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STUDY ON IMPLEMENTATION OF LEAN PRINCIPLES IN A SMALL SCALE ENTERPRISES

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ABSTRACT-*Lean principles are being implemented both in large and small scale manufacturing enterprises.*

They are not much effective in implementing lean principles due to lack of knowledge and skills as said by

previous authors. There are various lean tools such as Value Stream Mapping (VSM), Kanban and SMED,

Optimization tools such as FUZZY LOGIC, QFD and FMEA are used to lean principles and to measure the

performance in manufacturing enterprises. This research has explore the participation of lean and optimization

tools with regard to lean implementation. It has been noted that not many articles revealed the combination of

both tools. This paper discuss the applicability of these models for the effectiveness of lean implementation in

small manufacturing enterprises.

Volume: 1 Issue: 2 08-Apr-2014,ISSN_NO: 2320-7256

KEYWORDS: VSM, SMED, Kanban, FUZZY, FMEA, QFD

1. INTRODUCTION

Small and Medium Enterprises (SMEs) have played a vital role in India's economic growth.

With over 30 million units, SMEs accounted for 17 per cent of the countries GDP in 2011. Small and

Medium Business Development Chamber of India projects the share of SMEs in the expansion of the

Indian economy to increase to 22 per cent of the GDP in 2012. The estimate is backed by its

assumption of 12 million additional people joining the SME sector over the period (2012-14),SME

units currently employ 60 million people.

SMES TO FACILITATE GROWTH

The main barrier in the growth of SMEs is the lack of resources. SMEs require support from

government and industry bodies to overcome the limitations. In line with this, the National

Manufacturing Competitiveness Council (NMCC) has announced 10 schemes for developing global

competitiveness of the Indian MSMEs in the sector. Lean Manufacturing Competitiveness Scheme:

Implemented under the Public Private Partnership (PPP) mode with 42 Lean Consultants, the project

aims to reduce manufacturing waste, and increase productivity and competitiveness.

Lean manufacturing, developed first at Toyota plant in Japan, has become a very popular

production system improvement philosophy. It has been widely known and implemented since 1960

and according to Rinehart, Huxley and Robertson (1997) lean manufacturing will be the standard

manufacturing mode of the 21st century. Womack and Jones (1996) observe that the principles of

'lean' focus on eliminating waste and non-value added activities in a process while maximizing the

value-added tasks as required by the customer. They note that core principles used to achieve this

include: specifying *value* from the end customer perspective, identifying the sequence of value-adding

activities (*value stream*) for a given product, synchronizing processes to enable *flow* of physical

products and information, pacing production to exactly meet customer demand (*pull*), and pursuing

perfection through continuous improvement.

Papadopoulu & Ozbayrak (2005) observe that lean manufacturing could be a cost reduction

mechanism and if well implemented it will be a guideline to world class organization. Lean

manufacturing comprise of universal management principles which could be implemented anywhere

and in any company as observed by Womack, J.P., Jones, D.T and Roos. D (1990). It is now widely

recognized that organizations that have Mastered lean manufacturing methods have substantial cost

and quality advantages over those who still practice traditional mass production as noted by

Pavnaskar, S.J., Gershenson, J.K. and Jambekar, A.B, (2003). Implementation of lean practices is

frequently associated with improvements in operational performance measures.

According to Shah and Ward (2003), the most commonly cited benefits related to lean

practices are improvement in labor productivity and quality, along with reduction in customer lead

time, cycle time and manufacturing cost. Therefore, lean production is an intellectual approach

consisting of a system of strategies which, when taken together, produce high quality products at the

pace of customer demand with little or no waste.

1.1 VALUE STREAM MAPPING [VSM]

A value stream is defined as all the value-added and non-value-added actions required bringing

a specific product, service, or combination of products and services, to a customer, including those in

the overall supply chain as well as those in internal operations [Womack JP, Jones and Rother M,

Shook. VSM is an enterprise improvement technique to visualize an entire production process,

representing Information and material flow, to improve the production process by identifying waste

and its sources. A VSM, both current and future state, is created using a pre-defined set of icons. VSM

creates a common language about a production process, enabling more purpose full decisions to

improve the value stream. A value stream map provides a blueprint for implementing lean

manufacturing concepts by illustrating how the flow of information and materials should operate.

