



## ARTICULATED FUNCTION OF LEAN THINKING APPLYING TO SML SCALE INDUSTRIES

Sarjak G. Mamtora<sup>1</sup>, Nirav R. Panchal<sup>2</sup>

<sup>1,2</sup>Gandhinagar Institute of technology, Gujarat, India

### Abstract

Lean manufacturing make a start as the Toyota production system in the Japanese auto industry. With the current economic situation pressure is being felt at all levels of all organization so its necessary to set main objective, the efficiency of management method. Lean manufacturing is most powerful formula for eliminating waste and non value-added activity, improve quality and inventory, improving overall performance with the promise of huge early gains and address their specific needs in a restricted market in times of economic trouble. In this context, this study is an attempt to develop a structural model of the variables, important to implement lean manufacturing system in industry. In this paper a framework is created by a brief exposure to lean manufacturing processes and prepare common flow chart of process which is implementing for small scale, medium scale and as well as large scale industry. This flowcharts are used in analyzing, designing, documenting or managing a process of lean manufacturing.

**Keywords-** Lean Roadmap, Takt time, OEE, 5s, Kaizen, Kanban

### Nomenclature:

<b>SML</b>	<b>: Small Medium Large</b>
<b>LM</b>	<b>: Lean Manufacturing</b>
<b>TPM</b>	<b>: Total Productive Maintenance</b>
<b>SMED</b>	<b>: Single minute exchange of die</b>
<b>TQM</b>	<b>: Total Quality Management</b>
<b>I.A</b>	<b>: Internal Activity</b>
<b>E.A</b>	<b>: External Activity</b>
<b>P.K</b>	<b>: Production Ordering Kanban</b>
<b>W.K</b>	<b>: Withdrawal Kanban</b>
<b>CSF</b>	<b>: Critical Success Factor</b>

### [1] Introduction :

A new Philosophy has Built in the past decade that stems from the Toyota Production System. This manufacturing system is totally differ from traditional mass production because it is not only talking about adding some new techniques on how to build products, but actually changing the way of thinking about manufacturing. [41] Lean Manufacturing is the process whereby all employees work together to optimizing the existing production activity based on customers need by understanding and Recognizing the customers values. [42] A huge Number of manufacturing Company throughout the world have implemented LM. Although LM promises large improvement, most of companies implementing LM are failing to create gains.

### [2] Lean Manufacturing concept :

Lean Manufacturing is philosophy that is best way for continues eliminating wastes in industries using various tools and methods used by Toyota production system for improving various factors such as reducing the defects, waste minimization, lead time reduction, completely utilization of space, minimize the utilization of manpower, material and machine, lower the inventory level, greater flexibility, improve the labor productivity. lean thinking can be

summarized in five principles: precisely describe value by specific product, describe the value stream for each product, make value flow without pauses, let the customer pull value from the producer, and continue perfection [1].

The word WASTE is second important in lean culture there are seven types of wastes include in any organization and cause the problems for productivity and time and so on. The seven types of waste are defects, over production, waiting, unnecessary movement, transportation, inventory, motion.

### **[3] Lean Tools and Methodology:**

#### **[3.1] value stream mapping:**

A value stream mapping is a lean enterprise technique used to document, analyze and ameliorate the flow of materials of information required to produce a product or service for a customer.[4] A value stream mapping is the communication tool, business contriving tool and a tool to organize the company change process[7].

#### **[3.2] kaizen:**

The definition of Japanese word Kaizen is given by New oxford American dictionary is given as below:“A Japanese business philosophy of continues improvement of working practices and personal efficiency etc.”[9]

Kaizen is the process of small improvements in daily routine work lines in any organization for better quality and higher productivity it involve all the members of industry and this strategy is implied to all the branches of the organization from material ordering to dispatching [11].

#### **[3.3] 5 S :**

5s was developed in japan and was identified as one of the technique that including in just in time manufacturing.[14].

