

PERPUSTAKAAN UMP



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STUDY OF LABOR UTILISATION AND MAN TO MACHINE RATIO AT
AUTOMOTIVE COMPONENT COMPANY

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ABSTRACT

The effective use of man power is essential in manufacturing industry for high return of investment from expensive resource nowadays. Thus, this study has been carried out as the platform to utilise the resource of the company. The study of labor utilisation and man to machine ratio is about improving productivity through identifying the current labor utilisation before man to machine ratio can be determined using time study methodology. The problem rose from the undefined and unbalance work content lead to this study to utilise the resource of the company. This study has been carried out using time study method and data have been analysing using Tecnomatix Plant Simulation. The objective of the this study are to observe and record the sequence of the task time performed by operator, and analyse the data using the simulation to determine the current labor utilisation of floor console assembly line and propose man to machine ratio for the company. From this study, the utilisation of labor utilisation of each workstation can be determined in order to propose to the management the investigate area for fully use the resource. Operators A in lid console assembly line indicate the labor utilisation of 81.8% that is the highest value of labor utilisation. The current man to machine ratio is 1:1 for all the process. But after the improvement has been made, the line can support 1:2 ratio for process D and process I. The improvement when it implement will enable the company to reduce the operational cost as well as achieve the competitiveness among other competitors.

ABSTRAK

Penggunaan berkesan tenaga manusia adalah penting dalam industri pembuatan bagi pulangan yang tinggi daripada pelaburan dari sumber mahal pada masa kini. Oleh itu, kajian ini telah dijalankan sebagai platform untuk menggunakan sumber syarikat. Kajian penggunaan buruh dan manusia nisbah mesin untuk adalah meningkatkan produktiviti melalui mengenal pasti penggunaan buruh semasa; sebelum manusia nisbah mesin boleh ditentukan melalui kaedah kajian masa. Masalah daripada ketidakseimbangan kandungan kerja telah menyebabkan kajian ini dijalankan bagi menggunakan sumber syarikat dengan sepenuhnya. Kajian ini telah dijalankan dengan menggunakan kaedah kajian masa dan data telah dianalisis menggunakan Tecnomatix Simulasi Plant. Objektif kajian ini adalah untuk melihat dan merakam urutan masa tugas yang dilakukan oleh pekerja, dan menganalisis data menggunakan simulasi untuk menentukan penggunaan tenaga buruh semasa pemasangan konsol lantai dan mencadangkan nisbah pekerja kepada mesin bagi syarikat itu. . Daripada kajian ini, penggunaan buruh bagi setiap stesen kerja boleh ditentukan untuk mencadangkan kepada pihak pengurusan kawasan untuk penambahbaikan supaya dapat menggunakan sumber sepenuhnya. Operator A iaitu bagi process pemasangan penutup konsol menunjukkan penggunaan pekerja sebanyak 81.8% iaitu nilai tertinggi bagi penggunaan tenaga pekerja . nisbah semasa pekerja kepada mesin adalah 1:1 bagi semua proses. Tetapi selepas penambahbaikan telah dibuat, 'line' boleh menyokong 1:2 nisbah untuk proses D dan proses I. Peningkatan ini apabila ia melaksanakan akan membolehkan syarikat untuk mengurangkan kos operasi serta meningkatkan daya saing di kalangan pesaing lain.

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LIST OF ABBREVIATION

IQM	Industrial Quality Management Sdn Bhd
SMI	Small and Medium Industry
SOP	Standard Operation Procedure
TPS	Toyota Production System

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Nowadays, in the modern world, everyone keep on competing to survive especially in automotive industry. The small medium industry like Industrial Quality Management Sdn Bhd (IQM) (234436-K) also felt the same way. IQM was established in 19th February 1992. Headquarter in Shah Alam, it has another three manufacturing branches in Tanjung Malim, Perak, Gurun Kedah and the new family in Bukit Beruntung plant which specialize in ED coating service. The products include Floor Console, Gear Shift Assembly, Door Check Assembly, Door Handle Assembly, Latch Hood Assembly, Assist Grip Assembly and various other automotive components.