VSM is divided into two components: big picture mapping and detailed mapping. Before starting

detailed mapping of any core process, it is useful to develop an overview of the key features of that

entire process.

1.2 FUZZY LOGIC

Fuzzy logics for the elaboration of a decisional model regarding the implementation

of the

process by following arguments. Fuzzy logics are one of the methods which allow the extraction of

precise conclusions, based on vague, imprecise input data; When elaborating the model of fuzzy-type

multi criteria analysis, especially the fuzzy-type rules base, one can benefit from the experience of

specialists in this domain, experience which can successfully replace the usage of complex

mathematical algorithms;

The fuzzy model has a great flexibility, its modification and refining being done with great

easiness. The collection of data needed for the applying of the fuzzy model for multi criteria decision

and its unfolding can be done in very short time, so that it can be even regarded as a real-time

decision. Currently there are several software programs which make possible the easy implementing of

models based on fuzzy logics, without requiring advanced programming knowledge. Based on the

above-mentioned arguments, a generalized fuzzy model referring to the decision of starting process

reengineering has been implemented

1.3 FAILURE MODE EFFECT ANALYSIS [FMEA]

Failure Modes and Effects Analysis (FMEA) is a systematic, proactive method for evaluating a

process to identify where and how it might fail and to assess the relative impact of different failures, in

order to identify the parts of the process that are most in need of change. FMEA includes review of the

following:

Steps in the process

Failure modes, Failure causes and Failure effects

Teams use FMEA to evaluate processes for possible failures and to prevent them by correcting

the processes proactively rather than reacting to adverse events after failures have occurred.

Volume: 1 Issue: 2 08-Apr-2014,ISSN_NO: 2320-7256

This emphasis on prevention may reduce risk of harm to both patients and staff. FMEA is particularly useful in evaluating a new process prior to implementation and in assessing the impact of a proposed change to an existing process. FMEA determines the risk priorities of failure modes through the risk priority number (RPN), which is the product of the Severity (S), Occurrence (O) and Detection (D) of a failure.

$$RPN = S \times O \times D$$

1.4 QUALITY FUNCTION DEPLOYMENT

Quality function deployment was developed by Yoji Akao in Japan in 1966. In 1972 the approach has been demonstrated at Mitsubishi heavy industries (Sullivan 1986) and in 1978 the first book on the subject was published in Japanese and translated into English in 1994 (Mizuno and Akao .1994). In Akao's words QFD is a method used for translate the customer's requirements into technical requirements. QFD has demonstrated the reduction of product development time by one half to one third (Akao 1990).

QFD uses some principles from concurrent engineering in all four phases of product development.

Each phase uses a correlation matrix to translate the customer requirements (Becker Associates Inc.2000). The first phase in implementation of QFD involves "House of Quality" (Hauser and Clausing 1988).

2. LITERATURE REVIEW

2.1 VALUE STREAM MAPPING (VSM)

Lean manufacturing is a set of tools that main aim for eliminate the waste continuously in

production cycle. Rosnah MY (2012) discussed the implementation of lean tools and Value Stream

Maps (VSM) in Small and Medium scale Enterprises or industry [SME] focused on the operation of

plastic injection moulding. The main target to eliminate the waste in shop floor.VSM were constructed

the current and future state of process flow; required to eliminate wastes and sources and finally

overall production flow as to improve. By implementation of VSM, SMED, Heijunka and Kanban has

shown good results. The main aims were to achieve less inventory, high productivity, less change over

time and delivery on time. The current state map is to visualize the actual process and information

related to operation of plastic injection moulding. The identification of systematic approach and proper

lean tools for improve the process. Future state maps are endless of VSM activities at time to time

varying of continuous improvement process. According to customer requirement date, changes are

been present at batch production. The final results to achieve the more productivity, profit and flexible

in industry. In future research, result of non-productive time at machine and energy cost are

considered.