#### **[3.4]Total productive maintenance:**

Total Productive Maintenance is consider as the medical science of machines. It is the newly developed technique in which all the plant equipment and objects are maintain in counterbalance condition. Ultimate goal of TPM is to hold exigency and unscheduled maintenance to lower limit. [18].

#### **[3.5] Single minute exchange of die (SMED) :**

SMED also known as rapid change over of tools or equipment was invented by shingo,[21]. Which is a scientific method for reducing the setup time for die or tool and applied in industrial unit to any machine. The word “single minute” has not mean that all the changeover take the only one minute or single minute but they should take less than 10 minutes.(in other word single digit unit)[22]closely associated is a yet more difficult concept, One-Touch Exchange Of Die(OTED) which is related that changeover should be made in 100 second.

#### **[3.6] Poka-yoke :**

Poka-yoke is the Japanese term which means that “mistake Proofing ” It is the subset of lean management that is used to avoid the mistake happened by operator. Main objective of the Poka-yoke that to reduce or eliminate the mistake or Problems by foreclosing , compensating and drawing attention to errors made by employees.[26].

#### **[3.7] Kanban :**

Kanban is the Japanese word which means bill board Or sign board.it is scheduling system used in lean manufacturing.[31] Kanban is the logistical string from the production point of view and is not inventory control system.It is discovered by Taiichi ohno. And used to achieve JIT.[32]Kanban is a signal to replace what has been used If authorization is present, one can act. If it is not one can't.[33].

