

Kanban in Apparel Manufacturing: A Case Study



RMVS Ratnayake, WDG Lanarolle, RMDT Ratnayake

Abstract: Pull system and Kanban are effective lean manufacturing tools. Though many companies in various manufacturing fields have successfully implemented pull manufacturing using Kanban systems, such studies in apparel manufacturing are rarely found. Kanban system was implemented in an apparel manufacturing company, which had implemented some of the lean manufacturing tools. The apparel manufacturing line was identified in four different sub sections and separate Kanbans were used in each sub section. The system was evaluated using two parameters: the number of Kanban cards in each point; the production output. Correct number of Kanban cards were found at all the time of the monitoring period of two weeks-the production efficiency has increased by 22%.

Keywords: Pull system, Kanban system, Inventory fluctuation, smooth flow

I. INTRODUCTION

Pull manufacturing is a lean manufacturing methodology that controls production from the end of the process [1]. Pull system operates as a backward motion- the products are produced when there is an order from the customer [2] - delivers parts at each work station as per the production sequence from the finished goods towards upstream operations [3]. Pull system controls the flow of resources in a production process by replacing only what has been consumed, and at the same rate the finished or semi-finished goods are consumed [4]. Pull System smooths the flow of Work In Progress (WIP) [1], [3].

Pull system supports to avoid large inventories by making the production immediately and delivering to the internal or external customers. As the semi-finished goods are running as single pieces or as small batches, the defects are immediately visible, hence quick decisions can be made to solve any quality defects [2]. An effective pull system creates numerous benefits in terms of cost, quality, on time delivery and employee morale to an organization since it minimizes overproduction and excess inventory, hence reduce inventory, hence reduce the storing and handling costs [5], [2]. Heizer and Render [6] state that a company never achieves a low-cost strategy without good inventory

management. Toyota's management employed the pull system for over many years to earn remarkable and consistent profits, and capitalized the market over Volkswagen, Daimler, Ford and GM combined. Wal-Mart is another example of a company that used the pull system strategically and improved its efficiency [1].

Toyota practiced 'Kanban' system to control the inventory in its pull system [7] - [11]. 'Kanban' is a combination of two Japanese words 'Kahn', meaning a card and 'bahn' meaning a signal. Kanban means a card carrying a signal [3]. It is a visual indication to show the requirement of parts [2], [12]. Kanban is a card-based control system to convey instructions not to produce until needed [8], [12].

The objective of Kanban is to minimize the inventory of the work in progress (WIP) and the total cost of inventory [1], [13], [14].): it is an effective inventory management system.

Kanban can control the levels of the inventories in the system, to regulate production. When a buffer reaches its planned maximum level, the operator or the machine is instructed to stop producing the next piece [10]. Further, it maintains inventory levels by sending a signal to produce and to deliver a new consignment indicating that the material has been consumed [7]. By controlling the release of inventories into the system it achieves smoother production flow' with a steadier, more predictable output by reducing fluctuations [1], [14].

Implementation of Kanban involves six rules: do not pass defects-if defects found-stop the whole line to fix the defects; signals from following process goes to preceding process to withdraw parts; quantity of parts produced must be equal to the quantity of parts withdrawn by following process; parts must not be produced or conveyed when there is no Kanban; Kanban must be attached to actual parts- the number on the Kanban must agree with the number of actual parts [9], [10].

Kanban system is a very effective tool to improve the productivity-: it optimizes the process; reduce idle time of the process; makes the process flexible for any proposes; reduce wastage; continuous deliveries to costumer, and increases efficiency of the plant [15]. Moreover, it improves the quality, reduces cost, reduces the lead time and increases the flexibility. Among many companies implemented Kanban methodology, Toyota has made remarkable achievements in all these indicators [2], [3], [5].

Though, many industries have successfully implemented the pull system and Kanban systems, not many are available in the area of apparel manufacturing. This paper presents the Kanban system implemented at an apparel manufacturing- the selected company has implemented the lean manufacturing techniques such as 5S, Setup reduction, total productive maintenance (TPM) and total quality management (TQM).

