

# Increasing Productivity In Automobile assembly Line Industry by Transforming Man Machine System And Inventory

Piyush Viswakarma, Asst. Prof. Y.P. Ladhe, Prof. Rajneesh Rai  
Scholar in Shri Dadaji Institute of Technology and Science, Khandwa, M.P., India, Mail: [singhahsan@gmail.com](mailto:singhahsan@gmail.com)

**Abstract-** Assembly line belongs to Backbone of the modern Automobile industry, after various studies it came to know that assembly lines can produce better lead time and customer satisfaction. The assembly line is one of the key components of the modern automobile Revolution. The principles of the assembly line allowed manufacturers to produce greatly increased amounts of products at lower cost and indirectly made for easier maintenance of products after their assembly. While the ideas behind assembly line manufacturing are a vital part of the way, in which products are being made and assembled today, it is also interesting to consider the disadvantages of these types of production systems. By transforming this methodology in any assembly line you can get better productivity or efficiency. In this thesis I am work to increase the efficiency of the automobile sector assembly line. This methodology has two major parts. The First part is Man- Machine system and in this we are implementing Work Measurement, Method Study and Time Study. The second part is inventory management we are implementing the Inventory management system to reach the higher productivity. The concept of the man-machine system works between labors and machines and in between raw materials and finished goods. Simultaneously I am going to implement the inventory management system to produce effect of the overall plant efficiency. Using Work measurement, a technique designed to establish the time for a worker to carry out a specified manufacturing task at a defined level of performance. It is concerned with the length of time, and it takes to complete a work task assigned to a specific job. By applying work measurement, it can show clearly existing result. Method study is the process of subjecting work to systematic, critical scrutiny to make it more effective and more efficient. It is one of the keys to achieving productivity improvement. It can improve the productivity of the implemented method. Another field the time study will improve the efficiency of the implemented method Time study is a tested method of work measurement, In this thesis the use of time study is to suggest a methodology for a qualified worker to perform specified work under stated conditions and at a defined rate of working. By this implementation we can improve the implemented method and that will increase the productivity.

**Keywords** - work study, work measurement, time study, Just-in-time , man-machine system, inventory management, operations management.

## INTRODUCTION –

Assembly lines are designed for the one by one operation in organization, in this work the motion of workers is minimized in the operation area. All parts or assemblies are handled either by conveyors or motorized vehicles such as cranes. Machines such as overhead cranes do heavy lifting. Each worker typically performs one simple operation.

## REMAINING CONTENTS –

### Assembly Line –

An assembly line is a production of goods process (most of the time called a progressive assembly) in which parts (usually interchangeable parts) are added as the semi-finished assembly moves from workstation to workstation where the parts are added in particular order until the final assembly is obtained. By mechanically moving the parts to the assembly work and moving the semi-finished assembly from work station to work station, a finished job can be assembled faster and with less worker than by having workers carry parts to a stationary piece for assembly. A manufacturing tool, first made popular by Ford in his manufacturing of automobiles. The principle of an assembly line is that each worker is given one very specific job, which he or she simply repeats, and then the process moves to the next labor who does his or her job, until the task is completed and the product is obtained. It is a way to mass produce goods quickly and efficiently. All workers do not have to be human; robotic workers can make up an assembly line as well.

