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Poka-Yoke Method Implementation in Industries: A Systematic Literature Review

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A B S T R A C T

The use of this poka-yoke approach is influential in preventing human error and can increase machine utilization and efficiency levels, to reduce breakdowns and product defects. The fundamental principle of the successful implementation of Poka Yoke is when everyone in the organization places quality attributes as important. This study aimed to determine the level of success of the Poka-Yoke method in improving quality in the manufacturing and service industries. The technique used is to conduct a review of research papers. The only 33 journals (around 69%) use the implementation of Poka-Yoke. And 15 journals (31%) as a review of the method. The method used is to review research papers that consistently apply Poka-Yoke. The obtained six similarities in the function and purpose of improvisation from the application of the poka-yoke method, namely reducing defects, improving the design, saving costs, increasing productivity, reducing losses, and saving time. Poka-Yoke method can improve the quality of the manufacturing and service industry in future research.

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1. INTRODUCTION

In the industrial business process, one of the efforts to increase productivity and quality is to Prevent Error and Detect Error. Productivity is a mental attitude that always holds the view that today's quality of life must be better than yesterday, and today is done for the good of tomorrow. To achieve an optimal level of productivity, it is necessary to make a multidisciplinary approach that involves all efforts, skills, expertise, capital, technology, management, information, and other resources in an integrated manner to make improvements to improve the quality of human life. Each company has its approach or way to increase the productivity of its company. Each of these approaches must have its advantages and disadvantages. Procedures that can provide satisfactory results such as small expenses and short time but can offer maximum benefits are

the most widely applied approaches in every company.

The approach used by the company will have a direct impact on productivity. One method used in increasing productivity is the Poka-Yoke approach. The use of this poka-yoke approach is influential in preventing human Error and can increase machine utilization and efficiency levels, to reduce breakdowns and product defects. It is hoped that company profits will increase due to the smaller rework costs that must be incurred. In the manufacturing industry Continued efforts to reduce quality costs with Poka-Yoke bring a significant competitive advantage to Quality Cost (Malega, 2018). Poka-Yoke in production and service systems can be designed in developing development models and systematic approaches to the application (Lazarevic et al., 2019). In The Automotive Industry production system applies the five Pillars of TPM with Poka-Yoke aimed at strengthening the process in more realistic applications(Shelke et al., 2007)

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2. LITERATURE REVIEW

In this study only a literature review on the implementation of the poka yoke method in industry. This is found in the study frame Figure. 1

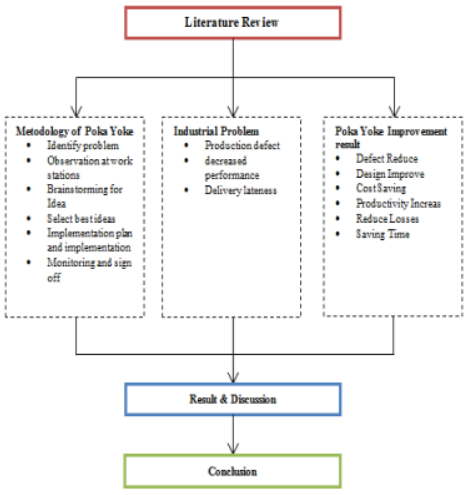

Figure 1. Study framework

3. RESEARCH METHOD

This research was conducted by reviewing 48 journals found using Poka-Yoke, both journals from Indonesia and journals from abroad published internationally. However, 15 journals did not meet the requirements and aspects discussed. So it can be concluded that there are only 33 journals left in accordance with this discussion. So the data used in the journal is data that has been implemented correctly in their respective industries.

In this study, the author reviewed several international journals, all of which were related to the implementation of Poka-Yoke. The review in this study is based on two aspects: (1) prevent error; (2) Detect Error (Figure 2). Prevent Error is an approach to prevent errors from occurring before errors or quality problems arise. The method used for the Prevent Mistakes approach is the Control Method and the Warning Method. Detection Error is an approach that is carried out after an error or quality problem has occurred. The methods used for the Detect Mistakes approach are the Contact Method, Fixed Value Method, and Motion Step Method.