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II. METHODOLOGY

A. Introduction of the Production Line

The selected factory produces men’s wear apparels in 20 production lines. The management of the factory agreed to implement pull system through the Kanban tool as they have observed high WIP fluctuations in; all production lines. The management of the factory recommended to use a production line that was producing men’s short-this line had comparatively high WIP fluctuation and the output was below the expected production.

The operation breakdown of the men’s short contained 69 operations-the number of operators assigned to the line was 35. Almost all the operators were well trained, multi-skilled operators. As per the skill inventory report, skills of all the operators were more than 90%. The work-study department had made a balancing chart and the production line followed it. Cutting section issues the cut bundles when the production line requested. A cut bundle contained 70 pieces. The factory uses their own time database to calculate the standard times of the products. According to that the standard time of a men’s short was 33.61 minutes. Expected production in an 8 hours working day from this line was 500 pieces.

Initially, WIP of each operation were counted in the production line hourly- for 6 days. The average total WIP of the line was 426 and the WIPs of the operations were varied from 0 to 15. Also the average production output of this line for these 6 days were 424 pieces.

B. Designing the Kanban System

When designing a Kanban system the optimal number of Kanbans should be calculated, and a mechanism to extract the Kanban cards should be established [11], [15], [16]. The flow of the Kanban should be designed as per the operations flow of the production line [4]. All required manufacturing data to determine the number of Kanban cards and its flow was collected from the manufacturing line itself.

All input operation/s and output operation/s of each operation and the machine used in each operation were studied. It was decided to maintain 4 pieces bundles. A 4 pieces bundle was considered as 1 Kanban. Depending on the operations and the required parts, 1 Kanban may contains different parts. Required cut parts are delivered to the respective input operation by a line issuer with 4 pieces (1 bundle) at a time.

The number of Kanbans was calculated as follows [17], [18]:

$$\text{Number of Kanbans} = \frac{(\text{Demand} \times \text{Lead time})}{(1 + \text{Safety stock}) / \text{Container size}} \quad (1)$$

As the lead time (production time) per garment is 33.61 minutes, the production time for 4 pieces is 134.44 minutes. The expected daily production (demand) is 500 pieces. Therefore, the expected production during the lead time is 140.04 pieces. As 4 pieces bundles were maintained, the additional 3 pieces contained in the bundle can be considered as the safety stock. The number of Kanban to be maintained in the line was 35. There are 35 operators in the line-it required to maintain 1 Kanban with each operator.

The daily demand was 500. The available time to produce 500 pieces (125 Kanbans) was 28,800 seconds. Therefore, the Takt time is 0.96 minutes-Takt time is the available time to produce single piece of the demand [20]. Thus, each

Kanban should be completed by the line in 3.84 minutes.

As per Japanese Management Association [19], if a Kanban system is implemented with large number of Kanbans it is unexpected to have a higher accuracy- when the number of Kanbans are smaller, more accurate results can be obtained. In order to obtain the more effective outcome it was decided to split the production line into several well defined sections so that the operators can work in their particular section. Considering the sequence of operations and the parts of the garment, initially 3 sections were identified as front operations, back operations the assembly operations. Standard times of the operations of these sections were 7.04 minutes, 10.59 minutes and 15.98 minutes respectively. The number of Kanbans to each section was allocated based on the standard time of the respective section. The number of Kanbans allocated to front operations, back operations and assembly operations sections were 7, 11 and 17 respectively. Since the assembly section has the higher number of Kanban, this section was divided into 2 sub sections: Assembly 1 and assembly 2 when assigning the Kanbans. Total standard time of the operations in assembly section 1 was 9.09 minutes and in assembly section 2 was 6.89 minutes. The number of Kanbans allocated to assembly sections 1 and 2 are respectively 10 and 7.

The standard times assigned to each operation was taken from the work-study department. The procedure of implementing the Kanban system is described below using the front operation section. Table I shows the operations of the front operations and their input & output operations with the standard time of operations and the machines used for each of the operations.

