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Implementation of Cellular Manufacturing Systems in Garments Industry: A Case study

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ABSTRACT— Layout design and the flow of materials have a significant impact on performance of manufacturing system (garments industry) .These can help to increase productivity, reduce work in process and inventory, short production lead time, streamlines the flow of materials, cost and reduce non value added activities from the production process of waiting and transportation, which make the factory meet customers requirement quickly. There are many types of layout design in manufacturing system such as process layout, product layout and cellular layout. A process layout is suitable for high degree of interdepartmental flow and little intradepartmental flow.it is proper for low-volume, high variety environment. On the other hand, a product layout is used for high-volume, low-variety environment. A cellular layout is suggested for medium-volume and medium-variety environment. This kind of layout is also appropriate for both automated and non-automated manufacturing systems. This is an attempt to increase the efficiency of garments industry, by introducing sub-cell concept also changing existing plant layout to the new layout. The research proposes a method for introducing cellular manufacturing in an operating sewing floor. By applying cellular manufacturing system to produce garments, a factory can reduce costs and improve quality and time .The new sub-cell concept changes the organizational culture and makes the production lines more flexible. The conclusions of the research highlight the key lessons for successful design and implementation of cellular manufacturing in a sewing floor.

KEYWORDS— Layout, garments, Cellular Manufacturing

I. INTRODUCTION

Apparel industries are the most important part of the modern civilized world. Most of the apparel industries of India are export oriented. But the industries are operated in such an environment that they are the victim of low labor productivity, high WIP, low labor utilization and higher manufacturing cost, excessive manufacturing lead times. The most important task for the industry is to reduce the lead time of garment manufacturing. Modular manufacturing is a model for workplace design, and has become an integral part of lean manufacturing systems. Modular manufacturing is based upon the principles of Group Technology. Successfully implementing Cellular manufacturing allows companies to achieve cost savings and quality improvements, especially when combined with the other aspects of lean manufacturing systems. Modular manufacturing is based upon the principles of Group Technology. Successfully implementing Cellular manufacturing allows companies to achieve cost savings and quality improvements, especially when combined with the other aspects of lean manufacturing.

The American Apparel Manufacturing Association has defined modular manufacturing as "a contained manageable work unit of 5 to 17 people performing a measurable task. The operators are interchangeable among tasks within the group to the extent practical and incentive compensation is based on the team's output of first quality output". In a modular system, processes are grouped into a module instead of being divided into their smallest components. As a rule, fewer numbers of multi-functional operators work on the machines which are arranged in a U-line. All the operators in the group are responsible for the quality of each item that is produced in the line. This research explores whether or not cellular manufacturing can help vigneshwara garments, a highly export oriented garment industry with different national customers and products, to achieve improved performance and customer satisfactions.

II. GOALS OF THE PROJECT

This project has dual purposes: learning and improvement. The situation of the Sewing Floor in the present time needs action towards improvement. Any

avenue leading toward increasing throughput, lowering costs and improving delivery is welcome. Cellular manufacturing is seen not only as a way to increase the efficiency of the Sewing Floor, but also as a potential new way to "do business." However, before considering cellular manufacturing for the Sewing Floor, it was necessary to identify the following:

- Determination of the present conditions of the Sewing Floor whether it is possible or not possible to introduce cellular manufacturing system.
- Determination of the designing and implementation process of cellular manufacturing system in the sewing floor.
- Designing a cellular layout for the current sewing line and the measurement of performance.
- Some recommendations for successful implementation of cellular manufacturing system in the sewing floor

III. Literature Review

A. General

The following chapter reviews the literature to understand the advantages and limitations of Cellular manufacturing system which is a tool of lean manufacturing. The chapter will give a clear view of the back ground of lean manufacturing and the cellular manufacturing system. The various aspects of the cellular manufacturing system that are useful to RMG industries also revealed by this chapter

B. Cellular Manufacturing

The paper will concern about the last lean manufacturing tool that is Cellular manufacturing system. The Cellular manufacturing system is the concept that is emerged from the group technology. Further about this concept is discussed in the next section.

