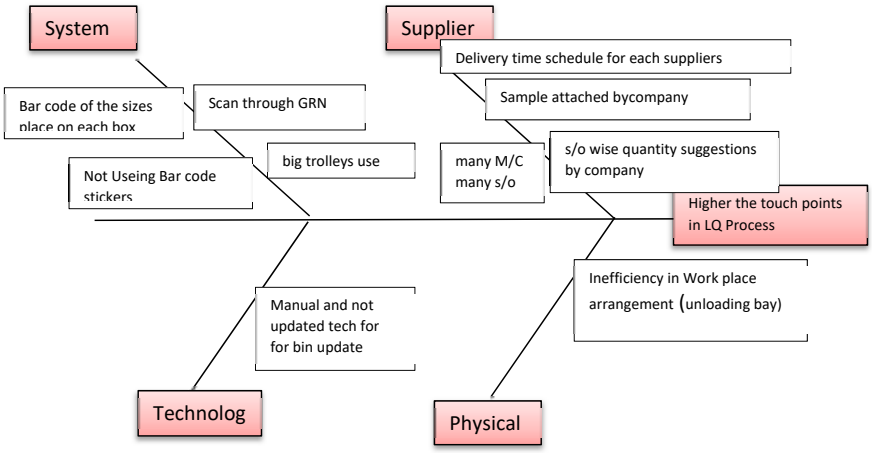


Figure 4: Fish bone diagram

Figure 4 highlights the issues that impact on higher touch points. This Figure is derived based on the interviews and brainstorming sessions. Based on Kaizen suggestions, following common suggestions are identified by using Content and pattern matching method. They are highlighted in Table no 04.These ideas were used to reduce the touch points of the LQ process and shorter the cycle time.

Table 4: Analysed Kaizen Suggestions

Bar code of the sizes place on one box
One M/C, Many S/O, one invoice
One invoice
Use Bar code stickers
Scan through GRN
Work place arrangement(unloading bay)
Small portable trolleys
Tab with trolley for bin update
Sample attached by suppliers
s/o wise quantity suggestions by suppliers
Delivery time schedule for each suppliers.

After considering the Kaizen Suggestions following improvements have done to the current process. Few touch points are eliminated and some activities are not processing for the brands and their categories depend on the nature of them.

Table 5: Touch point eliminated process for each brand

	Material touch point LQ Process																																
	Description of activities	VSS							GAP									M&S								Lasenza							
	Sample attaching	LEBAL	PT	HS	STK	BOW	RING		LEBAL	PT	HS	STK	BOW	RING	IN CARD	ID	LR-STK	LEBAL	PT	HS	HU STK	BOW	RING	UPC	BUTTON	LEBAL	PT	TAB	STK			Total
1	Pick the invoice and box																																
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25	Pasting STK																																

In the Table 5 most of the activities are identified as touch points in the system and most of them are eliminated from the system based on Kaizen Suggestions in table 4. Only the red color cell activities are performed and green color ones are not performed. Figuer no 05 highlights the activities percentages to perform after the process improvement.

Quantitative Data Analysis

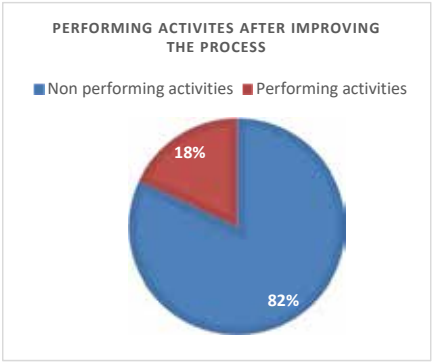


Figure 5: performance activities percentage after the improvement

It is reduced up to 18% from 55% of performing activities, (Touch points). Now the majority processes are not performing according to the SOPS and it is assigned to the suppliers.

Figure 6 Highlights the touch point removed process (after improvement process) by each labels.