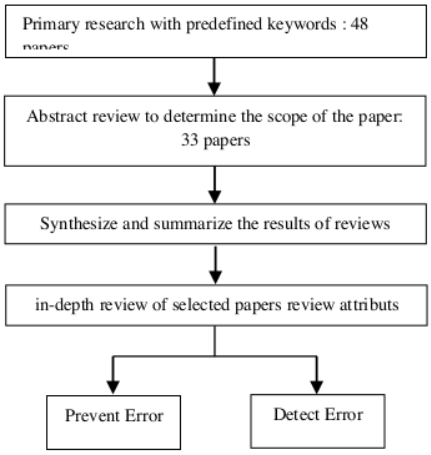

Figure 2. Research methodology

4. RESULT AND DISCUSSION

In the grouping to get the results of several journals that have been selected in this paper it looks as follows in table 1.

Table 1. Existing literature review of Poka Yoke

No	Paper Identity	Research object	Result
1	Dewita et al. (2019)	B8A Rotor Component Inspection	The results of the Poka-Yoke method make Inspection results become Zero Defect and Cycle Time better 79.77 seconds
2	Sarai et al. (2018)	Petroleum service depot in Zimbabwe's petroleum industry	The incidence can be reduced up to 28.6% if Poka-Yoke is used
3	Upadhyay (2018)	1 Kg tube packaging using cardboard in the FMCG industry	defect reduce is reduced by 125%
4	Mura et al. (2016)	Application of human performance sensors to avoid human errors	the ability to detect errors in the process, choose recovery procedures, and facilitate use during visual integration.
5	Sancheti (2018)	Welding Tank Switchgear	Root cause analysis is performed to find the root cause Breakdown and several parallel improvement opportunities are also identified for implementation so as to reduce downtime
6	Soni & Yadav (2018)	liner cutting machine	The application of Poka Yoke on ship cutting machines, the possibility of ship mouth misalignment to prevent rejection and increase productivity.
7	Muharam & Latif (2019)	Rotary Machine	Poka-yoke can not only detect rotary engine failures but can also monitor engine conditions automatically.
8	Tak & Wagh (2015)	Punching Machine	Increased productivity Achieved 0 PPM, Eliminated rework time, and No chance of error
9	Malega (2018)	Quality Cost	Continued efforts to reduce quality costs bring a significant competitive advantage
10	Hudori (2012)	When to calculate sounding stock	Initially 2 hours became 1 hour 5 minutes
11	Lazarevic et al. (2019)	PY	Developing development models and systematic approaches to the application of PY in production and service systems
12	Poladia & Shinde (2017)	Ultra SD Cartridge assembly operation	The introduction of a new fixture on the assembly line completely eliminates the possibility of the operator filling the wrong line pin.
13	Abu et al. (2019)	Application of Lean manufacturing in furniture companies	It is necessary to apply S5, lack of information and knowledge about Lean and products.
14	Azzat (2018)	Industrial Organization	The concept of error prevention systems can be measured by the SPSS statistical program
15	Rodrigues (2019)	the process of assembling the floor grid.	the benefits obtained in the safety of production process activities and accident reduction in the process of assembling the floor grid.

Table 1. Existing literature review of Poka Yoke (continued)

No	Paper Identity	Research object	Result
16	Kumar & Kumar (2017)	quality assembly at SNL Bearings Ltd.	Various defects in needle bearing assemblies where welding variations are incorrect, needle loss causes more rejection in needle bearing assemblies.
17	Niranjan & Sharma (2015)	Industrial Production Manufacture	PY technique and there is a multiplied increase in productivity.
18	Chandra et al. (2017)	Automobile Engine Assembly Shop	Every second of change in hours has made market competitors struggle to reduce waste or mistakes to build their leverage in the Dynamic competition market at optimal costs.
19	Singh & Tiwana (2018)	Defects in the manufacturing industry	in some areas more efforts can be made to actually implement the Poka-Yoke technique in the DMAIC phase to achieve Six Sigma goals.
20	Diego et al. (2018)	Industrial Automotive production system	The physical design of the elements, as well as the simultaneous involvement by all students in the exercise, serves to increase student motivation.
21	Lopez-Perea et al. (2016)	Industrial Automotive production system	Implementation costs are very low, because existing facilities are used, as well as 100 m of wire
22	Pekin & Çil (2015)	the planning stage of the project to the time it is operational in production.	Successful practices are put forward to realize lean thinking which is an important advantage on behalf of the company because it is actively used by businesses and continues to improve itself over time.
23	Premanand et al. (2018)	horn manufacturing	The long-term success of Poka Yoke provides time-saving output and can release work stress in the minds of workers.
24	Che-Ani et al. (2017)	Production Process Disparity Problems	The results show that through the application of the poka-yoke concept, its quality has improved and this will ultimately ensure economic benefits for the company.
25	Jamal et al. (2015)	Traub Machining operation.	All three creation metrics improve after implementing the Error Checking Tool.
26	Zhang (2014)	information system design (ISD)	Presents a theoretical framework for bringing together developments in design for Poka-Yoke and a practical Guide
27	Belu et al. (2015)	Industrial Automotive production system	Modules for image acquisition, intermediate level processing and object recognition modules using associative memory
28	Antonelli & Stadnicka (2019)	The human-robot collaboration (HRC)	Proper error checking methods to be applied in HRC assembly work cells.
29	Sachin RS et al. (2015)	The assembly automation of HSU (Hydrostatic steering unit)	It is possible to reduce human error to zero percent and reduce cycle times from 20 seconds to 10 seconds.