C. Cellular Manufacturing and Group Technology – an overview

The Group Technology (GT) approach originally proposed by Burbidge in 1971 and Mitrofanove in 1966 has projected the philosophy that exploits the proximity among the attributes of given objects [5]. GT is identified by many researchers as dividing the manufacturing facility into small groups or cells of machines; each cell is being dedicated to a specific set of part types and it is called cellular manufacturing[6,7&8] .Singh depicts the cellular manufacturing as an application of GT in manufacturing[5] while Mahesh and Srinivasan mentions Cellular Manufacturing as one of the primary applications of GT principles, where parts with similar process requirements are placed together into groups called part families[9]. Thus Group Technology and Cellular manufacturing are often refers to similar production environments and Cellular manufacturing is considered to be one of the main techniques towards a lean environment. The benefits of implementing GT is identified by many researchers as to minimize the through put time, improve the quality of the product, reduce the WIP levels and stocks and thereby the cost, improve the deliveries, reduced set-up times and improve productivity level[10,5&11] . Askin and Standridge explained the set up time reduction as an important aspect of GT [7]

D. The Details about Cellular Manufacturing

Cellular Manufacturing is the application of the principles of Group Technology in manufacturing. Group Technology was proposed by Flanders in 1925 and adopted in Russia by Mitrofanov in 1933 (although the work was translated into English in 1966) [13, 14]. Jack Burbidge did much to promote Group Technology in the UK [15]. Although there appear to have been similar applications earlier in history Portsmouth Block Mills offers what by definition constitutes an early example of cellular manufacturing. By 1808, using machinery designed by Marc Isambard Brunel and constructed by Henry Maudslay, the Block Mills were producing 130,000 blocks (pulleys) for the Royal Navy per year in single unit lots, with 10 men operating 42 machines arranged in three production flow lines. This installation apparently reduced manpower requirements by 90% (from 110 to 10), reduced cost substantially and greatly improved block consistency and quality. Group Technology is a management strategy with long term goals of staying in business, growing, and making profits. Companies are under relentless pressure to reduce costs while meeting the high quality expectations of the customer to maintain a competitive advantage. Successfully implementing Cellular manufacturing allows companies to achieve cost savings and quality improvements, especially when combined with the other aspects of lean manufacturing. Cell manufacturing systems are currently used to manufacture anything from hydraulic and engine pumps used in aircraft to plastic packaging components made using injection molding [12].

E. Assessment of Cellular Manufacturing

Cellular manufacturing is a new concept .To best utilization of this concept first the existing system's benefits and limitation should be known. Then compare it to the cellular manufacturing system. This chapter discusses the benefits and the limitation of the existing or conventional process structures, making it easier to appreciate the advantage of cellular manufacturing and the situation in which its implementation is desirable. Next it explain the reasons that justified pursuing the design and implementation of a manufacturing in a garment manufacturing line. Finally, a proposal is made on basis of the compare.

F. The cell design and implementation process

Since the goal of the research is to research the acceptability of the cellular manufacturing system in the RMG garment industries as the system is more feasible

than the existing line manufacturing technique. From one reference the preliminarily strategy of implement one new concept over the existing system has been described. In the reference A New American TQM11 Shiba et al. refer to two different ways to effect improvement within an organization while incorporating learning: the PDCA cycle (Plan-Do-Check-Act) and the CAPD cycle[16] . The authors explain that the PDCA cycle is most useful in continuous improvement, where the process already exists and the PDCA cycle is run over and over again to eliminate the next most important problem, and thus further reduce the variance of the process and its results. The CAPD cycle on the other hand, is more applicable to planning situations where the target for the next planning cycle is different from the target for the previous one. The letters are transposed to emphasize the control and feedback aspects of the loop and to focus attention on their importance in the planning of the improvement process. Fig. 1 enumerates the steps of the two different cycles and Fig. 2 shows the effect of applying and repeating them. It is worth noting that regardless of what type of cycle is used to drive improvement, there is great challenge in "picking the problem to solve". Since solutions are rooted on what problems are presented and how, "picking the problem that is most responsible for the variation in results" or "discovering how the process prevents achievement of desired results" are often difficult steps in the continuous improvement process because "the problem" is seldom obvious. Nevertheless, in a fundamental way "picking the problem" determines the direction, quality effectiveness of the improvement. According to Fig. 1 the CAPD cycle was the model used to develop the cell design and implementation process. The CAPD cycle lends itself to achieve more radical changes as it actually calls for looking at the big picture and reassessing the goals and processes used to obtain them. In addition, by following the CAPD model, there is room for rectifying the process and establishing new targets, rather than just refining them. Again, one important feature of both cycles is that they both used feedback to move forward. This is a necessary feature of any process seeking improvement through a new implementation, and it was purposefully included in the cell development process. The Fig. 3 represents the cell design and implementation process proposed as a method to introduce cellular manufacturing in an environment where an existing manufacturing layout.