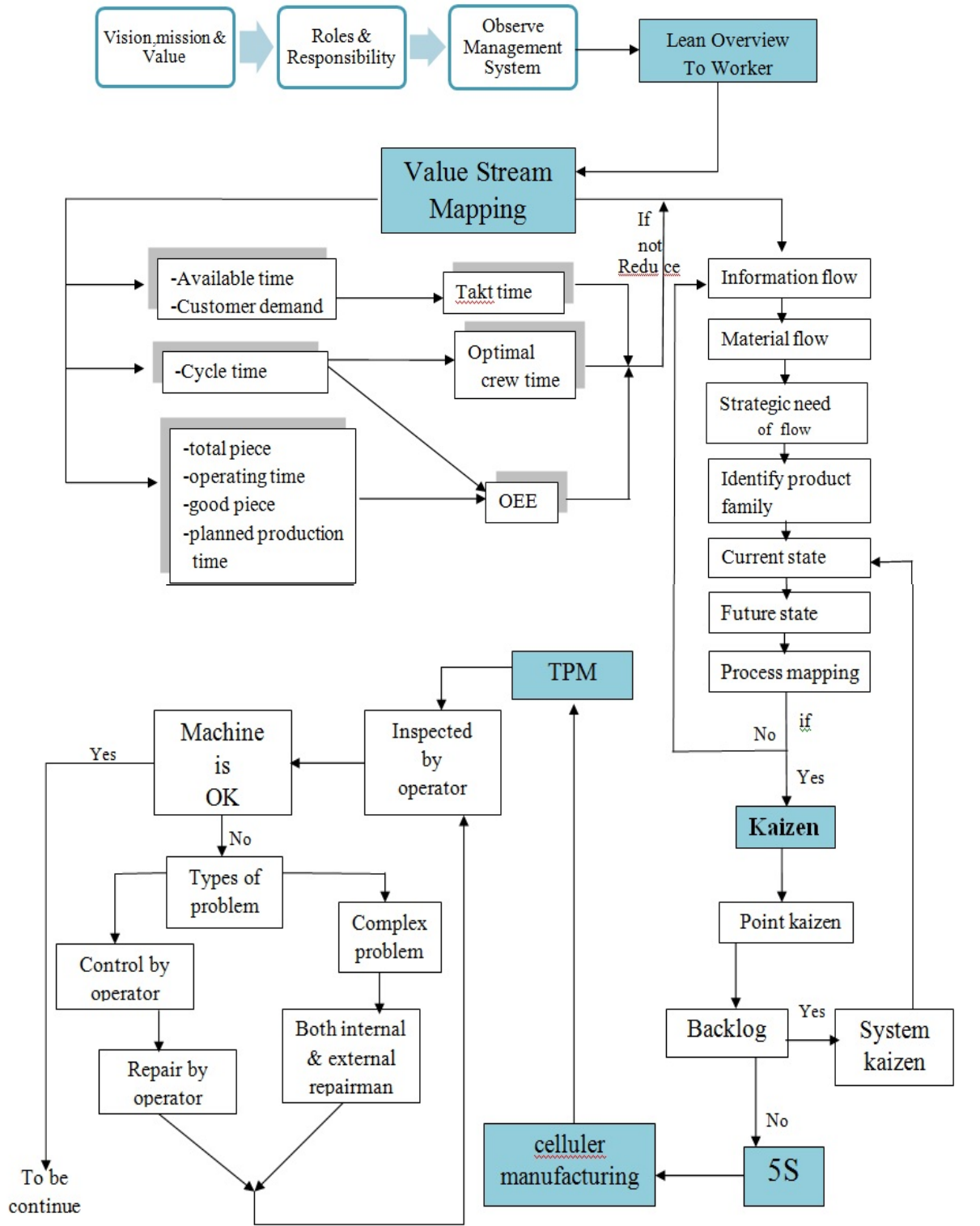
#### **[3.8]Andon :**

An Andon light is one of the most common form of visual management which is used in lean manufacturing.In lean Manufacturing , Andon is the word related to signal providing by equipment itself or manual. So basically it is the signaling system which provides the information about any mistake , error or discontinuity in streamlined process.

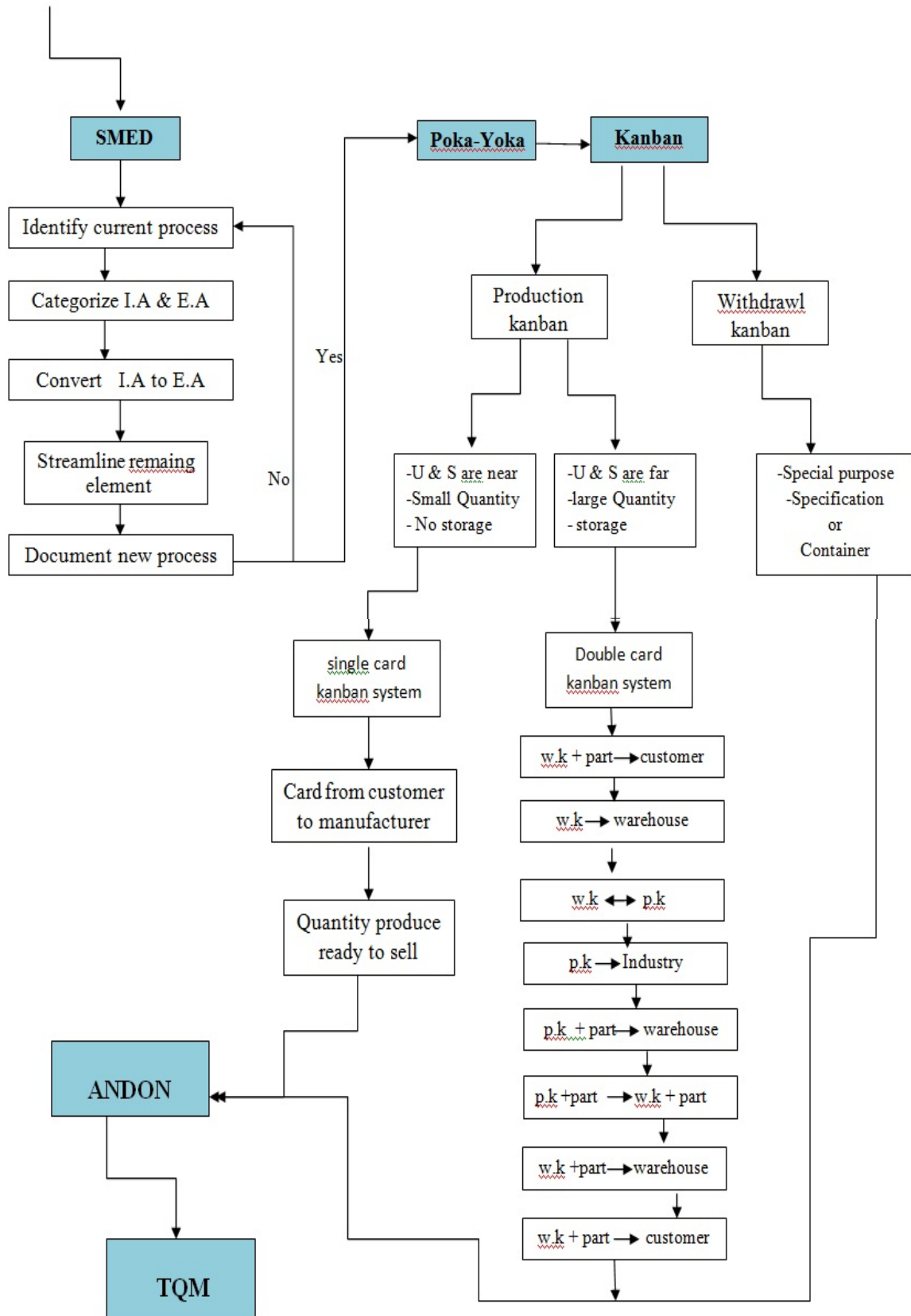
[3.9] TQM :