A.R. Rahani (2012) deals with application of Lean manufacturing principles in automotive part

manufacturing company. The D457 is front disc part to be manufactured. For implementing lean

principles the data are required such as cycle time, queue time, change over time details can be

Volume: 1 Issue: 2 08-Apr-2014,ISSN_NO: 2320-7256

collected. Through which the VSM mapping is plotted for particular product (D457). The data's are

hard copy based on their operation manuals and the standard operating procedure (SOP). Kaizen group

studied the current VSM map onto the D457 assembly line where the imperfections on product are

addressed. Then future state VSM is drawn with those wastages to be considered in assembly line and

higher productivity is achieved (D457) consists of eight machines where the waiting time in machine 4

is identified and eliminated immediately. Through VSM they resulted in savings like lower rejection

rates and continuous improvement.

Kuhlang, p (2011) considered the company connects value stream mapping and methods time

measurement so called methodical approach to increase productivity and to reduce lead time. They

both focusing on the work method, performance of the labour and utilization of the process in proper

manner. Value stream mapping includes all activities that are necessary to create a product and

available to customer. Methods time measurement includes activities like time required to finish a

work with particular process. For this approach they reduced lead time by standardize the process is

one of the lean tools implemented in the company

Lian, y (2002) considers the company's major problem is factory redesigning. For the change

of supply chain the needs high cost. So the main aim is to transform the process into lean one by

minimizing the overall cost. For this transformation the company implemented two lean tools such as

pull and push production system. Through value stream mapping company can draw their current state

map and implemented push system. By analyzing they found non value added items and eliminate that

in future state map by implement pull production system. By doing so, they reduce lead time, increase

value added ratios and also used to eliminate bottleneck problem.

Fawaz A (2007) Lean has been applied in discontinuous manufacturing than in continuous

sector, because of various obstacles in the environment that manager faced unwilling required

commitment. In this paper, lean has implement in large integrated steel mill. VSM tool is used to

identify the various opportunities of lean techniques. And draw to develop the before and after

scenario of industry. To benefit the production lead time is reduce and less WIP inventory. Arena 5

software as used to simulate the models can be evaluate the measures of basic performance and

analyse the configuration system. It can validate and facilitate the lean manufacturing and to obtain the

desired results.

2.2 FUZZY LOGIC, FMEA AND QUALITY FUNCTION DEPLOYMENT

Yang, Y.Q (2003) deals with developing a new design, decision making had major influence.

In this paper they integrate two tools such as fuzzy and QFD. QFD is an tool that is used to meet the

customer requirements technically. Fuzzy set theory is used as a tool to find the customer requirements

and strengthen the design characteristics. Through (HOQ) they meet the need for design and develop

fuzzy and QFD for evaluation. So by integrating these two lean tools the decision making is very

easier.

Almannai, B (2008) considers the design of a lean and computer integrated manufacturing

system to achieve proper communication between technology, organization and people to achieve their

goal. This research is about integrating two lean tools in decision making of manufacturing automation

technologies. QFD has the ability to identify the best alternative and FMEA has the ability to associate

the risk with that alternative. Finally with these lean tools they obtain best result in feasibility and

usability.

Hu-Chen Liu (2011) Failure mode effect analysis is used to solve the problem which occurs in

system, design, process or service. In FMEA two main important methods to identify failure modes

are diversity opinions and determination of risk priorities. Diversity opinions means different types of

information are very hard to used in FMEA and FUZZY logic approach. Risk priorities numbers are

multiplying the risk factors as Occurrence (O),Severity (S) and Detection (D) of a failure. FMEA

using FUZZY as to solve the problems and improve effectiveness of FMEA. In many industries used

FMEA tool to safety and analysis easily.

N.C. Tsourveloudis (2000) considers the production line of single and multiple part type and

unreliable machines and finite buffers of networks. Three control of fuzzy modules are developed

namely line, assembly and disassembly controller. To keep the high machine utilization and

throughput, cycle time at low levels and WIP are objective. Each production stage is adjusting and to

achieved, then machine blocking is reduced by extreme events and balanced of work flow. It tested via

simulation. Three independent modules are applied to the network production of general

topology. The

structural advantage operator known knowledge representation and reasoning approach. Simulator of

continuous flow is used to compare WIP controller. Future research to WIP controller applied to re-

entrant system which parts may visit more than once of machines.