The strategy allows for discovering reasons for not achieving desired results and key areas for improvement during the assessment stage (CA step). This stage involves identifying the scopes of this new concept over the existing one. In this stage of the strategy of implementation the area of the all balancing techniques are implemented and what is desired for the future can be determined in the Design and Performance Analysis steps (P step). Carrying out the plan involves implementation of the design and monitoring of the results throughout a period of time to finally (D step) check whether or not the target was achieved, and restart the CA step

	The PDCA Cycle
P	Pick the problem that is most responsible for the variation in results, analyze the root causes of the problem, and plan counter measures to fix the root causes
D	Do the improvement
C	Check that the improvement was effective
A	Standardize it as appropriate, and go to the next improvement
	The CAPD Cycle
CA	Discover what is wrong with the previous process that prevents achievement of the desired results; what are the key things to improve for the next cycle
P	Determine what is desired for the future (e.g. what is the next target)
D	Carry out the plan for the year
CA	Check whether target was achieved, and if not, why not (repeat CAPD)

Fig. 1 The Pdca And Capd Cycles

The main tasks of each step of the process are briefly explained below. And after discussing the implementation process, this research will give the quantitative and qualitative factors for applying the Cellular Manufacturing System over the traditional system in to the RMG (Ready-made Garment) industries.

In the Assessment stage it is very important to obtain an in-depth understanding of current process and the line activities. This assessment should be thorough in covering the different aspects that affect the process, including but not limited to personnel alignment and incentives, manufacturing process, driving metrics, etc. By doing so a baseline can be established this clearly defines "where we are today" and thus facilitates defining "where we want to be tomorrow" and how to get there. In this way, identifying the cell requirements and expectations is a more rational and realistic exercise. This also involves finding scope of all the areas for balancing in the area to minimize the WIP and acquiring a smooth product flow in the Cells.

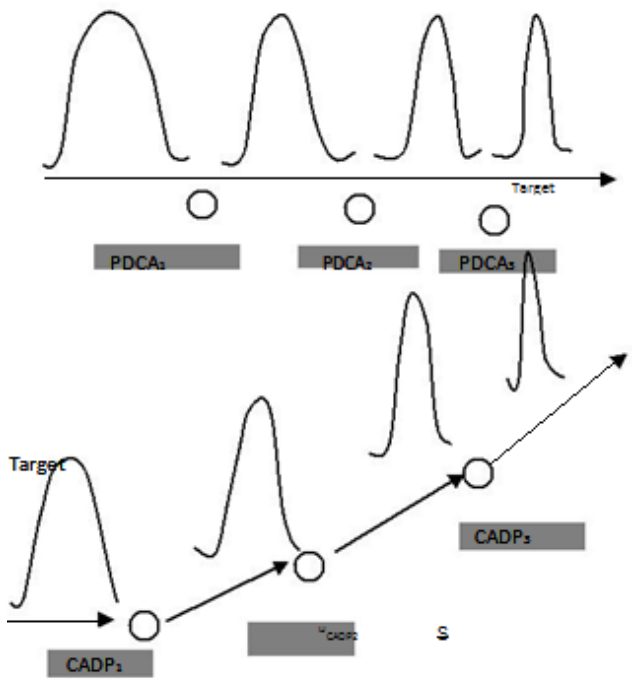

Fig .2 Effect of Repeating the PDCA

The Design step requires that information and feedback are solicited from all the functions and or individuals that are part of the process. In addition, it requires that effective methods are used to derive part families and their process. Sometimes an expert is very helpful during this stage of the process to guide the group wisely in determining and demonstrating the attributes of a successful design before a big investment is made in implementing it. During this step, care should be taken to balance the need to minimize the costs of introducing the new cell process in the production environment with the need for using the most effective processes or equipment to do the job.