Total Quality Management approach is management philosophy focused on quality based on the active participation of all the employees and satisfying the customer in long term is the main aim and also benefited to the all the members of organization and society.[39]

[4] LEAN ROAD MAP :



( Fig 4.1 common flow chart of lean manufacturing-1)



( Fig 4.2 common flow chart of lean manufacturing-2 )

#### [5] FLOW CHART DISCRPTION :

In any industry whether it is small or large scale, the vision ,mission and value is very important parts for success in every field.Vision statement are short phrases that convey organization community's hopes for the future. Vision is the view that would have been happen in future. Vision statement can emphasis to organization focus on what is really important? Mission statements are very similar to vision statement in that they , look at the big picture. However , they are more concret , and they are definly action oriented then vision statement. Vision statement of any organization should inspire people to dream ; mission statement should inspire them to action. Organization should often use value statements to help them identify with and connect to targeted customer , as well as it also reminds to employees about its priorities and goals.the value should be in terms of leadership , collabration , integrity , accountability , passion , diversity , quality etc.

According to the vision , mission and values of companies the roles and responsibilities are identified and given to employees as per their cadre because of achieving the goal of company. For distributing the different roles and responsibilities the management system of company is being observed that means how the company works ? what is the working policy of company ? so it gives the clear idea about the company management. And for understanding the company management with their all aspect the lean concept was evolved. The lean concept is not only concept but it is culture so it is accepted by all employees for successful business of company so knowledge about lean culture is very necessary. First step for implementing the lean culture the brief introduction about the lean is given to all the employees from lower cadre to upper cadre like CEO of company so it is very easy to implement the lean and there is no problem in achievenig goal by implementing the lean culture.

A **value stream mapping** is the communication tool, business contriving tool and a tool to organize the company change process[7]. Constructing the value stream mapping process shown the current stage of the company's working processes , inventory levels , change over time , machine cycle time , available time , up time and no of worker allotted per machine and so on. Based on that data analyzer determine the ratio of value-added to total lead time of the product family being analyzed, creating a vision of an ideal value flow.based upon this value it's very easy to find Takt time ,OEE,optimal crew time.