Also for the successful implementation of Kanban system all the employees in the selected production line were aware on the Kanban system and specially the six rules of Kanban. Thereafter trained them how to follow the rules and monitored their work.

Table- I: Details of the front section operations

Operation Identity	Operation	Machine	Input operation	SMV
A _f	Facing attach on front pocket bag	L/S	Cutting section	0.82
B _f	Close pocket bag	4 O/L	A _f	0.58
C _f	Turn & outline pocket bag	L/S	B _f	0.60
D _f	Outline fly hem	L/S	Cutting section	0.10
E _f	Attach zipper to the fly	L/S, zipper foot	D _f & Stores	0.40

F _f	O/L front rises	3 O/L	Cutting section	0.22
G _f	Attach fly to front	L/S	E _f & F _f	0.26
H _f	Tack waist band pieces together	L/S	Cutting section	0.24
I _f	Sew waist band Kansai stitch	Kansai	H _f	0.24
J _f	Iron waist band hem	Iron	I _f	0.30
K _f	Tack labels on waist band	L/S	J _f & Stores	0.28
L _f	Pocket bag attach on front	2 L/S	C _f & G _f	0.58
M _f	Tack pocket bag on side & waist	L/S	L _f	0.38
N _f	Tack pocket mouth top	L/S	M _f	0.14
O _f	Attach WB to fly corner	L/S	N _f & K _f	0.21
P _f	Turn WB corner of fly side	Table	O _f	0.10
Q _f	Sew fly edge stitch	L/S	P _f	0.11
R _f	Sew fly J stitch	L/S	Q _f	0.32
S _f	Tack and turn fly box	L/S	Cutting section	0.22

T _f	O/L fly box	3 O/L	S _f	0.10
U _f	Tack fly box end	L/S	T _f	0.09
V _f	Attach fly box to the front panel	L/S	R _f & U _f	0.30
W _f	Tack waist band on fly box corner	L/S	V _f	0.08
X _f	Close zipper	L/S	W _f	0.21
Y _f	Tack crotch	L/S	X _f	0.16
Total SMV				7.04

Total number of Kanbans allocated to the front section was 7 and the total SMV of the front operation section is 7.04. Number of Kanban belongs to each operation was calculated based on the standard time of the operation. Number of Kanbans belongs to the operation *i* is calculated as,

$$\left(\frac{\text{Standard time of the operation } i \times \text{Number of Kanbans allocated to the section}}{\text{Total standard minute value of the operations belongs to the section}} \right) \quad (2)$$

The calculated values of number of Kanbans for all operations were decimal values. The operations were combined and made groups to get approximate integer values for the number of Kanbans. When combining the operations, as much as possible, combined operations use the same parts and the same machine to minimize the handling times. Table II shows combined operations and the allocation of Kanbans of the front section.

Table- II: Number of Kanbans assigned to each operation and the combination of operations in the front section

Operation			Machine	SMV	Number of Kanban	
Input	Identity	Description			Operation	Combined operations
Cutting section	A _f	Facing attach on front pocket bag	L/S	0.82	0.8	2.0
A _f	B _f	Close pocket bag	4 O/L	0.58	0.6	
B _f	C _f	Turn & outline pocket bag	L/S	0.60	0.6	
Cutting section	D _f	Outline fly hem	L/S	0.10	0.1	1.0
D _f & Stores	E _f	Attach zipper to the fly	L/S, zipper foot	0.40	0.4	
Cutting section	F _f	O/L front rises	3 O/L	0.22	0.2	
E _f & F _f	G _f	Attach fly to front	L/S	0.26	0.3	1.0
Cutting section	H _f	Tack waist band pieces together	L/S	0.24	0.2	1.0
H _f	I _f	Sew waist band Kansai stitch	Kansai	0.24	0.2	
I _f	J _f	Iron waist band hem	Iron	0.30	0.3	