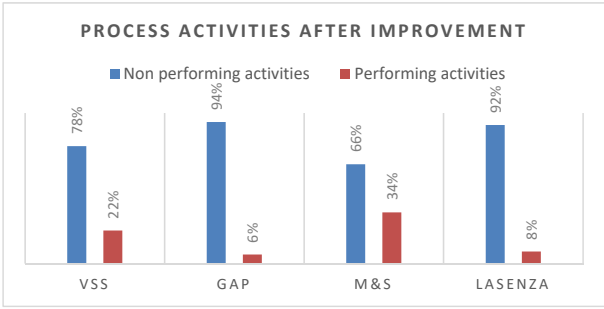


Figure 6: Improvement process by each label.

When compare the diagram no 06 with Diagram no 03 it is highlighted that VSS Brand is reduced its activities 36% to 22%. GAP Brand LQ process is reduced up to 6% from 57.3%.M&S brand process is reduced from72% to 34%.and Lasenza brands LQ process is reduced from 42% to 8%. The GAP brands touch points are reduced by 94% of its previous activities.

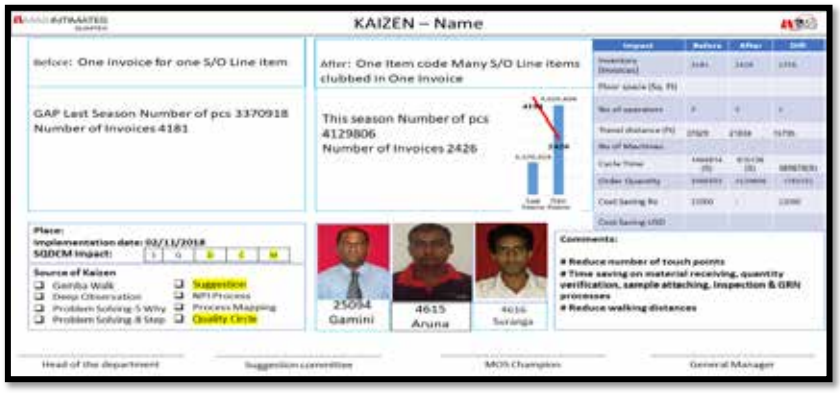


Figure 7: KAIZEN Analysis

After the successful lean implementation Number of invoices has reduced from 2426 to 1481 within a season of 03 months. Due to the process improvement additional laboring activities are reduced and

DISCUSSION AND CONCLUSION

With compare to the SOP, twenty-five activities are there to perform for the labels and its related components. LQ process improvement is done in four areas such as System, supplier, Technical and physical improvements based on fish bone diagram. Majority consideration is given in the view point

of our supplier/ customer than other component in process improvement. Average of 55% of touch points are existed in the LQ processes before the lean application. After applying the Lean tools, it is reduced up to 18% and Mainly Kaizen suggestions was used to reduce the touch points. It was 67% improvement in LQ Process by reducing touch points. (Nystuen 2002) experienced the generating variety of benefits through applying lean manufacturing by reducing reduction of travel time by 90%. Reducing touch point impact to the trave time and it will not focus on this study. With the improvements No of invoices are reduced up to 2426 from 1481 and activities are blend and similar activities are done with the help of customers with their approvals. Activities removed are not performing and requested and got approvals from customers to deliver them. Highest touch points in LQ process for label was found in M&S brand and it was reduced up to 34% from 72%. Highest improvement is with the GAP brand and the LQ processes were improved by reducing its touch points from 57% to 6% it's a 89.4% improvement compare with before lean application. It is clear that by using lean manufacturing the LQ process has improved in the view point of reducing touch points and it leads to reduction of Cycle time of the LQ process.

IMPLICATIONS

This was currently practice in introductionary stage and by reducing the touch points ninety-six employees are reduced up to forty-seven in department. And twelve employees in LQ section was reduced up to four. There is a future potential of applying lean to the overall warehouse practices.

KEYWORDS

Lean manufacturing, label Quarantine, touch points in warehouse.

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