Jesus Gonzalez (2007) The field of fuzzy system modeling and function approximation theory

model is one of the identification of key issues. Fuzzy system as distinguishes in this area as

transparency and interpretability. In the construction fuzzy system they paid the trade-off between

complexity and maintaining the accuracy of final fuzzy system. In this paper to determine the Pareto

optimum set of fuzzy with various compromises between complexity and accuracy. Fuzzy system

modeling addressed two fundamental and concerning objectives as optimization and the identification

of system structure of obtained system. Another type as algorithm presented in work, specially

designed for problem of fuzzy systems. By modification of the NSGA algorithm for the problem

modelling the data applies mutation to avoid the less fitted solution. The simulation performed the

different paradigms and techniques used to produce the best solution of fuzzy systems.

2.3 JIT concept

Lean manufacturing has most important factor for manufacturing system and to get more

income in recent items. FarzadBehrouzi (2011) system implemented in many organisations around the

world and difficult to understand the lean performance. Lean techniques and tools are

Volume: 1 Issue: 2 08-Apr-2014,ISSN_NO: 2320-7256

discussed in

many papers and articles but lean performance are evaluated few papers only. By using fuzzy system

is to measure the lean performance as flexible and easily to use as discuss in this paper. The most

important factor of lean performance are eliminate waste and JIT to be identified. Waste elimination

are differed into three categories such as quality, cost and time.JIT as presented in delivery time.

Continuous improvement should involve at all level. The final effect of lean performance was

calculated by membership values. It can easily analyze the manufacturing strategies of effectiveness

by managers and supervisor. Also identify the required capable of improvement.

Christian Hofer (2012) To identify the relationship between implementation of lean production

and financial performance. The particular stress is placed between the role of inventory leanness in

solving the financial performance with lean production. Various lean practices bundles affecting in

inventory and financial performance is valued. Lean production implement and focused on internal

and external lean practices. Internal lean practices are directly helpful to financial performance by

operating lower cost. TQM and TPM are organized with financial performance. External lean

practices, financial performance are insignificant. These lean practices implementation in inventory

leanness (JIT concept) is contribute with financial performance. Future research, evaluate the effect of

changes in lean practices over time.

The current market place as severe competition has pulled firms to re-examine their methods of

doing their business. Rosemary R (2001) focused trade deficits and outsourced operations on struggled

US manufacturers. JIT and continuous improvement are emerged in the form of strong competitors.

This study surveys the 95 JIT implementation firms have experienced through JIT adoption and

implementation more comprehensive. The research results explain that implementing the

continuous

improvement, quality and waste reduction practices involved in the JIT philosophy. Implementation of

JIT improves performance through reduced quality costs, low inventory level and customer

responsiveness. JIT practices on more unique of Kanban and JIT purchasing. It measures between low

and high JIT adopters. They associated with JIT manufacture and JIT quality. JIT practices most found

in firms that fully committed to JIT philosophy that are represented in JITUNIQUE factor.

Matthias Holweg (2001) Lean production not only challenged successfully for mass

production. Significantly trade-off shifts between quality and productivity. And also led rethinking of

manufacturing and services the high volume manufacturing environment. The machine that change the

world book introduced the lean production in 1990 widely used operation management over the last

decade. JIT concept had been known decade prior, key role to distribute the concept outside of Japan.

Lean concept was not single invention and outcome of a dynamic learning process. And it set a clear

vision of many organisations.

Yoshiki Matsui (2007) The Requirement of JIT production systems and the roles and

drawbacks of JIT for manufacturing systems production are focused . JIT production practices 46

Japanese companies are report reliable and valid measurement scale. Based on the measurement scale

is proved to improving competitive performance and efficient equipment on impact strongly. The main

important of JIT production are interacting with operations management areas. JIT production scales

are closely to 14 companies. They characterise and committed to solving the high problem

competence

of human resources,TQM, stable information systems and encouraging the functional integration of

business strategy. JIT production to identifying and evaluate the role of JIT production in competitive

performance. It contributes to improving the system performance. Future research should conduct the

analysis a concerning organisations and human resources management and determinants the entire

competitive performance.

2.4 KAIZEN

Mihai apreutesei (2010) considered lean manufacturing is a new management concept mainly

focused on small and medium size firms, especially in older firms which are followed push systems.