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J _f & Stores	K _f	Tack labels on waist band	L/S	0.28	0.3	
C _f & G _f	L _f	Pocket bag attach on front	2 L/S	0.58	0.6	1.1
L _f	M _f	Tack pocket bag on side & waist	L/S	0.38	0.4	
M _f	N _f	Tack pocket mouth top	L/S	0.14	0.1	
N _f & K _f	O _f	Attach WB to fly corner	L/S	0.21	0.2	0.8
O _f	P _f	Turn WB corner of fly side	Table	0.10	0.1	
P _f	Q _f	Sew fly edge stitch	L/S	0.11	0.1	
Q _f	R _f	Sew fly J stitch	L/S	0.32	0.3	
Cutting section	S _f	Tack and turn fly box	L/S	0.22	0.2	1.2
S _f	T _f	O/L fly box	3 O/L	0.10	0.1	
T _f	U _f	Tack fly box end	L/S	0.09	0.1	
R _f & U _f	V _f	Attach fly box to the front panel	L/S	0.30	0.3	
V _f	W _f	Tack waist band on fly box corner	L/S	0.08	0.1	
W _f	X _f	Close zipper	L/S	0.21	0.2	
X _f	Y _f	Tack crotch	L/S	0.16	0.2	

Thereafter operators were allocated to each operation. As the total number of operators allocated to the line was 35 and the total SMV was 33.61, on average, each operator is assigned 0.96 minutes of work approximately. Table III shows the allocated operations to each operator/s and the number of Kanbans for their operations. The combined operations are named as groups.

Table- III: Number of operators and the Kanban assigned to the front operation section

Group	Operations assigned	Number of Kanban	Total SMV	Number of operators
G ₁	A _f , B _f , C _f	2 - (K ₁ , K ₂)	2.00	2
G ₂	D _f , E _f , F _f , G _f	1- (K ₃)	0.98	1
G ₃	H _f , I _f , J _f , K _f	1- (K ₄)	1.06	1
G ₄	L _f , M _f , N _f	1- (K ₅)	1.10	1
G ₅	O _f , P _f , Q _f , R _f	1- (K ₆)	0.74	1
G ₆	T _f , U _f , V _f , W _f , X _f , Y _f	1- (K ₇)	1.16	1

As per the SMV allocations for the operators, the time of the operator assigned to the group 5 was 0.74 minutes and for group 6, it was 1.16 minutes. The operator at the 5th group has less time of work, she can help the operator at the group 6.

Figure 2 shows the number of Kanban allocated to each group and the flow of the WIPs in the front operation section. The operations are shown in the circles. The material flow direction is shown by arrows. The material handler of the line, who carries the cut bundles from the cutting section, puts the garment parts (4 from each part) required to perform the respective operations into boxes. Cards are prepared indicating the card number, style number, group number and the parts included as shown in the Figure 1. A small removable sticker is fixed by the material handler on the card

by indicating the piece numbers of the order. As an example operations Af, Bf & Cf are carried out at the operation group G1 and the number of Kanbans allocated is 2, and they are named as K1 & K2. The card is attached to the box. G1 collects the box from the material handler and completes the operations. As the system is a pull system the materials are pulled from the downstream operations. G4 collects the parts in the box K1, as G4 is the internal customer of G1 and put them to the box K4. At the same time the part number sticker is pasted in K4, as the part number sticker of K4 is already taken by the G5. Then G1 collects the next bundle from the material handler and put into K1 and, as the part number sticker is taken from the G4 the respective part number is taken and pasted. When there are 2 internal customers, the group will collect 2 stickers of part numbers from 2 groups. The Kanban card for them are designed to paste both stickers to make sure the collection of parts. All the material transports should happen at the same time at 3.84 minutes intervals.