Table 1. Existing literature review of Poka Yoke (continued)

No	Paper Identity	Research object	Result
30	Rismawan et al. (2018)	plastic resin materials such as electronic spare parts and automotive accessories.	The bottom finishing process part that can reduce the waste of time the tool designed is able to reduce the standard finishing process time by workers by 36.4% which is 48.6 seconds per one finishing process under the cover.
31	Aikhuele & Turan (2016)	LPD performance.	a preliminary study of the LPD Conceptual Model
32	Gupta et al. (2017)	Cylinder Head	The design was tested on several cylinder heads and the probability of error was almost zero. This machine helps reduce manual work time and also reduces the possibility of human error
33	Girase et al. (2016)	Diesel Fuel Filter	1. So by using a sophisticated PLC, this engine resolves one defect in the fuel injector. 2. Early detection of filter rods prevents cost and time of repair later. Trust Consumer confidence is maintained because they get efficient products.
34	Shelke et al. (2007)	Industrial Automotive production system	Implement the five Pillars of TPM Aimed at Strengthening the process in a more realistic application.
35	Khandare & Deshmukh (2018)	Propeller Shaft manufacturing	Productivity optimization that reaches more than 50%, another breakthrough is saving 20% in the "rework" section and 30% in the "Not ok" section
36	Baseer et al. (2017)	Software quality	Company individual characteristics, the correlation behavior of the companies they implement the proposed model, analysis of improvement over a period of time with the proposed model and software performance forecasts for the next product.
37	Wahab (2011)	Clothes Factory	Can be developed To benefit from research organizations and other organizations that strive to achieve Zero and global disabilities
38	Thareja (2016)	Performance drawing technique	Poka Yoke is a paradigm that directs operators or designers to ensure that unintentional errors are eliminated in a system.
39	Bălan & Janłă (2019)	Pallet for transport	Total activities carried out at each product stage to improve the performance of all processes and their results to meet customer needs and increase production efficiency.
40	Patria et al. (2019)	Automotive Manufacturing & ERP	Losses caused by late decision making by Inventory Controls are reduced or absent.

Table 1. Existing literature review of Poka Yoke (continued)

No	Paper Identity	Research object	Result
41	Khorasani et al. (2018)	Pharmaceutical products distribution in hospital	The recommendations given in this work can be established as guidelines to help health practitioners avoid making similar mistakes and understand the potential benefits of implementing poka-yoke.
42	Biswas & Chakraborty (2016)	The development of SMEs	Resulting in improved product quality and minimizing the percentage of rejections and waste
43	Sundaramali et al. (2018)	Piston manufacturing	Saves time and effort, thus tracking items that are rejected through the database.
44	Vinod et al. (2017)	POYSS models	That will facilitate to obtain information and knowledge that can be incorporated into the POYSS model to make it a model that is practically compatible.
45	Ahmad et al. (2017)	Safety Improvement Worker	The solution of implementing a new cutting tool design significantly reduced the risk by more than 55%.
46	Malega (2018)	The production Process	Poka – Yoke result an excellent method for the elimination of human errors in the production process and thereby reducing costs in production
47	Patil, Parit & Burali (2013)	Total productive management process	Poka yoke is launching preventive actions for systematic movement on the success ladder of QMS with higher level of performance and productivity of system with high quality products at minimum cost
48	Kurhade (2015)	Technique To Prevent Defects	The long term success of poka yoke gives output of saving time and we release the work pressure on mind of worker