To keep surviving in the industry, continuous improvements are crucial. This is why more research is being done to improve their production line and ensure on time delivery to customer. Assembly lines are usually the area for improvement because assembly line produces finish goods. As the small and medium company usually using direct man power to produce the part, they are very useful resource. Doing research in man power especially can ensure that company fully utilise their resource.

Thus, study on labor utilisation is one of the ways to use the resource effectively. Labor utilisation is about how many you can make use of the manpower. As example, you have labor that is required to perform certain tasks to produce your products. If your labor force is not happy you may find your operations struggling. When a direct

employee that is the ones actually making your company money can really define it work content, the flow of the production will be smooth. Man to machine ratio means how many person that will be assign for a machine or workstation. Identify the number of person or the ratio of manpower to machine is important as the manpower is also a cost.

1.2 PROJECT BACKGROUND

This paper is about identifying current labor utilisation before ideal man to machine ratio can be determined for supporting improvement of assembly line of floor console in IQM at Tanjung Malim, Perak. In particular, this thesis discuss about the time study that has been carried out to identify the current labor utilisation of operator at floor console line in order to achieve excellent performance that can increase the productivity, quality of product and its benefits in future.

The study of labor utilisation and man to machine ratio in automotive component company is the title of project that discuss some analysis about the manufacturing management industry. In this study, floor console part is chosen; that is one of the automotive components that produce in IQM. Floor console is refers to the control-bearing surfaces in the center of the front of the vehicle interior. The term is applied to the area beginning in the dashboard and continuing beneath it, and often merging with the transmission tunnel which runs between the front driver's and passenger's seats of many vehicles. Floor console is the part for new car which is one of the latest models of Proton company product. As the vendor of Proton Company, producing part within their specification and delivery on time is crucial. This is because floor console is the most expensive part that being sold to the Proton. Improvement in productivity of floor console line will also improve the cash flow of the company. This is why floor console line is chosen as study area. From this selection, it is important to recognise the cycle time of the production from the selection product. Each operation of the workstation can be influence the design of the layout and the production time.

Process and labor utilisation that ensures all workstations are balanced is essential factor for factory productivity. Another important factor that has to be considered is the Man-to-Machine (M-to-M) ratio which provides an answer to how many manpower should be assigned to a machine or workstation (Mohamed K. Omar, Rohana Abdullah, Md Nizam Abd Rahman, 2012). The identification of current labor utilisation is important to be the bench mark of the improvement that needs to be done. To improve the productivity researcher need to identify the current utilisation of each operator. So that, researcher can knows which operator need to give more attention or need more training. To identify the current utilisation, the time study method is being used. The cycle time each of the operator are collected. The utilisations of the operator are generated through the simulation.

This project requires the student to understand the concept of manufacturing and design of production process. This study also require student to make some observation in the industry to observe about process flow of the product, production time that including cycle time for one product , work content of the operator and layout of the manufacturing cell in floor console assembly line. Through this project, most of the waste also can be reduce such as waste of motion, waste of waiting, waste of handling, waste of defect or rework and also waste of overproduction.

1.3 PROBLEM STATEMENT

Productivity is the manufacturing industry's main concern. There are many alternatives available for improving productivity. This project is concern on the improvement of productivity and manufacturing process through identification of labor utilisation and man to machine ratio. One of the issues identified at automotive component company is that some tasks performed by the operator are unnecessary and repetitive. The unnecessary task will affect the cycle time and daily production rate of the department (Rohana Abdullah and Aida Bahiyah Mohd Rodzi, 2011). The unnecessary task will cause some operator experienced muscle fatigue due to long hour standing position. As the operator is the fixed cost resource of the company, effective

use of them is essential for high return of investment to generate more cash flow of the company.

