A REVIEW ON POKA YOKE TECHNIQUE IN LEAN MANUFACTURING

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Abstract- For many years, Poka-Yoke (PY) has been used as one of the means to overcome challenges that can affect errors and defects in process. It is a widely accepted concept- a way of thinking, which undoubtedly contributed to significant results in a struggle against the occurrence of errors in various work processes. This paper summarizes the latest studies and definitions in the field of PY applications so a comprehensive and generally acceptable definition of PY can be proposed. In order to find a common cross-section of the most important attitudes in the field of PY, a systematic literature review has been used. Finally, some conclusions and prospective future research directions are presented.

Keywords- Poka-Yoke, quality control, stationary spot welding, mistake proofing, lean manufacturing.

I. INTRODUCTION

It was year 1961 when Dr. Shigeo Shingo, an industrial engineer at Toyota Motor Corporation, introduced the concept of poka-yoke. Based on Shingo's long-term experience and observations, he developed the concept of poka-yoke and turned it from the idea into a formidable tool; a tool for achieving zero defects and eventually eliminating the need of quality control inspections. Since then, "poka-yokes" have been an integral part of Japanese quality and manufacturing systems. [1]

Figure 1: Procedure using Poka Yoke

Poka-Yoke is a Japanese improvement strategy for mistake-proofing to prevent defects arising during production processes. Poka-Yoke is a preventive action that focuses on identifying and eliminating the special causes of variation in production processes, which inevitably lead to product defects. This concept was initially called Idiot Proofing, but it was understood that this name may hurt the workers sentiment, so term Mistake Proofing was coined by Shigeo Shingo. Poka-Yoke gives a strategy and policy for preventing defects at the source. These solutions are not only cost effective but also easy to understand and apply. It is one of the important tools to add to any organization's Continuous improvement. [2]

II. LITERATURE REVIEW

(Wijaya *et al.*, 2020)[3]Presents the design and implementation of a poka-yoke system in a stationary spot welding (SSW) production line. The human-based SSW production process in a local automotive component company was considered in this study. Due to the repetitive and fast cycle-time of the production process, human errors are inevitable. Such errors lead to customer claims with the subject company. Based on the data of customer claims, there

were three major quality issues (missing nuts, wrong-size nuts, asymmetrical spot weld marks). Due to the production line being manual, control of planned production and actual production was poor, leading to delivery issues (delayed delivery). Together these major issues contributed to 34.7% of customer claims on average from May to December 2018. The objective of this study was to solve the issues in the subject company through design and implementing a poka-yoke system utilizing the internet-of-things (IoT) platform to ensure data acquisition and information storage, and production progress monitoring and data analysis to meet user requirements. The combined approach of the poka-yoke system utilizing IoT in the SSW production line yielded satisfactory results with reduced customer claims to 5.3% for the stated problems from February to May 2019. Hence, the design objective was achieved.

(Singh, Yuvika, 2019)[4]analysed that Every Organization aims to the "zero defects" philosophy which establishes zero error as a goal. This cannot be achieved overnight but can be approached over time by continuously striving for the increased quality by reducing the errors. So it remains a question in our minds that what kinds of techniques are to be adopted to assure zero defects? Poka-Yoke, is one of tool that can be used to achieve manufacturing with zero defects and it has the potential to support the implementation of DMAIC phases of Six Sigma. DMAIC stands for define, measure, analyse, improve and control phases. Several survey & researches were studied by referring to the relevant research papers on applying Poka-Yoke concept in DMAIC phases. It has been pointed out that the PokaYoke solutions suggested in these research papers were not actually implemented in real-time scenario. Hence, our research paper is concluded with a suggestion that prospective researchers in several areas can make more efforts to actually implement Poka-Yoke technique in DMAIC phases for achieving the goals of Six Sigma.

(ewita *et al.,* 2019)[5]extended that XYZ is one of the companies that manufacture automotive spare parts. At present the company should focus on producing high quality, non-handicapped products with the fastest production time to win business competition. The company's strategy is to carry out kaizen which is a continuous improvement with the aim of preventing defective materials from entering the production process in the most effective manner. The method used by the company is to conduct inspection on incoming materials using poka-yoke method. The decision to run poka-yoke has been proven by reducing the amount of dimension defects material on the B8A rotor component of the supplier delivered to the production process up to zero the following month and producing a better cycle time in the 79.77 second. It can be concluded that the poka-yoke method is the right way to prevent the defective material from entering into a production process that can cause a defective.

(de Souza *et al.,* 2018)[6]aims to present the Poka-Yoke error-proof system, aimed at the automotive sector, presenting and defining what will become the Poka-Yoke methodology and how it can be used in order to bring benefits to a company by means of its implementation in a case study. Quality problems are part of everyday business and the way in which they are treated/detected is what defines the level of Final Quality that a product or service is delivered to the customer. The use of quality tools or technologies such as Poka-Yoke is necessary to maintain a quality level that meets or exceeds the customer's expectations, besides avoiding high costs with rework, waste of productive material, recall among others and dirty the image of company.