In the Automotive Spare Parts industry, B8A Rotor Component Inspection using the Poka-Yoke method makes the Inspection results become Zero Defect and Cycle Time better 79.77 seconds. In the petroleum industry in Zimbabwe, Incidents can be reduced by 28.6% if Poka-Yoke is used. In the FMCG industry, using the Poka-Yoke defect reduce method reduced by 125%. In the design and application of human performance sensors to avoid human error, detect errors in the process, choose recovery procedures, and facilitate the use of visual integration. In manufacturing a reliable Switchgear Tank Welding analysis, the root cause is done to find the root cause Breakdown, and several parallel repair opportunities are also identified for implementation to reduce downtime.

Poka-Yoke's application on ship cutting machines can detect ship mouth misalignments, which can prevent rejection and increase productivity.. Poka-yoke can not only detect rotary engine failures but can also monitor engine conditions automatically. Increased productivity in punching achieved 0 PPM, eliminated rework time, and no chance of error. Continued efforts to reduce quality costs in the manufacturing industry with Poka-Yoke bring a significant competitive advantage to Quality Cost. Poka-Yoke's application on the Sounding Stock calculation time can save time from 2 hours to 1 hour 5 minutes.

It can be designed in developing development models and systematic approaches to the application of Poka-Yoke in production and

service systems. In working system improvements, Poka-Yoke can be applied. The introduction of a new fixture on the assembly line eliminates the operator's possibility of filling the wrong line pin. In the Furniture Industry, Poka-Yoke also supports the application of S5, the lack of information, and knowledge about Lean and products. The concept of error prevention systems can be measured by the SPSS statistical program in Industrial Organizations. Get the benefits obtained in the safety of production process activities and accident reduction in the process of assembling the floor grid.

Various defects in needle bearing assemblies where welding variations are incorrect, needle loss causes more rejection in the needle bearing assemblies at the bearing company. The Poka-Yoke technique can increase exponentially in productivity. At the Automobile Engine Assembly Shop, the Poka-Yoke Method supports every second change in hours. It has made market competitors struggle to reduce waste or Errors to build their leverage in Dynamic competition markets at optimal costs. To prevent defects in the manufacturing industry can be made to implement the Poka-Yoke technique in the DMAIC phase to achieve the Six Sigma goals. In learning the Automotive Industry Engineering production system, Poka-Yoke's physical design of the elements, as well as the simultaneous involvement by all students in training, serves to increase student motivation.

The Automotive Industry production system in Brazil implemented the Poka-Yoke with the result that implementation costs are meager because the existing facilities are used and 100 m of wire. Poka-Yoke at the project planning stage is up to the operational time in production. In practice, it was successfully put forward to realize lean thinking, which is an essential advantage on behalf of the company because it is actively used by businesses and continues to improve itself over time. Implementation of the horn manufacturing company, the long-term success of Poka Yoke, provides the time-saving output and can release work pressure in the minds of workers. The Problem of Production Process Disparities in the Automotive Industry shows that its quality has improved through the application of the poka-yoke concept, which will ultimately ensure economic benefits for the company. Traub Machining's performance in the manufacturing process of the three manufacturing metrics improved after applying the Error Checking Tool.

Information System Design (ISD) can produce a theoretical framework for developing the design for Poka-Yoke and practical guidance. Industrial Automotive production systems can be applied in image acquisition modules, mid-level processing, and object recognition modules using associative memory. Implementation of Poka-Yoke with The Human-Robot Collaboration (HRC) for the correct error checking method to be applied in HRC assembly work cells. The assembly automation of HSU (Hydrostatic steering unit) is possible to reduce human error to zero percent and reduce cycle times from 20 seconds to 10 seconds. In the plastic resin material, the bottom of the finishing process, the part that can reduce the waste of time. The tool is designed to reduce the standard finishing process time by workers by 36.4%, 48.6 seconds per one finishing process the bottom cover, such as electronic spare parts and automotive accessories.