In the small and medium industry like IQM, the small improvement can lead to the major effect. Through the observation of the factory, operators have the problem on the step of the work that they do. As example, if they main person that in charge of the process is absent, the replacement operator did not know the correct step of producing the part. The main factor is they do not clearly define the work content of each operator. Thus they did not know if they fully utilise their operator. Each of operator doing the process in different sequence. Thus, there is no specific sequence that one can refer as their references.

In the floor console assembly line, the cycle time of each operator is different from another as stated by the time study that has been conduct previously by the company. Unbalance of work load will cause the fail of one piece flow implementation. If the operator A has the workload more than operator B, it will cause the waste of waiting. This is because operator B needs to wait the part from operator A. In contrast, if the operator A have the smaller workload than operator B, the inventory waste will be happen. This is because, operator A produce part fast than operator B to complete it task. The unbalance of workload may lead to the overburden to the operator. Overburden will cause operator easily fatigue and sick. The utilisation of operator cannot be achieve if the condition of operator not good. The utilisation of operator is important in order to increase the productivity and reduce the cost of manpower. When man power is fully being utilised, the efficiency of work will be increase.

1.4 PROJECT OBJECTIVE

The objectives of this study are as following:

- (i) To perform the time study on operator activity at assembly line of floor console
- (ii) To determine the current labor utilization at assembly line of floor console
- (iii) To propose ideal man to machine ratio based on the current labor utilisation

1.5 SCOPE OF STUDY

This research conducted at IQM in Tanjung Malim, Perak. IQM has been chosen because they are one of the automotive component companies that have a great future to be more successful. The research area will be focusing in the production department at the assembly line of floor console. Floor console is the biggest part and most expensive product that being sold to the customers of IQM. Most of the waste are usually occur at assembly line. This is why they always focusing on the assembly line for more improvement.

Other than that factor, assembly are usually line that producing finish good. In this assembly line, there are 11 processes that being engaged for 11 operators. These lines are including one sub assembly process of console upper A and one inspection process. IQM running their business in normal shift that is 8 hours working hours from 8 am until 5 pm and also have one hours break. In this research, the entire work content of the operator has been recognised. The cycle time of each process from each operator of floor console line has been taken. Somehow, to propose the man to machine ratio is by the current labor utilisation. Currently, the assembly line used the product layout. By combine the line, one operator can handle two processes. Thus, it will increase the labor utilisation as much as increase the man to machine ratio.

1.6 SIGNIFICANT OF STUDY

In conducting a research about the real problem that face by the automotive company, it can contribute the benefits toward the researcher and the company itself. Thus, through this study researcher can apply knowledge about manufacturing system in the real world situation. All the theories that have been learnt need to practically implement in the industry. Thus, through this study it will expose researcher to the real industry problem.

The benefit to company they will achieve smooth flow of the production as the line have been improved. Smooth flow will lead into improvement of productivity and reduce waste. By doing more on the resources, productivity can improve as the output is increase. Through identification of the current utilisation of each operator, improvement of productivity can be achieved. Standardization will help in reducing waste as well as identify the workload for each operator. Thus, no more over burden and extreme fatigue experience by the operator and it will increase the morale of the worker. As the increase in productivity it will also effect on improvement of cash flow. These studies also hope it will help to achieve competitive advantage over other competitors.

CHAPTER 2

LITERATURE REVIEW

This topic is discussed about any related factor that effect on the study of labor utilisation and man to machine ratio that have been done previously. Any information, quote and fact from existing journals, book or other source have been gathers and compile in this section. In the study of labor utilisation and man to machine ratio, there are some factor that should be look seriously. In order to improve productivity from this study, better understanding about productivity must be done by refers to the previous research. In this study, researcher also includes Toyota Production System (TPS) that is the crucial study that have been used as the tool to improve the productivity of the factory especially in automotive industry. Through the previous research, it can help to develop a better understanding about the whole project.