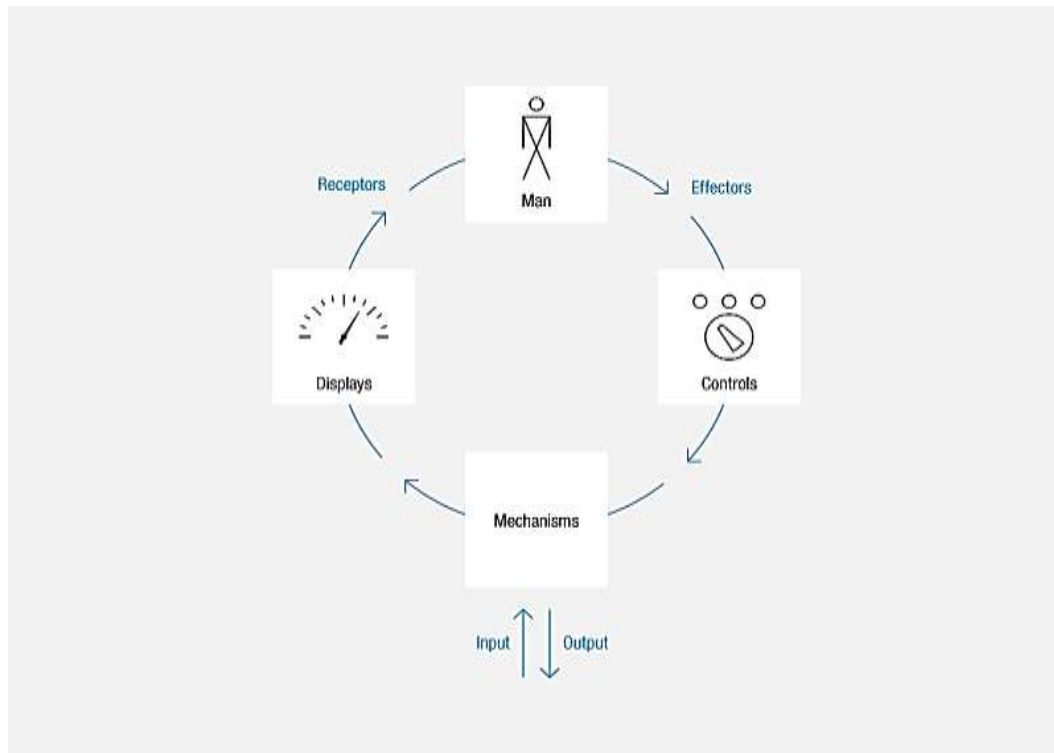
### Man/Machine System –

**Human-machine system is a human operator (or a group of operators) and a machine are integrated. This term can also be importance the view of such a system as a single entity that interacts with external environment .**

Generally a system consists of hand tools and other tools which are coupled by a human operator who controls the operation. Operators of such systems use their own power.. The system could range from a person with a hammer to a person with a strength giving exoskeleton. Human machine system engineering is different human-computer interaction and technical engineering in that it focuses on complex, that often are partially automated (such as flying an airplane). it also studies human problem environments

The area of human-machine movements is yet to be extensively explored. How body-structure can be extended through machine mechanisms points to how the body can perform beyond its biological form and functions as well

as beyond the local space it inhabits. How human movement is transfer into machine motion and then can be both expressed and



extended into performance on the web promises new possibilities in both conceptual approach and **Fig:1-Man Machine System**

aesthetic application. For example, incorporating virtual camera views of the performing human-machine system enriches the choreography and intensifies the artistic result. The Machine is a hybrid human-robot walking machine. Designed by artist James (who has also created other such systems), it is an exoskeleton with six robotic legs that are controlled by the single worker.

### Time Study-

A time and motion study (or time-motion study) is a business efficiency technique combining the Time Study work. It is a major part of scientific management. After its first introduction, time study developed in the direction of establishing standard times, while motion study evolved into a technique for improving work methods. The two techniques became integrated and refined into a widely accepted method applicable to the improvement and upgrading of work systems. This integrated approach to work system improvement is known as methods engineering and it is applied today to industrial as well as service organizations, including banks, schools and hospitals.

Time study is a direct and continuous observation of a task, using a timekeeping device (e.g., decimal minute stopwatch, computer-assisted electronic stopwatch, and videotape camera) to record the time taken to accomplish a task and it is often used when: there are repetitive work cycles of short to long duration, wide variety of dissimilar work is performed, or process control elements constitute a part of the cycle. The Industrial Engineering Terminology Standard defines time study as "a work measurement technique consisting of careful time measurement of the task with a time measuring instrument, adjusted for any observed variance from normal effort or pace and to allow adequate time for such items as foreign elements, unavoidable or machine delays, rest to overcome fatigue, and personal needs."

### Inventory Management-

In any business or organization, all functions are interlinked and connected to each other and are often overlapping. Some key aspects like supply chain management, logistics and inventory form the backbone of the business delivery function. Therefore these functions are extremely important to marketing managers as well as finance controllers. Inventory management is a very important function that determines the health of the supply chain as well as the impacts the financial health of the balance sheet. Every organization constantly strives to maintain optimum inventory to be able to meet its requirements and avoid over or under inventory that can impact the financial figures.



*Figure 2- Inventory Management*

Inventory is always dynamic. Inventory management requires constant and careful evaluation of external and internal factors and control through planning and review. Most of the organizations have a separate department or job function called inventory planners who continuously monitor, control and review inventory and interface with production, procurement and finance departments.