The Poka-Yoke implementation was carried out for a preliminary study of the LPD Conceptual Model. The applied design was tested on several cylinder heads, and the probability of error was almost zero. This machine helps reduce manual work time and also reduces the possibility of human error. In the Diesel Fuel Filter Inspection using a sophisticated PLC, this engine resolves one defect in the fuel injector, which at the initial detection of the filter rod's presence prevents costs and later repair time. Trust Consumer confidence is maintained because they get efficient products. The Automotive Industry production system applies the five Pillars of TPM with Poka-Yoke to strengthen the process in more practical applications. For Propeller Shaft manufacturing optimizing productivity that reaches more than 50%, another breakthrough is a savings of 20% on the "rework" section and 30% on the "Not ok" section. In the Informatics industry, companies' characteristics, the correlation behavior of the companies they implement the

proposed model, analysis of improvement over some time with the proposed model, and software performance forecasts for the next product.

At the Clothes Factory, the Poka-Yoke method can be developed to benefit from research organizations and other organizations that strive to achieve zero and global defects. Poka-Yoke is a paradigm that directs operators or designers to ensure that unintentional errors are eliminated in a system that can be implemented in Performance Drawing Techniques. In the distribution system, all the total activities carried out at each stage of the product to improve the performance of all processes and their results to meet customer needs and increase the efficiency of pallet production. The Poka-Yoke implementation of Automotive Manufacturing & ERP is that losses caused by late decision making by Inventory Control are reduced or absent. The results of the Poka-Yoke Implementation can be a Recommendation given in this work. It can be established as a guide to help health practitioners avoid making similar mistakes and understand the potential benefits of applying poka-yoke on Pharmaceutical product distribution in hospitals.

The benefits of Poka-Yoke in the development of SMEs increase product quality while minimizing the percentage of rejections and waste. In Piston manufacturing, Poka-Yoke can save time and energy, thus tracking items that are rejected through the database. In the POYSS Design, the model will facilitate obtaining information and knowledge that can be incorporated into the POYSS model to make it a practically compatible model. The result of the application of Poka-Yoke in the Improvement of safety, the design of the new cutting tool, significantly reduces the risk by more than 55%. Poka-Yoke produces an excellent method for overcoming human error in the production process and reducing production costs.

Poka-Yoke launches preventive measures for systematic movements on the success ladder of QMS with a higher level of system performance and productivity with high-quality products with minimum costs in the total productive management process. This solution consists of a module to collect image data, an intermediate level process, and a module to encrypt objects using associative memory (Hopfield network type). The long-term success of the poka-yoke results in time savings, and we release work pressure on the minds of workers in Engineering to Prevent Defects. The recommendations given in this work can be established as guidelines to help health practitioners avoid making similar mistakes and understand the potential benefits of implementing Poka-Yoke in hospital inpatient pharmacies.

Figure 3. is the result of a journal review that has implemented the Poka-Yoke concept. From 48 journals, only 33 journals (around 69%) use the implementation of Poka-Yoke, and 15 journals (31%) as a review of the method. The distribution of final samples per year of publishing is shown in Figure 4. Some articles published online that have been included in this review can be seen from the following chart. Interest in research in the last nine years with the Poka-Yoke method was discovered in 2018.