2.1 PRODUCTIVITY

The significant of labor utilisation and man to machine study is to improve the productivity. According to Rohana Abdullah, Aida Bāhiyah Mohd Rodzi (2011), they said that productivity and labor are two main key elements in manufacturing. Productivity is the ratio concept that relate with the output of the system to the input which are utilise to produce that output (William T. Stewart and Ronald J. Calloway, 1982). Productivity is also can define as a measure of the efficiency of production in the factory. It is based on the number of input and output. This means that to increase the productivity, we need to do more with the same resources. Other statement that state by the Nigel Nolan (2011) , he said that increases in productivity can be achieved by producing more outputs that is more goods or services with the same inputs; or by

producing the same level of outputs with fewer inputs; or by producing more outputs with fewer inputs.

The impact of labor productivity in an organisation is huge as it contributes to the organisation or company's performance (Rohana Abdullah, Aida Bahiyah Mohd Rodzi, 2011). Greater labor productivity enables firms to produce a given amount of goods or services with a smaller number of labor hours (Lardaro, 2001). Some practical ways of achieving an increase in efficiency or productivity are by investing in new machinery; automating (or further automating) all or part of the production or transformation process; training and up-skilling staff; making changes to systems or processes. This involves staff from more than just operations (Nigel Nolan, 2011).

In improving the productivity of a company, the business will gain many benefits. These can include (Enrico Giovannini, 2001):

- increase in income or profitability
- lowering running cost or operational costs
- maximising the use of all of company 's resource such as land, equipment or machinery, factory and workers
- More cash flow means more opportunity for the company to expand and grow.

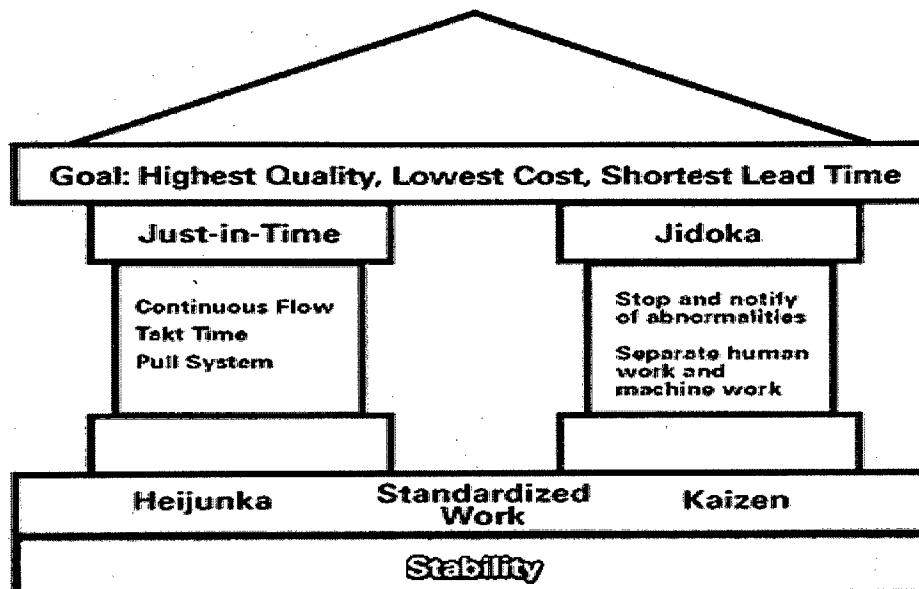
As discuss above, improving the productivity will increase the income or profitability. This is because, when the operator can produce more finish goods and can deliver the customer demand on time, the income will be increase and company will be more profitable. As the study is about proposing the man to machine ratio, company can maximise use of utilise their resource as manpower is one of their resource.