Improvement is the only end result to be expected from any company in terms of quality, cycle time

and customer satisfaction. Lean manufacturing is the only set of tools and techniques widely used in

many companies to get continuous improvement. In this research they mainly focused on tools like

kaizen, kanban, pokayoke

Gautam, N (2008) considers in market so many product developments getting incremented, the

main objective is to give valuable product to the end customers to increase their profit. In this research

a mathematical model is developed by considering case study on automotive vehicle department to

maximize the value for change. By the process flow diagram they analyzed the existing products are to

be reused for nest level of product development. By considering cost reduction and performance they

developed the product by implementing lean tool called kaizen through which continuous

improvement.

Diego Fernando (2007) investigated the main objective is to integrate the lean activities with

lean metrics. After implementation the metrics are to be measured to improve in five dimensions. They

are (1) Elimination of wastage (2) kaizen (3) continuous flow (4) multi functional teams (5)

information systems. They compare the results before and after the implementation of lean activities.

Before the implementation they identify the wastage and after implementation they eliminate those

wastage by applying lean practices

2.5 KANBAN PROCESS

Pool, A (2011) investigated that lean has been implemented in semi-process industry where the

process production turns into discrete production. Basically there is a particular point where the

translation takes place. At that point the lean concept is to be implemented. Here the study considers

how the ‘flow’ (or) process in industry is converted to ‘pull’ production by introducing cyclic

schedules. Through the cyclic schedules the setup time and costs can be reduced by recycling the

process for various batch size products. Through the pull production there is reduction in stock and

increase in customer satisfaction.

Sullivan (2002) investigated that Equipment replacement is major issue faced by any company.

They followed batch and queue system where they produced products in batch and shifts to

other

location. So to avoid such transportation and to reduce lead time they followed lean practices. Value

stream mapping is the lean tool they used in which current state mapping is drawn and matched with

future state map. Through VSM they identified wastes like unwanted motion, increase in scrap. To

eliminate certain wastage they introduced pull production through which lead time is reduced with

increase in performance. They also used u shape cell to reduce the setup time.

2.6 SINGLE MINUTE EXCHANGE OF DIES

Wang, P (2009) deals with the problem in batch and queue fabrication system. So to overcome

this problem they create a simulation model .Time taken to complete is the major issue in batch and

queue fabrication. They used value stream mapping as a lean tool which is used to analyze their

current state and eliminate wastes for future work and pull system as another lean tool through which

the performance is improved. To reduce lead time major industry used one piece flow as a lean tool

through which operating time is reduced.

Almomani, M.A (2013) deals with reducing setup time is the major problem faced by many

small organizations. In this research they integrate two lean tools such as smed and multiple criteria

decision making technique. Through SMED approach the setup time is reduced by comparing the

internal and external operations. Through mcdm technique they can easily identify the best setup

technique with available resources. By integrating both lean tools the setup time is reduced by

improving machine utilization and increase in productivity and flexibility with the available resources.

Volume: 1 Issue: 2 08-Apr-2014,ISSN_NO: 2320-7256

2.7 TOTAL PRODUCTIVE MAINTANENCE

Bakri,A.H (2012) aims on the main role of total productive maintenance in supporting lean

improvement such as lean production. The major key factor which is to be considered during TPM is

quality, cost and delivery lead time. The ultimate goal of TPM is zero defects, zero breakdowns and

zero wastage. For achieving their goal they reduce the wastage by improving equipment performance

and reduced delivery lead time through maintenance and higher quality.

Bicheno,J (2001) made an investigation on automotive steel supply network. There are two

major functions like batch sizing and scheduling. The main aim is to identify the waste during supply

chain and to develop solutions for those problems. In this research they used two lean tools like

kanban and TPM .To sequence the batch sizing and scheduling they used changeover reduction tool.

They developed an algorithm EOQ through which the inventories are reduced and leads to higher level

of performance.