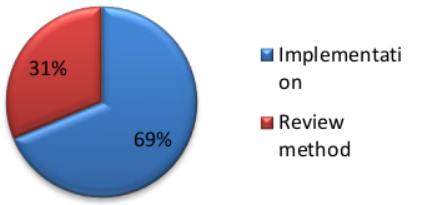

Figure 3. Distribution of poka yoke implementation

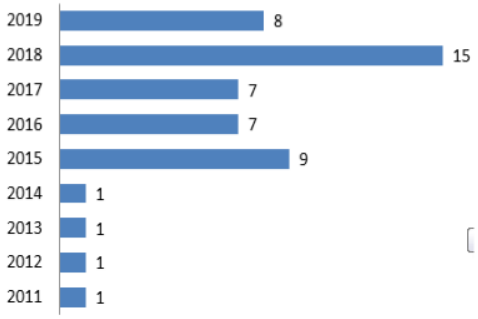

Figure. 4. Article/Journal's published year

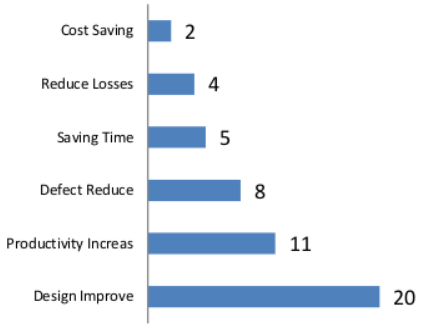

Figure 5. Poka Yoke improvement of author

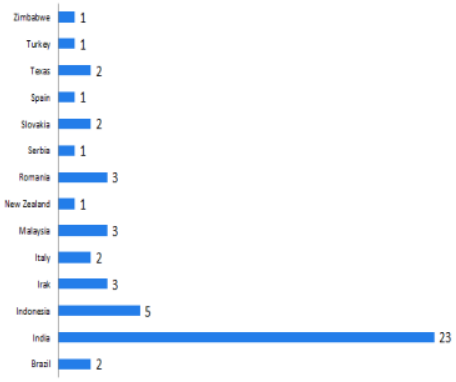

Figure 6. Countries of author

Figure 5, Poka-Yoke, is widely implemented as Design Improve. The research article obtained six similarities in the results of the Poka-Yoke Improvement Result, which stated that the results were the result of the function and purpose of improvisation from the implementation of the Poka-Yoke method. These results are Defect Reduce, Design Improve, Cost Saving, Productivity Increase, Reduce Losses, and Saving Time. They were reviewed based on the chart in Figure 6 of the research article that most countries that use the Poka-Yoke method are implemented in India.

As shown in Figure 7, the future research framework on Poka Yoke can be improved companies as a benchmark in Industri Revolution 4.0. If both are implemented, it will be a beneficial value for the Product and Service Industry in Industri Revolution 4.0. The reference and what needs to be considered in companies to maintain quality in the 4.0 industry revolution is seen in terms of products, methods, finance, strategy, and performance. In detecting errors such as Processing Error, Setup Error, Missing Part, Improper part/item, Operations Error, and Measurement Error are things to consider in identifying problems using the poka-yoke method

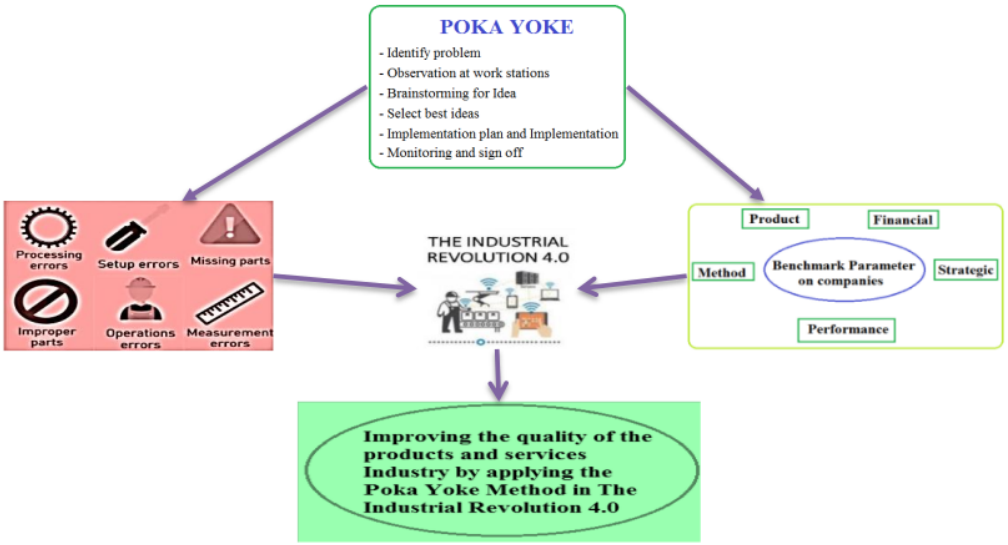

Figure 7. Future research framework

5. CONCLUSION

In a 48 journals review, 33 journals (about 69%) use the Poka-Yoke implementation, and 15 journals (31%) as method reviewsThe review in this study is based on two aspects: (1) prevent Error; (2) Detect Error. The obtained 6 similarities in the function and purpose of improvisation from the application of the Poka-Yoke method, namely Reducing Defects, Improving Design, Saving Costs, Increasing Productivity, Reducing Losses, and Saving Time. For future research, the Product and Service Industry can apply all of the Poka-Yoke methods to improve the quality of Product and Service.

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