In this study, Toyota production system (TPS) is one of the tool that can be used to improve the productivity by reduce the waste in the assembly line. Methods and tools used in lean concept modelling can be described as important elements in manufacturing system construction (A. Gunasekaran, L. Forker and B. Kobu, 2000). TPS is the frame work of concept and method to enhance corporate vitality. TPS is the

production system developed by Toyota Motor Corporation to provide the best quality, the lowest cost and the shortest lead time through the elimination waste. TPS was developed with the objective of identifying and reducing wasteful activities in manufacturing processes through education and involvement of the employee and top management (Hajar Abdullah, 2012).

Creating smooth stream requires that every employee, every manager, every supplier and every machine will change to meet the requirements of customers. The TPS 'house' diagram is a demonstration of how TPS can be the foundation for improvement management and communication in an ideal situation. As mention by Norazmein Abdul Raman and Engr. Khairur Rijal Jamaludin (2008) in their paper, the economic advantage of implementing TPS would be of great benefit to automotive parts manufacturers classified as small and medium industries (SMI).

IQM is one of the small and medium industries that now growing to be more successful in the future through TPS implementation. TPS are the best method to be implemented in the SMI such as IQM and now they are also implementing lean production system in their production line. In the research that being conducted by A. Gunasekaran, L. Forker and B. Kobu (2000), TPS or known as lean system can use for improving their productivity and quality by eliminating non-value adding activities and improving their competitiveness.



Toyota Production System "House."

Figure 2.1: Toyota Production House

Source: Jose Ferro, Dan Jones and Jim Womack (2008)

2.2 STANDARDIZATION

Another key important issue for any productivity improvement program is the management of people (A. Gunasekaran, L. Forker and B. Kobu, 2000). Job satisfaction is an important antecedent to having productive workers, so any improvement in the working environment, especially on the assembly line where tasks are repetitive but critical for product quality, should be taken into account. This means that by identifying the standard work of the operator, we can achieve the job satisfaction of the operator. Another research that done by Rohana Abdullah and Aida Bahiyah Mohd Rodzi (2011) say that through their study, they found that the differences in work method to perform similar task were also able to detect through labour utilisation and man to machine ratio's study. They also proposed a standard operating procedure (SOP) that is used to train the operator. From the observation at the factory plant, researcher notice that the

work content of each operator are different and no standardize. So through this study, it will recognise the standard work content of each operator in this floor console line.

The identification of work content is important to avoid any over burden to the operator. Overburden will cause operator to be less efficient due to the fatigue. The entire job that has been done by the operator will be recorded in the process check sheet in order to standardize it. Standardized work is the foundation of the everyday operation of TPS. It regulates every single step in the entire process of producing an automobile (Marek Piatkowski, 2009). Standardized Work TPS organizes all jobs around human motion and creates an efficient production sequence without "*Muda*" that means waste. The work organized standard operation procedure (SOP) that it can truthfully be called standardized work (William J. Stevenson and Sum Chee Chuong, 2010).

It concentrates on operator movements and identifies the best and the most efficient sequence for each manufacturing and assembly process. It is always repeated in exactly the same way, therefore avoiding unnecessary motion and wasted effort, maintaining quality, assuring safety, and preventing equipment damage. Each worksite manager is in charge of standardized work for his group. Standardized work is a living, flexible tool that can be changed and improved along the way (Hazmil Hapaz, 2008). Standard Work is simply information, a measure against which we can view a process in order to look for further improvements (Stevetuf, 2009). In this study, researcher will establish the standard work at the workplace for each process so that they will identify their work content.

CHAPTER 3

METHODOLOGY

This chapter describes method and technique that has been used to show the way to study the labor utilisation and man to machine ratio in current manufacturing industry. The main purpose of this chapter is to do the documenting of all the process that involved in developing the system. This chapter will explain the project developments that have been implemented. The overall methodology is presented in the flowchart. Each step in the methodology is explained in detail.