Ahmad, M.F (2012) investigated to survive in the market quality is the essential factor for all

companies. TQM concept has arisen to sustain in the global market. This paper is to propose

relationship between TQM, TPM and lean production. They used structural equation modelling

techniques to determine the relationship between the three lean tools to be implemented

P.T. Ward, (2003) investigated in lean production systems there are three major factors to be

considered plant size, plant age and unionization status by applying 22 manufacturing

practices by

inter relating four bundles such as JIT, TQM, TPM and HRM. By validating these four bundles the

operational performance is vary by 23%. In these four bundles the key factors may vary but the major

objective is related with operational performance. This research clearly shows that the influence of

plant size on lean implementation is higher. These findings are not adequate for all lean practices

associated with better manufacturing performance

2.8 LEAN OTHER TOOLS

Sanjay Bhasin (2012) focused on the large organisations present lean as more successful and

also future performance. Lean measured by the financial and operational efficiency level. It analysed

68 questions gathered in manufacturing industries such as small, medium and large entities. Apart

from that seven companies data are validating. The result at larger organisations focusing lean as best

performer and respective organisations benefit high level of efficiency. Lean implementing

successfully to analysis both difficult and time consuming. And also improve overall performance in

large organisations. It considered a clear cut indication of performance of organisations. And took 36

indices looking at proper respect the organisations as financial, customer relation, process and future

prospects.

Krisztina Demeter (2011) Lean manufacturing is a great success in current systems. Lean

practices are implementing in various industries to change the competition and achieve best results.

Fully concentrate on how to improve the performance of inventory turnover in industry through

Volume: 1 Issue: 2 08-Apr-2014,ISSN_NO: 2320-7256

use of

lean practices. According to our main plan as high inventory turnover don't rely on LM. There may be

significant various in unpredictable future event. Also investigate predictable future factors of lean

manufactures. WIP is affected at production system and also Raw materials and finished goods are

affected by various type of order. In future research, model can elaborate to business performance

indicators. In this way directly relationship between business performance and inventory turnover.

Another method as to research whether verify a mismatch of product process does exist at some

companies.

Ma Ga (Mark) Yang (2011) examines that relationship between lean manufacturing practices,

business performance and environmental management. In this model data are collected from 309

manufacturing firms. Environmental management are alone to give negative impact of market and

financial performance. However, they improved and reduce the negative impact. In this paper resolve

the lean manufacturing and environmental performance. They need to measure performance of

environmental management on other outcome of business performance is examined. Organisations

may respond to improve environmental performance. In our research, result as be interpreted with

caution. In future research provide avenues in certain limitations. They environmental management

and lean manufacturing focus on reduce waste and inefficiency. Lean manufacturing not only improve

environmental performance. They environmental management as implement to reduce environment

waste and efficiency. To implement both lean manufacturing and environmental management are to

improve better business performance.

NitinUpadhye (2010) Lean manufacturing system are implementation in MSME are important

factors in the supply chain, making effective and efficient. They reduced cost, improve quality, better

services and enhance value to the customer. MSME is an important play role in Indian economy. LM

is shortlisted by manufacturing lead time and less setup/change over time. But concept of LM are not

properly to use in MSME. They improve the process and fulfil the customer requirements. In this

paper fully focus on MSME on Indian scenario in mid-size auto components at implementation of lean

principles. Indian MSME should improve satisfy customer requirement, quality, deliver and services.

Lean implements industry to improve efficiency and effectiveness and eliminate waste. They

overcome their weakness and improve strength in MSME.

David J. Meade (2006) accounting methods on profit and inventories are being reduced are

negative impact to identified on many researchers. It explores the magnitude and duration of negative

impact on during lean implementation. Five accounting method is evaluated at reported profit and

three levels of reduction rate inventory. The operational efficiency indicated that period by period

gains by lean program from process improvement by lean program be reduced the negative impact of

continues inventory. Poor inventory from past periods are being erased by improvement of lean

program. Multi-simulation model involved a manufacturing planning and inventory tracking systems.

Simulation tool identified that impact an reduced inventory on profit is found.

Danny J. Johnson (2003) reduction of throughput time manufacturing can be intimidating task

due to factors and complex interactions. There basic principles are implementing correctly to reduce

the throughput time. Framework is illustrates principles in these paper. It illustrates that to

alter

throughput time and their actions. In industry the framework is enough to guidance, how to reduce

manufacturing throughput time, while to apply to manufacturing situations. They reduce throughput

time such as production and transfer batch size and high utilisation of workstation.