There are major terms are include in value stream mapping such as takt time and OEE.

The creation of a VSM is divided into 8 basic steps:

- Identify the product.
- Information flow
- Material flow
- Strategic need of flow
- Create a current VSM.
- Evaluate the current map, determine problem areas.
- make a future state VSM.
- follow through the final plan.

some drawback effect flow of material and information flow.drawbacks are follow The map does not begin to capture "all specific actions." , Value Stream" conjures a vision of water running through a series of value-adding activities. But many icons do not depict value adding activities, do not touch the product and do not flow like a stream due to this disadvantage we apply another tool of LM which is kaizen.

The step by step procedure of kaizen activity is defined as follow:

- standardize an operation and methods.
- determine machine lead time and in process inventory.
- gauge measurement against requirement
- invent to meet the requirement and increase productivity,
- standardize the new methods
- continued cycle until satisfactory result will be get.

#### **Point Kaizen**

From my experience the most common type of kaizen practiced is called point kaizen.

These kaizen events typically come about as the plant manager is walking through the shop (a great thing by the way) and notices a mess in cell 4. So he or she finds the supervisor of the cell and discusses it. The supervisor gets the hint and launches an immediate 5S kaizen event in the area. Great stuff to be sure... but we must be careful lest point kaizen consumes us and we lose focus on the entire system.

#### **System Kaizen**

System kaizen, in contrast to point kaizen, comes about when this same plant manager realizes that their flagship product line is suffering from a growing past due backlog, too much inventory, and overall poor morale from the folks adding value to the product.[46]

With this in mind, he or she works with the team in developing both a current state value stream map and then a future state value stream map. This future state value stream map is a view of how the team wishes to see things working in a pre-determined time frame. By implementing kaizen some crises happen such that some companies need to bring about an immense change in their mind set and their style of functioning. This is some time very difficult and initial problems created can be very bad for overall business. Also many employees think very territorially and are unwilling to let go their work areas. So we implement the further tool for lean for better achievement of goal such as 5s.

5s creates the base for visual workplace. 5S is the technique which is building the self-sustaining culture which perpetuates a neat, clean and efficient workplace. In this Process all the extra tool and excess material or other object which has not mean to achieve goal are removed and managing the all the items which have the value for achieving goal are set in such a way that it is easy to find all the items very quickly, easily and also it is less fatigue to human worker.[15]

Group technology is the manufacturing philosophy in which to identifying similar parts are grouped together and to take the advantage of their similarity into Design and manufacturing attribute. The principle of group technology is to divide the manufacturing facility into small groups or cells of machines. The term cellular manufacturing is often used in this regard. Each of these cells is dedicated to a specified family or set of part types. After providing the cellular manufacturing technology in industry maintenance program is happen for better preserve of equipment and for achieving the highest efficiency so we incorporate the total productive maintenance (TPM).

TPM is used to conduct the all the equipment in working condition for avoiding delay and breakdown in manufacturing process[19]. There is better co-operation between employees and managers and all the work force is required for effective implementation of TPM and gain the best result. This should result in fulfilling the objective of TPM: "enhance the volume of production, employee morale and job satisfaction.[20]

Steps of TPM in organization[18]:

- Preparatory stage:
  - broadcast about TPM to all of organization by management.
  - initial education and propaganda for tpm
  - setting up TPM and departmental committee
  - establishing the TPM working system and target.
  - Master Plan for institutionalizing
- Introduction stage.
- Implementation
- Institutionalising stage.

By applying the TPM to all the equipments in industry we gain the higher efficiency in all equipment but some times six losses are happened such as break down losses, adjustment losses, Idealing and minor stoppage losses, speed losses, quality defect and rework losses, yield losses. these all losses are improved by SMED.