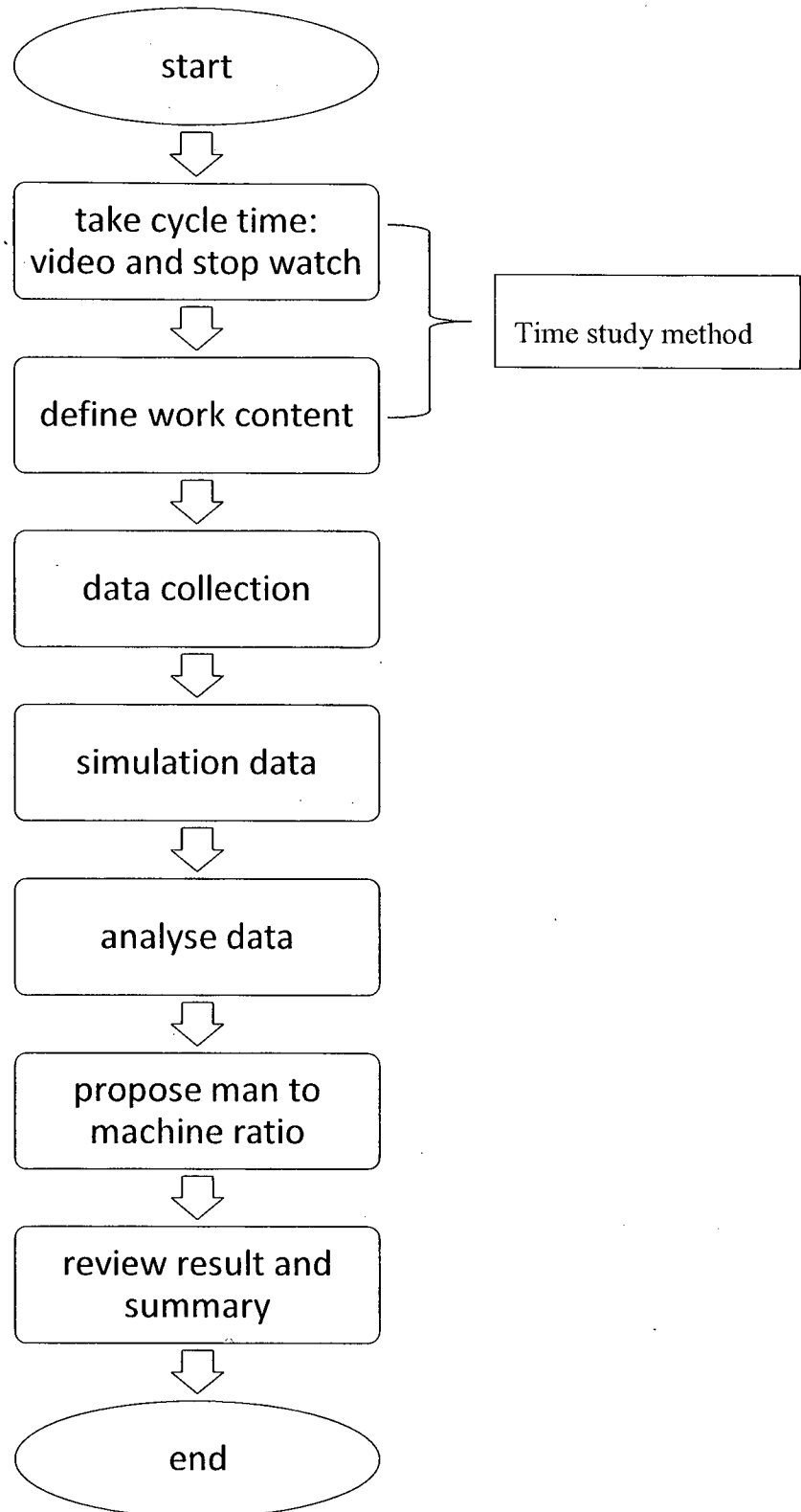


Figure 3.1: Flow Chart of Research Methodology

3.1 DESCRIPTION OF STUDY AREA BACKGROUND

To achieve the first objective of study of labor utilisation and man to machine ratio, the time study has been performed. This area will discuss about the background of the area that have been studied. These parts are discussed to give more understanding about the flow of the line. Figure 3.2 indicates the layout of the floor console in simulation interface and Figure 3.3 indicates the layout of the floor console assembly line in IQM.