Defining Inventory-Inventory is an idle stock of physical goods that contain economic value, and are held in various forms by an organization in its custody awaiting packing, processing, transformation, use or sale in a future point of time. Any organization which is into production, trading, sale and service of a product will necessarily hold stock of various physical resources to aid in future consumption and sale. While inventory is a necessary evil of any such business, it may be noted that the organizations hold inventories for various reasons, which include speculative purposes, functional purposes, physical necessities etc. From the above definition the following points stand out with reference to inventory: All organizations engaged in production or sale of products hold inventory in one form or other. Inventory can be in complete state or incomplete state. Inventory is held to facilitate future consumption, sale or further processing/value addition. All inventoried resources have economic value and can be considered as assets of the organization.

#### **Types of Inventory -**

Inventory of materials occurs at various stages and departments of an organization. A manufacturing organization holds inventory of raw materials and consumables required for production. It also holds inventory of semi-finished goods at various stages in the plant with various departments. Finished goods inventory is held at plant, FG Stores, distribution centers etc. Further both raw materials and finished goods those that are in transit at various locations also form a part of inventory depending upon who owns the inventory at the particular juncture. Finished goods inventory is held by the organization at various stocking points or with dealers and stockiest until it reaches the market and end customers. Besides Raw materials and finished goods, organizations also hold inventories of spare parts to service the products. Defective products, defective parts and scrap also forms a part of inventory as long as these items are inventoried in the books of the company and have economic value.

We like clearly Inventory Management. We think it's easy to use, and we know that it will help you become more productive. But no matter how good we think it is, it will fail to help you if you don't do some very basic things. The purpose of this section of the Inventory Basics Guide is to walk you through the absolute basic attributes of a pretty good inventory management system and to instruct you in detail about how to implement our recommendations. We say "pretty good" because there are no perfect ways to create the elements of an inventory management system, but there are lots of bad ways. You may be able to improve on our recommendations or your enterprise may have to do things differently, but if you follow our recommendations, you'll wind up with a pretty good system.

INPUT	PROCESS	OUTPUT
Raw Materials	Work In Process	Finished Goods
Consumables required for processing. Eg : Fuel, Stationary, Bolts & Nuts etc. required in manufacturing	Semi Finished Production in various stages, lying with various departments like Production, WIP Stores, QC, Final Assembly, Paint Shop, Packing, Outbound Store etc.	Finished Goods at Distribution Centers through out Supply Chain
Maintenance Items/Consumables	Production Waste and Scrap	Finished Goods in transit
Packing Materials	Rejections and Defectives	Finished Goods with Stockiest and Dealers
Local purchased Items required for production		Spare Parts Stocks & Bought Out items
		Defectives, Rejects and Sales Returns
		Repaired Stock and Parts
		Sales Promotion & Sample Stocks

Table 1- Inventory Systems

#### Proposed Methodology –

This Methodology is one of the theoretical systematic, analysis of the methods applied to a field of study. It comprises the principles associated with a branch of knowledge and theoretical analysis of the body of methods. Typically, it encompasses concepts such quantitative or qualitative techniques and as [paradigm](#), theoretical model, phases methodology is the general research strategy that outlines the way in which research is to be done and, among other things, identifies the methods to be used in it. These methods, described in the methodology, define the ways of data collection or, sometimes, how a specific result is to be calculated. By transforming this methodology in any assembly line you can get better efficiency or productivity. In this thesis I am working to increase the efficiency of the automobile sector assembly line. This methodology has two major parts. The First part comprises of Man- Machine system and in this we are implementing Work Measurement, Method Study and Time Study. The second part comprises of inventory management we are implementing the Inventory management system to reach the higher productivity. The concept of the man-machine system works between workers and machines and in between raw materials and product. Simultaneously I am going to implement the inventory management system to increase the efficiency of over all plant. Using Work measurement, a technique designed to establish the time for a worker to carry out a specified manufacturing task at a defined level of performance. It is concerned with the length of time, and it takes to complete a work task assigned to a specific job or function. By applying work measurement, it can show clearly existing result. Method study is the process of subjecting work to systematic manner, critical scrutiny to make it more efficient and more effective. It is one of the keys to achieve productivity improvement. It can improve the productivity of the implemented method. Another field the time study will improve the efficiency of the implemented method. Time study is one of the tested method of work measurement, in this thesis the use of time study is to suggest a methodology for a qualified worker to perform specified job under stated conditions and at a defined rate of working. By this implementation, we can improve the implemented method and that will increase the rate of productivity.