(Premanand and Umamaheswari, 2018)[7] In today’s competitive world any organization has to manufacture high quality, defect free products at optimum cost. The success of any industry depends on quality of their product. During actual manufacturing of any product, different operations are carried out by operators .The whole production depends on operator mentality and their interest in work which ultimately causes silly mistake or errors by the operator. Rejection of manufactured product cannot be ignored now a days in manufacturing industry due to worldwide competition. To avoid mistakes in assembly line, poka-yoke mechanism plays an important role in manufacturing industry. In the present work, an attempt is made to identify the areas of improvement in equipment. Kaizen and poka-yoke are implemented to enhance the overall

performance to increase the productivity. Why-why method of root cause analysis is used to eliminate the causes. This paper focuses on process improvement in a horn manufacturing company, using mistake proofing technique or Poka -Yoke. The study is aimed at providing process improvement ideas for existing bottleneck areas. The long term success of poka yoke gives output of saving time and can release work pressure in the minds of workers.

(Journal, Engineering and Concrete, 2017)[8]In today's competitive world any organization has to manufacture high quality, defect free products at optimum cost. The new culture of total quality management, total productive management in the manufacturing as well as service sector gave birth to new ways to improve quality of products. By using various tools of TQM like KAIZEN, Six Sigma, JIT, JIDCO, POKA YOKE, FMS etc. organization is intended to develop quality culture. During actual manufacturing of any product there are too many simple and monotonous steps which are carried out by operators. These monotonous work operations result in to mental fatigue and lack of interest in work which ultimately causes silly mistakes of operators and we know that human is prone to errors even though he doesn't want it. To avoid these simple mistakes, poka yoke concept play important role. By implementing some simple solutions we can avoid mistakes. The long term success of poka yoke gives output of saving time and we release the work pressure on mind of worker. We can use creativity and special skills of workers for more creative operations instead of increasing pressure for monotonous activities.

(Kumar and Kumar, 2017)[9]analysed that dismissal of made parts at different phases of assembling can't go on without serious consequences now days underway situation because of extreme rivalry around the world. All assembling businesses are moving toward zero deformity generation. To actualize this the first and most critical thing which is being finished by the assembling businesses is to avoid blunder or totally dispose of the mistake with the utilization of some demonstrated strategies and this paper concentrates on a use of this methods on a needle bearing assembling organization. Utilization of Poka yoke in assembling forms predominantly to wipe out manual blunder by outlining appropriate means which diminishes the dismissals. The review is gone for giving changes thoughts to existing issues at the manual gathering station for the needle roller orientation. Examinations were directed to recognize reasons for imperfections. Utilizing consequences of unstructured meetings and important information and from manufacturing plant perception the issue was examined utilizing circumstances and end results graph where the primary driver were recognized. Subsequently of the Poka yoke on the needle roller bearing, probability of deformity is disposed of totally.

(N. *et al.*, 2017)[10]hasanalysed that the concept of zero defects is remarkable for its simplicity and directness. One of the concepts of zero defects is Poka-yoke, which means "mistake-proofing". Its purpose is to eliminate product defects by preventing, correcting, or drawing attention to human errors as they occur. The primary goal of this paper is to focus on the improvement of the quality issue in production processes by identifying and implementing poka-yoke concept to improve the defects. In this paper, the quality tools such as Pareto diagram and Ishikawa diagram were applied to obtain the possible root causes of the quality issue and solving the issue by poka-yoke concept. The result shows that through implementing the poka-yoke concept, the quality has improved and this will ultimately ensure the economic benefits to the company.

(Poladia and Shinde, 2017)[11]evaluated that manufacturing defects are the major concern of all manufacturing industries. These defects occur due to poor material quality or lack of skilled labour. This paper focuses upon one such operation that was dependent on the skills of the operator which was deskilled by one of the successful devices in lean production which is used to eliminate waste caused by errors i.e 'mistake-proofing' or 'Poka-yoke'. The use of Poka Yoke in the Ultra SD Cartridge assembly operation eliminated the requirement of skilled operator. This was effectively done by introducing a new locating fixture on the assembly line.

III. CONCLUSION

This investigation was focused on a comprehensive review of the achievements in the PY domain, as well as on the innovative theoretical approaches to PY and the battle

against errors during work process. The aim of Poka-Yoke method is to eliminate or minimize human errors in manufacturing processes and management as a result of mental and physical human imperfections. For the main part is to eliminate errors independent. The main idea of this method is preventing causes, which may result in errors and use relatively cheap control system for determining compliance of the product with the model. Furthermore, the discussed approach to PY classification should also facilitate the creation of a model for the development of PY systems. Finally, this investigation should allow identification of important areas which are still insufficiently researched, such as how to develop PY to keep PY running and prevent PY from failure, which is interesting in its own way.

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