Style: ABC – Order 2	
K₁	Quantity: 4
	Piece nos. 105-108
G₁	Parts included
	Front panels
	Front pocket bag
	Front pocket facing

Fig. 1. Sample of a Kanban card

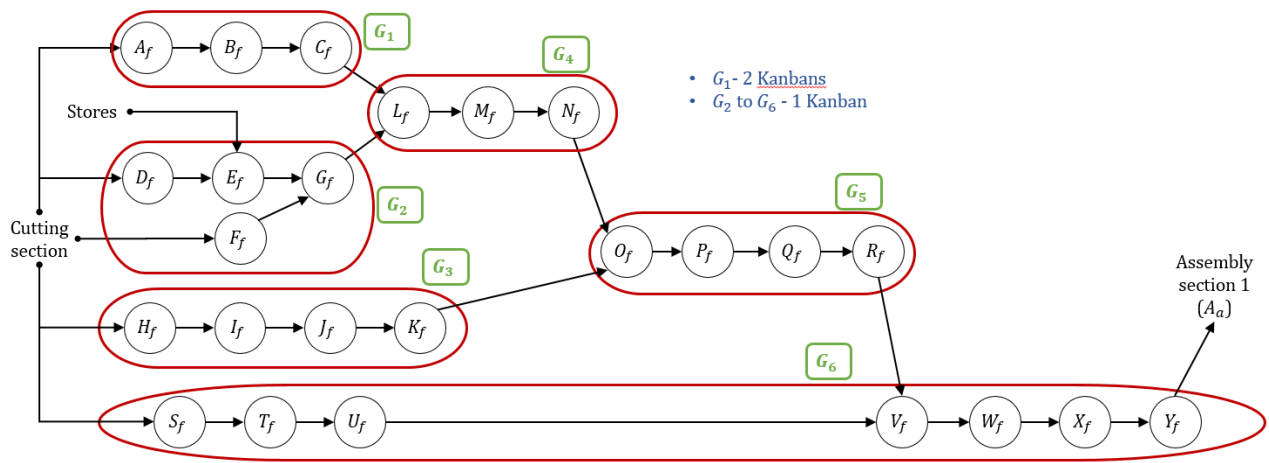


Fig. 2. Flow of the materials in the Front operation section

Same procedure was repeated for the other sections: back operations, assembly section 1 and assembly section 2. Table IV, Table VI & the Table VIII show the number of Kanbans and operation combinations for the back section, assemble 1 section and assemble 2 sections respectively. Table V, Table

VII & Table IX show the operator allocations for those sections respectively. Figure 3, Figure 4 and Figure 5 show the material flow and the group allocations of the back section, assemble 1 section and assemble 2 sections respectively.

Table- IV: Number of Kanban assigned to each operation and the combination of operations in the back section

Operation			Machine	SMV	Number of Kanban	
Input	Identity	Description			Operation	Combined operations
Cutting section	B _b	Iron welt facing	Iron table	0.90	0.9	0.9
Cutting section	C _b	Iron back & side pocket under patches	Iron table	1.00	1.1	1.1
Cutting section	D _b	Mark back under patch placement	Table	0.30	0.3	1.0
D _b	E _b	Sew back darts, Tack back darts on the waist	L/S	0.32	0.3	
E _b	F _b	Out line back darts.	L/S	0.33	0.4	
C _b & F _b	G _b	Attach back under patch	Velcro m/c	0.62	0.7	1.1
Cutting section	H _b	Facing attach on back pocket bag.	L/S	0.36	0.4	
B _b , G _b & H _b	I _b	Make back welt	welt	0.95	1.0	1.0
I _b	J _b	Tack welt pocket ends	L/S	0.58	0.6	1.0
J _b	K _b	Close welt pocket bag facing	L/S	0.36	0.4	
K _b	L _b	Close back pocket bag	L/S	0.92	1.0	1.0
L _b	M _b	Turn & outline back pocket bag	L/S	0.95	1.0	1.0



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Cutting section	A _b	Iron back pocket flaps	Iron table	0.20	0.2	1.1	
	A _b	N _b	Attach snaps on back under flap	Snap button m/c	0.40		0.4
	N _b	O _b	Outline flaps (back)	L/S	0.52		0.5
	O _b	P _b	Tack welt pocket ends	BT	0.62	0.7	1.0
	P _b	Q _b	Iron pocket facing	Iron	0.30	0.3	
	Q _b & M _b	R _b	Sew welt top mouth outline with flaps	L/S	0.96	1.0	1.0