This system has two major parts

Part 1: Implementation of Work measurement, Method and Time study.

Part 2: Implementation of the Inventory Management.

This to major parts of the implementation is lead to improve the efficiency and productivity of the overall plant.

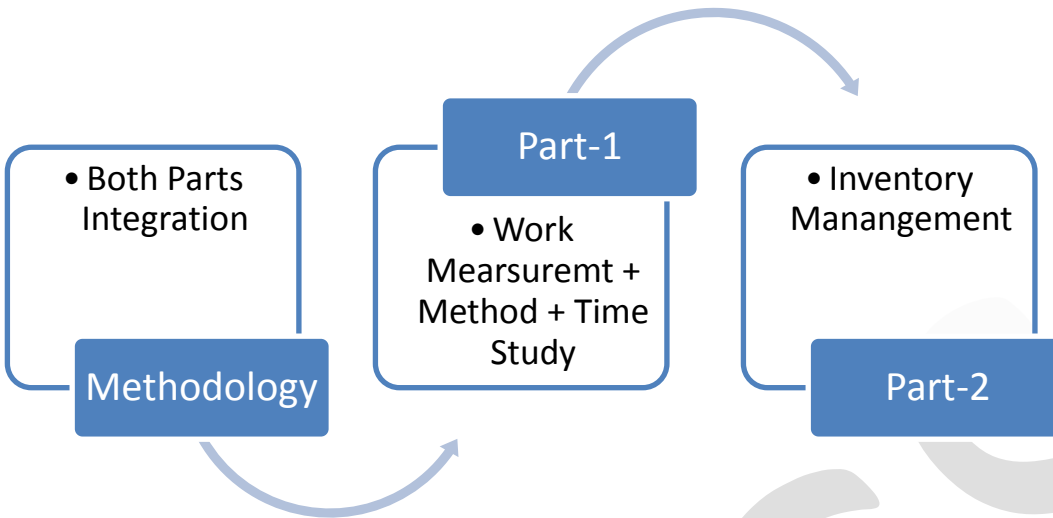


Figure 3- Proposed Methodology

This methodology can become efficient. My proposed method I am paying attention multi skilled operator who will operate the multiple CNC and VMC machines at a time.

Most of the time in filed we can easily see the operator inputs the code and starts the machine in CNC and VMC machines operations runs for the hours according to function. There is no work which will completes in minutes.

So what will the labor will do in that time when operation is running. At that time most of the labor starts machine and do all the wastage works which is not productive work for the company. The time counts in hours and the time is running under nonproductive work till the all operation is not done.

My proposed method is to transform non productive work into productive work and for the purpose it suggest to hire a multi skilled machine

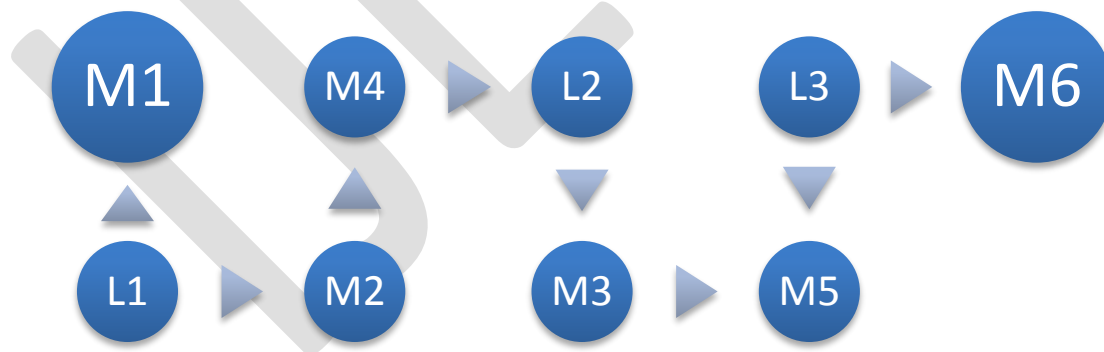


Figure 4- Machine Distribution

operator. Which input codes in all CNC and VMC machines and take care of two or more machine at same time.