In SMED there are seven basic maltreats for reducing the changeover time for tool or die and they are below[23]:

- Take note about the current Processes and methodology for any product in company
- In the manufacturing process there are two types:
  - Internal activity: It will performed after the manufacturing Process of current job is completed.
  - External activity: It will Performed Parallel to the current manufacturing Process..Ex. Tool for next Process is taken while current process is running.
- Try to convert the all the internal activity into external activity Ex. Heating of the water or Air into boiler is the good example of converting this.
- Rest internal activity can be viewed by experts and then arrange them into steady order as streamlines. This is the point of focusing shigeo-shingo observed that it's only last turn of a bolt that tighten it is focused and rest is just movement.
- Also streamline the external activities as the internal governs.
- documnetation of newly developed Procedure and action that are yet to be completed.
- Above illustrated Process will be repeated till the satisfactory results is not achieved. For each round 45% improvement in set-up time is expected so take the repeats until satisfactory result is not obtained. There are various benefits are achieved by using SMED technique with including POKA YOKE and KANBAN system such that Flexibility, quicker delivery, less inventory storage, better quality, shorter changeover which reduce downtime.

Mistake Proofing method can be implemented at any stage of manufacturing where the error can be made or mistake can happen by human worker.[29]. Ex. In the welding operation, jigs can be made for holding the work piece and the digital indicator the count the spot of welding for knowing that the whether worker is worked correctly or not. [30]There are three types of Poka-yoke for determine the mistake or errors which are contact Method, Fixed number, Sequence

method[29].

In which the particular sequence is followed by any machine if not follow it alarm or indicate. For implementation of Kanban system effectively in company six rules developed by Toyota production system will followed.

They are[35] :

- afterword Activity takes the no of item shown by kanban at earlier activity
- earlier process produced items as per kanban shown and maintain sequence
- without kanban no process will be undertaken
- kanban is connected with goods.
- defective products is not sent to next Process. Means 1005 defect free products.
- reducing the number of kanban increasing the sensitivity

#### **Kanban Card:**

There are cards used in kanban system which is known as kanban card. In this kanban card system the cards which are put in bin,shelves ,or box or post that indicate that what types of product is required? , when required? And in how much quantity is required? So it is very necessary in any manufacturing system. Now-a-days electronic kanban cards are also used because of eliminating the human error and in case of lost of documents.

Types of kanban system are production kanban,withdraw kanban , supplier kanban[33].

To achieve the best result for implementation of kanban we consider the manufacturing processes into two segments such as preceding and subsequent process. And the withdrawal kanban shows the quantity of product that the subsequent process should withdraw. While the production kanban shows the quantity that preceding process should produce.

There are only two type of kanban cards are used which are Production ordering kanban (pk),withdrawal kanban(wk).

In andon, If manufacturing process is made abnormal devise Produce the signal in the terms of the text , graphics, or voice or alarm and according to that necessary action can be taken. And the signal is Provide by means of different color and each color has own meaning and according to that action can be taken in different condition[37].

“TQM is the philosophy for managing an organization in a way which enables it to meet stakeholder needs and expectations efficiently and effectively, without compromising ethical values.”[40]

- Determine Critical Success Factors(CSF)
- Identify amount and metrics to trashing CSF data.
- Recognize Key people group.
- solicit customer response.
- Associate survey tool
- Survey each customer group.
- identify improvement plan.
- Resurvey
- screen CSF
- Incorporate satisfaction data into marketing plans.

#### **[6] CONCLUSION :**

In lean manufacturing we apply all the tool simultaneously whether it is required we get some benefits like improving the customer experience & responsiveness in such a way that on time delivery, reducing cycle time also reducing changeovers time. By implying LM, we gain better quality in terms of yield , customer satisfaction and also improving the working efficiency by means of better utilization of man, machine , material and money ,OEE and scheduled production system.by effective utilization of 4M we reducing the cost of product , increasing the profitability and reducing the maintenance. By using the Kanbansystem work-in-process inventory is greatly reduced. For Health and safety of worker as well as environment is acquired.

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