Table- V: Number of operators and the Kanban assigned to the back operation section

Group	Operations assigned	Number of Kanba	Total ISMV	Number of operators assigned
G ₇	B _b	1	0.90	1
G ₈	C _b	1	1.00	1
G ₉	D _b , E _b , F _b	1	0.95	1
G ₁₀	G _b , H _b	1	0.98	1
G ₁₁	I _b	1	0.95	1
G ₁₂	J _b , K _b	1	0.94	1
G ₁₃	L _b	1	0.92	1
G ₁₄	M _b	1	0.95	1
G ₁₅	A _b , N _b , O _b	1	1.12	1

G ₁₆	P _b , Q _b	1	0.92	1
G ₁₇	R _b	1	0.96	1
Total		1	9.09	11

As the operator's time at G15 is comparatively high and in G13 is comparatively less, the operator at G13 was asked instructed to help the operator G15 to complete the production. In addition, the operator at G7 was instructed to help the operator at G8 to maintain the time balancing. Figure 3 shows the flow of the materials in the back operation section.

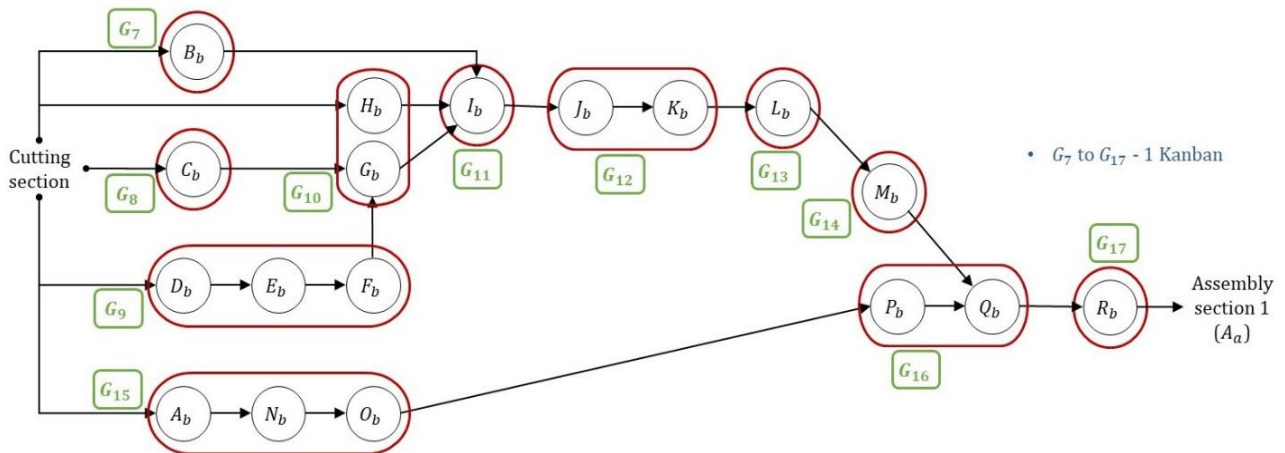


Fig. 3. Flow of materials in the back operation section

Table- VI: Number of Kanban assigned to each operation and the combination of operations in the assembly section 1

Operation			Machine	SM V	Number of Kanban	
Input	Identity	Description			Operation	Combined operations
Y _f & S _b	A _a	Sew side seam	50/L	0.55	0.6	2.0
A _a	B _a	Out line side seam	2 Chain	0.86	0.9	
B _a	C _a	Mark under patch placement	Table	0.40	0.4	
Cutting section	D _a	Iron flaps	Iron	0.65	0.7	2.0