That will save money for the company by which company will pay only for the 1 labor for the two or more machines. It can convert the module of the assembly line and proposed methodology will able to convert nonproductive work into productive work and saving company's money on more workers.

#### **ACKNOWLEDGMENT-**

First of all, I would like to thank my parents for all the continue support of them, without them it was not possible. I also would like to say thanks to my guide and HOD for his outstanding motivation and support, I also want to say thanks to my all faculty and all the staff for them mesmerizing support and planning.

#### **CONCLUSION-**

This thesis objective is to increase the efficiency of the automobile sector assembly line. This methodology has two major parts. For the purpose two parts methodology is being prepared, The First part is Man- Machine system and in this, Work Measurement, Method Study and Time Study is implemented. In second part Inventory, management system is implemented to reach the higher productivity. But for achieving the purpose following barriers are to be overcome: Over (or Under) Producing Due to a Change in Demand, Diminishing Returns on Lean Manufacturing Efforts, Lack of Real-Time Information, Unbalanced Station Workloads, WIP or Manufacturing Cycle Time, Lengthy Changeover Time, Late Product Launches on New Assembly Lines, Low Production Quality, Late Product Launches on Existing Assembly Lines. To overcome the related barriers required suggestion and steps are provided in the proposed methodology. Which are in brief; Protect company against theft, Establish an approved stock list for each warehouse, Assign and use bin locations, Record all material leaving your warehouse, Process paperwork in a timely manner, Set appropriate objectives for your buyers, Make sure every employee is aware of the cost of bad inventory management, Ensure that stock balances are accurate and will remain accurate, Determine the most advantageous replenishment path for each item in each warehouse, Distributive purchasing, Central Warehousing, Cooperative Purchasing, Transfer excess stock to a branch that needs the material, Return the stock to the vendor, Lower the time of items with excess inventory, Substitute surplus inventory for lower cost items that are still popular After implementing the proposed methodology the result shows this methodology Increasing Productivity in Automobile Assembly Line Industry by Transforming Man-Machine System & Inventory Management can be perform more efficient and productive this result can easily conclude that this new and improved methodology created slightly differentiate results. This is better than existing technologies and methodology.

#### **REFERENCES:-**

1. Gilbreth, Lillian M. The Home-Maker And Her Job. New York: D. Appleton, 1927.
2. Gilbreth, Frank B., And Lillian M. Gilbreth. Fatigue Study: The Elimination Of Humanity's Greatest Waste; A First Step In Motion Study. Easton, Pa: Hive, 1973
3. Gilbreth, Frank B. Bricklaying System. Easton, Pa: Hive, 1974.
4. Wrenge, Charles D., And Anne M. Stoka. "Cooke Creates A Classic: The Story Behind F. W. Taylor's Principles Of Scientific Management." Academy Of Management Review 3.4 (October 1978): 736-749.
5. David R. Hill, Man-Machine Interaction Using Speech, Department Of Mathematics, Statistics, And Computing Science The University Of Calgary, Calgary, Alberta, Canada 1995.
6. Mayank Dev Singh, Shah Saurabh K, Patel Sachin B, Patel Rahul, "To improve productivity by using work study and design a fixture in small scale industry", International Journal on Theoretical and Applied Research in Mechanical Engineering 2319 – 3182, Volume-1, Issue- 2, 2012.
7. Ge Rard P. Cachon, Marshall Fisher, Supply Chain Inventory Management And The Value Of Shared Information Management Science © 2000 Informs Vol. 46, No. 8, August 2000 Pp. 1032-1048
8. Jongyoon Kim, Stanley B. Gershwin-Department Of Mechanical Engineering, Massachusetts Institute Of Technology Cambridge, Massachusetts 02139-4307 Received: December, 2003 / Revised Version: May, 2004
9. T. Balomenos, A. Raouzaïou, S. Ioannou, A. Drosopoulos, K. Karpouzis, And S.Kollias- S. Bengio And H. Boulard (Eds.): Mlmi 2004, Lncs 3361, Pp. 318 – 328, 2005.© Springer-Verlag Berlin Heidelberg 2005.
10. Jez Humble, Chris Read, Dan North- The Deployment Production Line October 2003 Patricia Fernández-Kelly- Cmd Working Paper #06-05- June 2006The Global Assembly Line In The New Millennium
11. M. Mohd Hafizuddin, N.K Ahmad Nazif, Y. Mohd Needza And D. Azila Nadiyah-Proceedings Of The 2012 International Conference On Industrial Engineering And Operations Management Istanbul, Turkey, July 3 – 6, 2012
12. K Kuzume And T Morimoto, Hands-Free Man-Machine Interface Device Using Tooth-Touch Sound For Disabled Persons, Department Of Information Engineering, Yuge National College Of Technology 1000 Yuge, Kamishima-Cho, Ochi-Gun, Ehime Ken, Japan, Proc. 6th Intl Conf. Disability, Virtual Reality & Assoc. Tech., Esbjerg, Denmark, 2006
13. Scholl, A; Becker, C; 2006. State-Of-The-Art Exact And Heuristic Solution Procedures For Simple Assembly Line Balancing. European Journal Of Operations Research
14. Gilbreth, Frank B. Motion Study: A Method For Increasing The Efficiency Of The Workman. Whitefish, Mt: Kissenger Publishing, 2008.
15. White Paper: Inventory Control April, 2008: Control It Before It Controls You.
16. Taylor, Frederick W. The Principles Of Scientific Management. New York: Cosimo Classics, 2010.