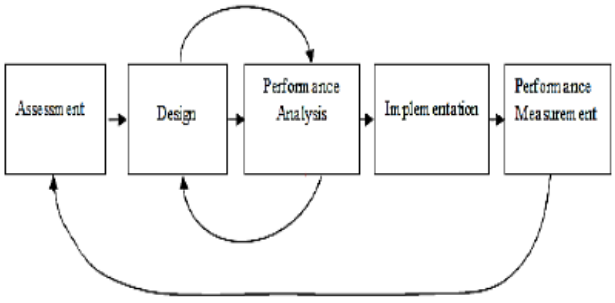

Fig. 3 Cell Design And Implementation Process

If this balance is not established, the changes proposed may be too small to achieve the desired results or too big to obtain the results at a justifiable cost. The success of cellular manufacturing is heavily dependent on correct capacity planning to ensure that dedicating the equipment is justified and feasible, and that the work is balanced, so that the cell can perform as expected. The Performance Analysis step is a necessary one to check the assumptions and proposals of the design step and to finalize the performance measurements of the cell. The Fig. 3 highlights the iterative relationship between the Design and the Performance Analysis steps.

The Implementation step requires mobilizing the people that "do the work" to implement the Changes as for the balancing the line. Many companies that have tried to implement to implement the cellular manufacturing but there is a big problem associated with mobilizing people and resources to make the balances. In the RMG garment industries most workers are women and this industries are mostly labor intensive for this one suggestion can be taken from the reference that the author suggests that these kinds of activities that are already in place may offer the a suitable environment to mobilize the resources. Preparation, identification of key players and clear goals will go a long way to ensure the success of the implementation.

Finally, the Performance Measurement step is an ongoing process, where performance measurements are monitored to determine the impact of the change in achieving the expected goals. This step is very important because it establishes the feedback loop needed to identify areas of success and areas where requirements need to be readdressed. In doing so, the CAPD cycle is restarted and continuous improvement is perpetuated.

IV. DATA ANALYSIS

A. Existing Manufacturing System output

TABLE I
Existing Manufacturing System output

S. No	Type	Man power	Time/piece (min)	Working time/min	Total output /day
1	Full hand	10	25	480	190
2	Half hand	10	20	480	240

B. Proposed Manufacturing System layout

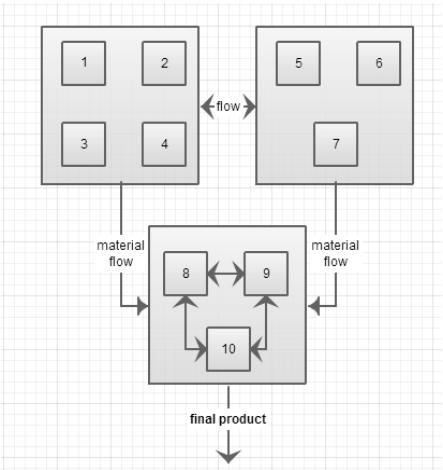

Fig. 4 Proposed Manufacturing System layout

D. Proposed Manufacturing System output:

Table II

Proposed Manufacturing System output

s.no	type	Man power	Time/piece	Working time/min	Total output /day
1	Full hand	10	22.5	480	210
2	Half hand	10	15.5	480	300

V.RESULT

Cellular manufacturing is a powerful tool of lean manufacturing. In the sewing floor of a ready-made garment industry, there exists an ideal environment to use this tool to obtain the benefits of lean manufacturing. As the lean manufacturing reduces wastes that do not add any value to the product, it helps to reduce the manufacturing cost by increasing the labor utilization. If the labor utilization increases, a factory can save a handsome amount of cost annually; this will help the factory to exist in the competitive business world. The result obtained from this research is that the factory can save cost by applying cellular manufacturing system.

VI. CONCLUSION

The goal of the project was twofold: learning and improvement. The authors feel that these objectives have been accomplished. In the sewing floor of a ready-made garment industry is an ideal environment to introduced cellular manufacturing. The cell design and implementation process proposed in this research can be used to implement the cell at the Sewing Floor, and hence the Sewing Floor will begin to realize the benefits expected from the cell. The cellular layout for the sewing line and its performance has been determined in this research work

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