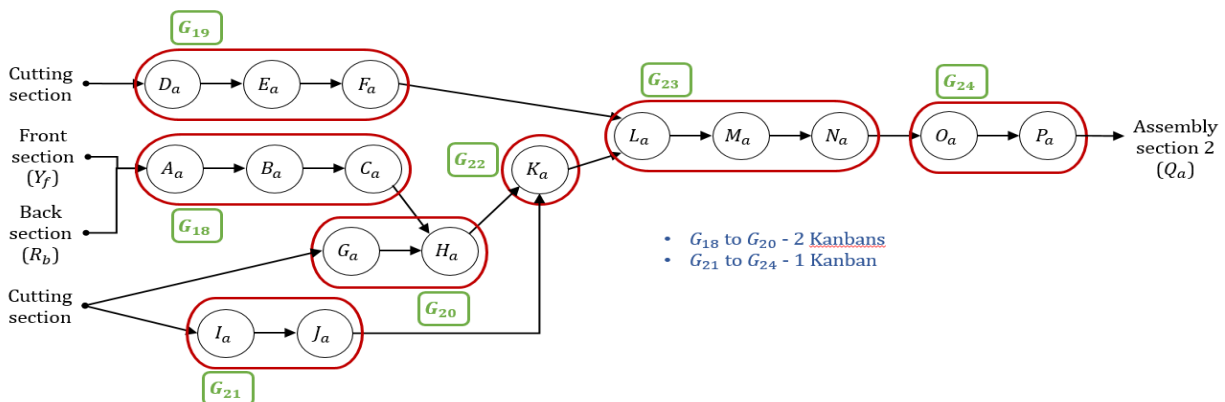
D _a	E _a	Attach snaps on flap under part	Snap machine	0.40	0.4	
E _a	F _a	Outline flaps (front)	L/S	0.76	0.8	
Cutting section	G _a	Iron side pocket under patch	Iron	0.80	0.9	1.7
G _a , C _a	H _a	Attach underside patch	L/S	0.75	0.8	
Cutting section	I _a	Sew front pocket pleats	L/S	0.33	0.4	0.9
I _a	J _a	Sew front pocket hem	L/S	0.45	0.5	
H _a & J _a	K _a	Attach side pockets	L/S	0.90	1.0	1.0
F _a & K _a	L _a	Attach side flaps	L/S	0.58	0.6	1.4
L _a	M _a	Sew in seams	5 O/L	0.30	0.3	
M _a	N _a	Sew front & back rises	5 O/L	0.39	0.4	
N _a	O _a	Out line in seam	Feed of the arm	0.32	0.4	1.1
O _a	P _a	Out line front & back rises	2 L/S	0.65	0.7	

Table- VII: Number of operators and the Kanban assigned to the Assembly 1 section

Group	Operations assigned	Number of Kanban	Total SMV	Number of operators assigned
G ₁₈	A _a , B _a , C _a	2	1.81	2
G ₁₉	D _a , E _a , F _a	2	1.81	2
G ₂₀	G _a , H _a	2	1.55	2
G ₂₁	I _a , J _a	1	0.78	1

G ₂₂	K _a	1	0.90	1
G ₂₃	L _a , M _a , N _a	1	1.27	1
G ₂₄	O _a , P _a	1	0.97	1

At G₂₀ & G₂₁, the allocated operators have less time than the other operators and the operator assigned to G₂₃ has more work than the average. Therefore, the operators in the G₂₀ & G₂₁ were instructed to help the operator at G₂₃. Figure 4 shows the flow of the materials in the Assembly section 1.



- G₁₈ to G₂₀ - 2 Kanbans
- G₂₁ to G₂₄ - 1 Kanban

Fig. 4. Flow of materials in the Assembly section 1

Table- VIII: Number of Kanban assigned to each operation and the combination of operations in the assembly 2 section

Operation			Machine	SMV	Number of Kanban	
Input	Identity	Description			Operation	Combined operations
P _a	Q _a	Tack loops on WB	L/S	0.65	0.7	2.0
Q _a	R _a	Attach waist band	L/S	0.72	0.7	
R _a	S _a	Sew waist band top edge out line	L/S	0.58	0.6	
S _a	T _a	Close waist band	2L/S	0.94	1.0	1.0
T _a	U _a	Bar tack garment	BT	1.00	1.0	1.0
U _a	V _a	Sew Reese hole waist band	Reese button hole	0.20	0.2	1.1
V _a & Stores	W _a	Mark & attach waist band button	Button Attach	0.20	0.2	
W _a	X _a	Sew bottom hem	2 L/S	0.70	0.7	
X _a	Y _a	Bar tack loops	BT	1.00	1.00	1.0
Y _a	Z _a	Attach snap buttons	Snap	0.90	0.93	0.9