17. Jon Schreibfeder, The First Steps To Achieving Effective Inventory Control, Worldwide (1) (701) 281-650, 2011, United States And Canada, Toll Free, (888) 477-7989.
18. Amardeep, T.M.Rangaswamy, Gautham J - International Journal Of Innovative Research In Science, Engineering And Technology Vol. 2, Issue 5, May 2013
19. Dilip Kumar Adhwarjee, M.C. Majumder, Nilotpal Banerjee- Ijitr) International Journal Of Innovative Technology And Research Volume No. 1, Issue No. 6, October - November 2013, 547 - 549.
20. Mary (Missy) Cummings, Duke University And Mit, Man Versus Machine Or Man + Machine? 1541-1672/14/\$31.00 © 2014 Ieee Ieee Intelligent Systems Published By The Ieee Computer Society.
21. Baykasoğlu, A., And Türkyay Dereli, T., 2009, Simple And U - Type Assembly Line Balancing By Using An Ant Colony Based Algorithm, Mathematical And Computational Applications, Vol. 14, No. 1:1-12.
22. Becker C., And Scholl A., 2006, A Survey On Problems And Methods In Generalized Assembly Line Balancing, European Journal Of Operational Research, Vol. 168, No. 3: 694–715.
23. Benzer, R., Gökçen, H., C,Etinyokus, T., And C,Erc,Ioglu, H., 2007, A Network Model For Parallel Line Balancing Problem, Mathematical Problems In Engineering, Article Id 10106, Hindawi Publishing Corporation.
24. Betancourt, L.C., 2007, Asalbp: The Alternative Subgraphs Assembly Line Balancing Problem. Formalization And Resolution Procedure, Ph.D. Thesis, Technical University Of Catalonia, Spain.
25. Chutima, P., And Suphapruksapongse, H., 2004, Practical Assembly Line Balancing In A Monitor Manufacturing Company, Tharnmasat International Journal Of Science Technology, Vol. 9, No. 2.
26. Eryuruk, S. H., Kalaoglu, F., And Baskak, M., 2008, Assembly Line Balancing In A Clothing Company, Fibres And Textiles In Eastern Europe, Vol. 16, No. 1(66).
27. Fonseca, D.J., Guest, C.L., Elam, M., And Karr C.L., 2005, A Fuzzy Logic Approach To Assembly Line Balancing, Mathware & Soft Computing, 12:57-74.
28. Gökçen, H., Agpak, K., Gencer, C., Kizilkaya, E., 2005, A Shortest Route Formulation Of Simple U - Type Assembly Line Balancing Problem, Applied Mathematical Modelling, 29: 373–380.
29. Pyo, S.T., 2000, Implementation And Line Balancing Of Assembly Line Of Abs Motor For Improvement Of Assembly Productivity, Thesis, Industrial Engineering, Pusan National University, South Korea.
30. Stevenson, W.J., 2002, Operations Management, 7th Ed. Mcgraw-Hill, Irvin.
31. Yegul, M.F., Agpak, K., And Yavuz, M., 2010, A New Algorithm For U - Shaped Two-Sided Assembly Line Balancing, Transactions Of The Canadian Society For Mechanical Engineering, Vol. 34, No. 2.