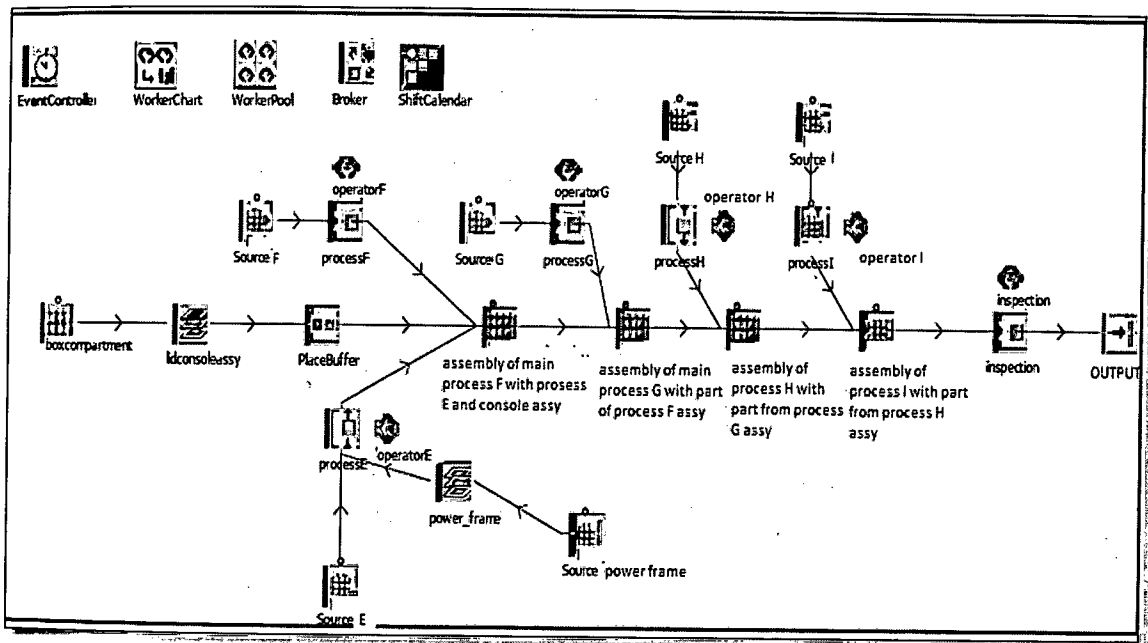


Figure 3.2: Layout of Floor Console Assembly Line in Tecnomatix Plant Simulation

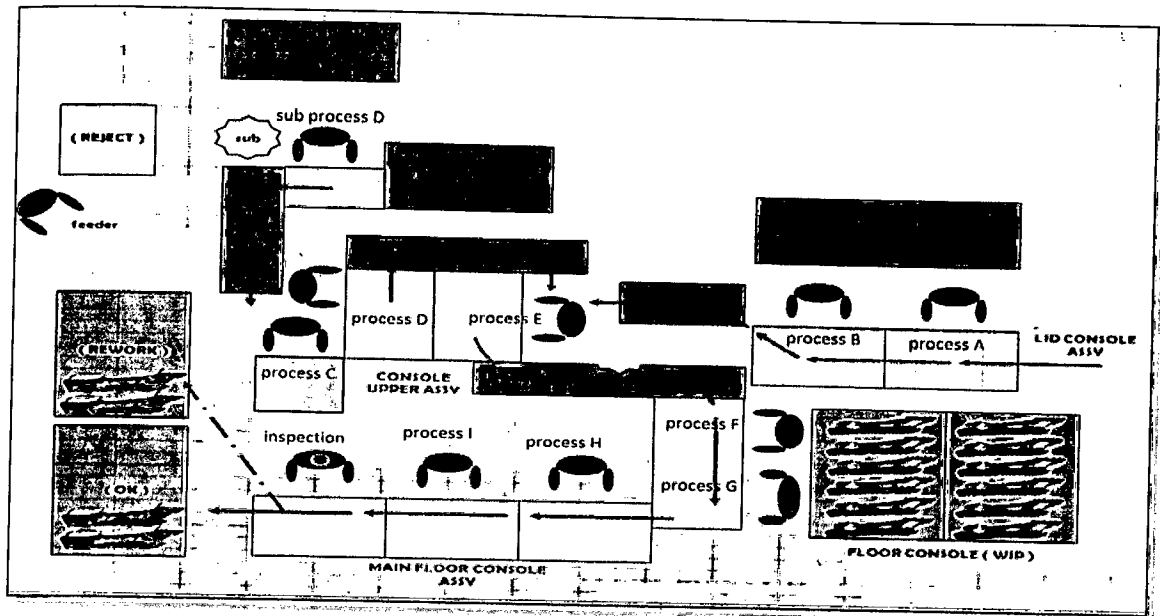


Figure 3.3: Layout of Floor console assembly line in IQM (Visual)

In this assembly line, there are 11 process include sub process and inspection process done by quality control members. The assembly line is beginning with process A that is lid console assembly. After operator A finish their part, operator B will use the part for assemble with operator B's part. Here, the process of assemble of lid console and box compartment is happen. Then operator B put the part on the chute. Operator C will assemble the console upper A and power frame socket. Here tool such ultrasonic is used. There are two type of ultrasonic tool are used in floor console line, one is machine ultrasonic and the other one is the manual ultrasonic. The ultrasonic machine can weld six spot places in one time while the manual is one spot place in one time. After that the next person that is operator D will use the part form part C and sub process D. Then, operator D will assemble with bracket heat stick. Here, manual ultrasonic welding is used. The complete part will be put on the chute to be used by operator E. The process of operator E is to assemble part from process D with box compartment of process B. the complete part will put on the chute.

Then, the line continues with the main flow of the floor console assembly line. The operator F will take main floor console body from work in progress (WIP) place. Then, operator will assemble break parking retainer and cover break. The critical point