S SMahapatra (2007) Lean manufacturing focusing on improves productivity and waste

reduction through various tools . It finds out the concept in Indian manufacturing organisations a

survey study. Indian managers understanding the concept of lean manufacturing and highlights

knowledge. It benefits and application of lean tools into operating environments. Finally study

concluded application of lean manufacturing in industries by stressed its key application. The survey

study indicates market factors, customer satisfaction at possible time. And takt time also important

among end users. Study also indicate the system in which end customer be operated in push and

finishing pull strategy.

T.Melton The lean manufacturing has major benefits by using key tools and techniques with

lean system included (i) Kanban (ii) 5S (iii) visual control (iv) poke yoke (v) SMED basically there are

two types of production like mass and lean production . In mass production the aim is for good

enough. But in lean production the aim is for perfection. The benefits in non process industries are

developed load time, reduced inventory, improved knowledge. So through the lean manufacturing cost

is reduced, increased supply chain, speed etc.

NoraniNordin (2010) presents a study of implementation of lean manufacturing in Malaysian

automotive industries and also extent the lean practices. Sixty companies are surveyed and performed

the lean practices in Japan automotive industry. Lean manufacturing practices directly involved to

production and quality personnel. They in-transition firms are categorised into five lean practices.

Internal areas are found such as firms operation and management compared to external relationship

between customer and suppliers. These firms believe to lean implementation as focus on customer and

achieve the continuous improvement in organisations. The results from survey discover the obstacle

that delays the implementation of lean. The main obstacles to implementation of lean systems are not

easily to understand the concepts and attitude of shop floor employees. The management should know

the stress to overcome resistance for the implementation of successful lean system in firms.

R.Carvalho (2010) Lean system is applied in a metal structures production system in a civil

construction system. The main aim was to improve the production, solving several production systems

such as long lead times, delivery delays, high stocks and unnecessary motion. Identified the problem

were analyzed and implement process to improve the actions. The actions based on lean production

model and tools. 5s model to implement in workplace to improve the production activity control

system and layout reconfiguration. In these actions to a reduction of lead time, transports, delivery

delays, defects and errors, transports and work in process. Final conclusion of project achieved to

reduces wastes in production plant and improvement of production process.

Abhishek kumarsingh is to introduce the work of information technology in the process

industry. In the industry the time is used as the money. So here the main task is to save time. The

maximum time spent due to the waste in industry. Lean Manufacturing is a term that is used to reduce

the waste from the industry. And to use the information system in the form of Kanban. Lean principles

and techniques have been applied in a wide variety of organizations, from make to stock and engineer-

to-order industries,. In order to apply lean principles in various areas and developed of well known

techniques, such as SMED, Kanban 5S and Kaizen. Here the discrete and continuous manufacturing

benefits are distinguished by the value stream mapping. Here the Value stream mapping is used to first

map the current state and then used to identify sources of waste and to identify lean tools to try to

eliminate this waste. In future state map is developed for a system with lean tools applied to it. This

thesis focuses on the development of a simulation model of the industry.

HudliMohd .Rameez (2010) Nowadays many organisations are interested to adopt lean

manufacturing strategy that would enable them to compete in this competitive globalisation market. It

is respect and necessary to assess the implementation of lean manufacturing in different organisations

so that the important best practices can be identified. This paper evaluates the development of key

areas which will be used to assess the lean manufacturing practices of adoption and implementation.

There are some key areas developed to evaluate and reduce the most optimal projects, the

manufacturing unit as to enhance their production efficiency and increase the purpose of the economic

benefits. Lean manufacturing is becoming lean enterprise by treating its partner as customers and

suppliers. This gives the extra edge in today's cost and time competitive markets. The conventional

competition points are become strong in the organisations such as Price, Quality and Delivery. Lean

enterprise owners can quick to deliver the high product with low price.

Adnan Hj. Bakri (2012) aims on the main role of total productive maintenance in supporting

lean improvement such as lean production. The major key factor which is to be considered during

TPM is quality, cost and delivery lead time. The ultimate goal of TPM is zero defects, zero

breakdowns, and zero wastage. For achieving their goal they reduce the wastage by improving

equipment performance and reduced delivery lead time through maintenance and higher quality.