Table- IX: Number of operators and the Kanban assigned to the assembly 2 section

Group	Operations assigned	Number of Kanban	Total SMV	Number of operators assigned
G ₂₅	Q _a , R _a , S _a	2	1.81	2
G ₂₆	T _a	1	0.94	1

G ₂₇	U _a	1	1.00	1
G ₂₈	V _a , W _a , X _a	1	1.1	1
G ₂₉	Y _a	1	1.0	1
G ₃₃	Z _a	1	0.9	1

In the assembly section 2 operator at G26 was instructed to help the operator at G28. Figure 5 illustrates the movements of the Kanbans in the Assembly section 2.

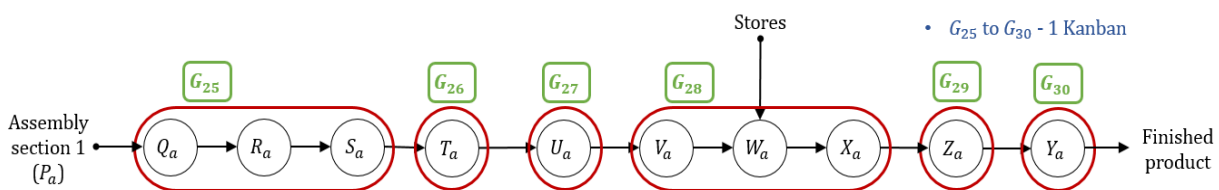


Fig. 5: Flow of materials in the Assembly section 2

III. RESULTS AND DISCUSSION

One week after the implementation of the Kanban system, the number of Kanbans at the allocated places were counted hourly for 2 weeks. At every observation, the number of Kanbans recorded were similar to the Kanban allocations of each group and the total number of Kanbans were 35 at all the time. It was instructed to stop the line quickly when any critical problems happened. Accordingly, the line was stopped at 38 such incidents during the 2 weeks period-until the problem is solved. The reasons for the stoppages were quality problems (20 times), machine breakdowns (12 times) and input delay from the cutting section (4 times) and the stores (2 times). The total time lost during these 38 stoppages

was 208 minutes. Though, some lean manufacturing techniques have been implemented, the factory need to further improve them. During this period of 2 weeks, average production output was 518 pieces - the minimum and maximum production per day were 492 pieces and 526 pieces respectively. The production output has increased by 22%.

According to the lighting arrangement of the factory the line layout was limited to 2 straight lines. Therefore some materials were moved to some distance as per the material flow.

Here the lighting and the line setup should organize to minimize the material movements. By eliminating the above mentioned drawbacks the factory can maximize the gain of the Kanban system.

IV. CONCLUSION

The pull system incorporated with Kanban system is a proved to be highly effective in manufacturing industries. This research implemented a Kanban system in a highly labor-intensive apparel manufacturing industry. Despite several line stoppages due to various problems during the observed time of 2 weeks, the production output has been increased by 22%. Moreover, the correct number of Kanban cards at the Kanban collecting points is an indication of the effective implementation of the Kanban system.

The selected factory had implemented some of the major lean manufacturing tools and techniques: setup reduction, TPM and TQM are among them. Having implemented these tools and techniques would be a reason for effective implementation of the Kanban system. If the machines breakdowns were high and if the quality issues were high, the Kanban cards would not flow as expected. Number of Kanban card at the collecting points together with the improved production output is an indirect indication of the success of the other tools. As indicated by the skill matrix of the operators, the factory has a highly trained work force. Highly trained work force, implementation of major lean manufacturing tools and techniques are essential components for successful implementation of a Kanban system.

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