of ultrasonic weld will be mark to indicate part have been done. Thus it will be easier for the control inspector to inspect the part. The next process used the previous part of process F. Operator G will assemble the part form process E with the current part of process F. Next is the process for operator H. Operator H take part G, tighten the screw and also manually ultrasonic weld bracket heat stick point. Process I, will take part from process H, tidy the wire hardness and test the wire hardness. The final process is the inspection. The complete part will be inspecting by quality control inspection. The finish goods will be put on the rack. The reject or defect will put in one place for rework. The details of work study of each operator in floor console assembly line are shown in the standard combination table in appendices. The summary of the process and operator of floor console assembly line are given in table below.

Table 3.1: Process descriptions in Floor Console Assembly Line.

Item	Operator	Process Description
Process A	A	Lid console assemble
Process B	B	Lid console assembly and box compartment
Process C	C	Assemble of console upper A and power frame socket
Process D	D	Assemble of part process C with bracket heat stick
Sub process D	Sub D	Minor assemble of console upper A
Process E	E	Assemble of part process D with part process B inside floor console body
Process F	F	Assemble main floor console with retainer parking brake
Process G	G	Assemble part process E with main floor console part F
Process H	H	Take part G, tighten screw and ultrasonic weld bracket stick point
Process I	I	Take part H, tidy wire hardness and test
Inspection	Inspector	Check for any defects and wrap the finish goods