Treville, S.d (2006) deal with lean production is the old concept which arrived 20 years before

but still the problem is unresolved. In this paper the job design is motivated through test of a theory.

They extend the job characteristic model to lean production to define the link between job

characteristic and outcomes through lean production. Lean practice is very essential for workers to get

motivated to achieve their target.

Hofer, C (2012) mainly focused on understanding the relationship between financial and lean

production implementation. There are several lean practice bundles through which the financial and

inventory performance is assessed. They further analyzed that the effect of lean production on

financial performance is influenced by inventory leanness

Bhasin, S (2012) mainly focuses on whether the lean implementation in large organizations is

successful. For that they analyzed the 68 survey questionnaires both in large, small and medium

organizations. For this they considered data which includes the age of organization, size etc. Time is

mainly considered before and after the lean implementation and their level of success. From the

analysed survey they concluded the large companies are more successful because of their resources

and potential to implement the lean performance

Rubio, S (2008) made an analysis whether to implement the concept 'reverse logistics' for

remanufacturing used products. This model does not consider EOQ model as another research can

done. For this implementation of policy they should examine the decision variables such as return

rates and used rates for products. From this analysis the mixed policies can be optimal.

Demeter, K (2011) investigated most of the companies are widely used lean practices to

improve their performance and competitiveness. In this research they mainly focused on inventory

turnover performance. The measures are rejects, reworking, manufacturing cycle time etc. So initially

company has to invest less for raw materials purchase. By doing so rejects can be easily eliminated.

The cycle time is reduced by altering the transportation facilities to increase inventory.

Fullerton (2013) deals with a lean strategy are rapidly becoming the dominant paradigm in

company. Kennedy and Widener (2008) use a case study to develop a theoretical framework of

management accounting and control practices for firms following a lean manufacturing strategy. We

build on Kennedy and Widener (2008) by examining a structural equation model that provides

demonstrate on the extent to which a lean manufacturing implementation is related to five

management accounting and control practices. Using survey data from 245 US companies with an

interest in lean manufacturing, we analyze a direct positive relation between the range of a lean

manufacturing implementation and a simplified strategic reporting system, value stream costing, visual

employee empowerment and performance measurement information. We find a direct negative

relation with inventory tracking; however, we find it is conditional on the range of top management

support for change in production strategies such that companies decrease reliance on inventory

tracking in the presence of strong management support. We also conclude that the management

accounting and control practices work together as a bundle in a lean manufacturing environment as

evidenced by the many direct union among the five management accounting and control practices.

Chandraiah Mopuru (2013) considered the scope for adoption of lean manufacturing system on

oil pump OP 475 (machine shop) in Autolec division plant-4. We select oil pump OP475 because there

has been a ramp up of volume in this model. To improve the productivity and to give a higher output

we are doing this project. An accurate study was done to explore key areas of lean manufacturing

system namely, inventory, scheduling, equipment, quality, employees, layout and suppliers. Based on

this study, we determined on the key areas which are to be addressed for introducing lean

manufacturing system. Thus from the key areas, we have found on the failures and errors. We have

also recommended the possible ways of implementation of the lean manufacturing system on oil pump

475 (machine shop) in Autolec division plant-4.

Goss, R (2010) deals with a semiconductor manufacturer applies lean concept to perform their

operation flow. In 2007 SEMI standard introduces concept called material redirection through which

wastes can be reduced and improved WIP handling. It directly impacts on cycle time, throughput time.

This paper deals with some tools required to achieve the high throughput time. The lot size is to be

reduced for improvement in takt time. They compare the large and small lot size and eliminate the

wastages using lean tools.

3. CONCLUSION

From the article concluded that lean manufacturing is the old concept used in any industry to

eliminate wastages. Value stream mapping is the primary lean tool used to identify the wastages in an

industry from the current state mapping and eliminate the wastage from future state mapping by

applying various lean tools such as fuzzy logic,FMEA, QFD and 5S. Fuzzy logic is uses as a tool to

optimize the lead time with available resources. 5S is the lean tool used in any industry to keep the

work environment clean by allocating the resources properly. Most of the industry used kanban as a

lean tool to change the push production to pull production.

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