

Automation on Manufacturing Facility to Improve Process Quality and Productivity

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Abstract

The aim of this article is to discuss the impact of automation on process efficiency and productivity in the manufacturing industry. The use of automation in Brakes India Pvt Ltd is empirically illustrated in this article. The analysis was carried out using primary data obtained from Brakes India Ltd. The thesis was carried out based on the compilation of primary data from Brakes India Ltd. According to this report, using automation in the manufacturing sector increases efficiency and productivity, allows better use of products, improves product quality, improves employee welfare, and decreases factory lead times. In any manufacturing industry, the key aim of introducing automation is to improve productivity by either growing processing capacity or lowering costs, or both. The Chi square test and various diagrams were used in the analysis to discover and draw conclusions about the use and effect of automation in the manufacturing sector. Various literature reviews were also included in the analysis to determine the importance of efficiency and quality in the manufacturing process, as well as the efficacy of automation in the manufacturing process. A survey of 20 workers was chosen using the basic random sampling procedure. The study's conclusions and assumptions are presented in the report.

Keywords: Automation, Production Process, Automotive Industry

Introduction

"The technique of making an apparatus, a procedure, or a device work automatically," according to the dictionary. The automation career is defined as "someone interested in the development and deployment of technology to track and manage the production and distribution of goods and services" according to the above definition. "Any person interested in the development and deployment of technology to track and manage the production and distribution of goods and services" is what an automation specialist is. At the common connection point or customer service point, harmonic and reactive power produce low power factor and distort the supply voltage. (Bahi, (2014)) In the context of engineering, automation refers to the use of machines to automate systems or output processes. Automation's ultimate aim is to increase productivity by either rising manufacturing capability or lowering prices, or both. There is a procedure of product quality control and quality assurance in the examination of material components in every organisation.(T., Feb 2019).Automation has come to mean using robots to reduce the amount of work that people have to do. Automation of tasks can help companies boost efficiency by eliminating mistakes, improving consistency, and speeding up operations, and in some cases producing results that are beyond human capabilities. The achievement of a company's commercial objectives requires a high degree of quality. (Akshay O, JANUARY 2020).These goods and services were not able to meet the world class standards of price and quality (Sujeet Kumar Yadav)Technology, as it does in the past, leads to efficiency. Automation allows factories to produce goods of accuracy once considered difficult to obtain while making less waste while consuming less raw materials. (Sujeet Kumar Yadav)

Company Profile

In the field of vehicle, electrical, and electronic goods, BRAKES INDIA PVT LTD. is one of the most productive Tool rooms and manufacturing units in NANJANGUD. Brakes India Limited - Sundaram Polymers Division is situated in the industrial area of Nanjangud, Mysore district, Karnataka, on a picturesque sloping landscape overlooking the river Kapila. The sloping terrain was perfect for the flow of the operation. Sundaram Polymers Division produces a diverse variety of high-performance manufacturing thermoplastics for use in the aerospace, electrical, electronic, mechanical, and high-precision engineering industries. The group aspires to meet today's ever-increasing industry demands for practical efficiency, dependability, and reliable high quality. The company's main grades are drawn from five basic thermoplastic resin families: polypropylene, polyamide,

polyesters, polycarbonate, and ABS, both of which are used in injection moulding. Low specific weight, excellent durability at low temperatures, hardness, creep tolerance, heat deflection temperatures, dimensional stability, and fatigue resistance are all features of these items. The Quality Assurance department monitors the technical specifications of the raw materials and components to ensure good product quality. Both measurements are conducted in compliance with international guidelines. Color is evaluated visually against a norm as well as by colorimetric techniques. The process of quality control does not stop until the product exits the factory. SPD assists its customers in the production of new products, technical service processing, specification and test method development, and computer assisted component design. Power and architecture.

Literature Review

1. Mawson, Victoria Jayne, Hughes, Ben Richard (2019), has conducted a research on “The development of modelling tools to improve energy efficiency in manufacturing processes and systems”, Certain standards have been developed by the government in order to minimise energy demand and increase energy quality. There are several ways to strengthen this feature by enforcing the following basic measures in our daily lives, whether in the workplace, warehouses, hotels, or at home:

- Substitute light bulbs with LEDs.
- Wash your clothing as much as possible with cold water.
- Make your house an air seal.
- Replace or disinfect all filters on a daily basis.
- When cooking, use the oven instead of the grill.
- Repair products until they break down.

Also, the following approaches are the most important for achieving energy efficiency in industries:

- Any business should have an Energy Management Team to keep an eye on things.
- Energy audits should be done at least once a year.
- Computers must be carefully managed and operated on a daily basis
- To boost the efficiency of air compressors

Most countries have now joined together to boost energy production by exchanging technologies and pooling expertise. This will greatly assist with cost saving and improving the company's profitability, and this is true for all.

2. Gibson, B, T.Lammlein, D. H.Prater, T. J.Longhurst, W. R.Cox, C. D.Ballun, M. C.Dharmaraj, K. J.Cook, G. E. Strauss, A.M(2014), has conducted research on “Friction stir welding: Process, automation, and control”, Friction swirl spot welding and friction stir manufacturing are used in shipbuilding and offshore, aerospace, automobile, railway rolling stock, general fabrication, robots, and computers, among other sectors. The measures that must be taken in friction stir welding to achieve frictional heat and material mixing are highly dependent on the friction welding method used. The four main techniques are friction stir welding (FSW), friction stir spot welding (FSSW), linear friction welding (LFW), and rotary friction welding (RFW). There is now equipment and modern tools available to verify the consistency of welding in joints and vulnerable areas. However, destructive inspection of joints is the best way to ensure that they are of high consistency. In the last few decades, the use of friction stir welding in industry has grown dramatically. Aluminium alloys are now generally used to minimise product weight. Strict quality and process management will guarantee the product's and people's protection at all times, which is crucial in today's world.

3. Lu, YuqianXu, XunWang, Lihui(2020), conducted study on “Smart manufacturing process and system automation – A critical review of the standards and envisioned scenarios”, In today's dynamic environment, smart production process and machine automation is a must. The majority of firms and all work environments have already adopted smart production practises and device automation. This form of device can significantly assist in mitigating human error during the production process, as well as rejection during the quality review. Automation is important for mass manufacturing of the goods in order to satisfy consumer demand and customer distribution requirements. This will also help the company's financial success significantly. Companies have continued to employ robots in manufacturing and material processing areas as technology has advanced, which has significantly aided production performance and the welfare of those working in production areas.

Artificial Intelligence and Machine Learning are allowing manufacturers to improve productivity, optimise supply chains, and drive research and development in unprecedented ways. The world's top-producing corporations have digitised their productions since the rise of the internet.

4. Rosa, ConceiçãoSilva, F. J.G.Ferreira, Luís Pinto (2017), has conducted research on “Improving the Quality and Productivity of Steel Wire-rope Assembly Lines for the Automotive Industry”, In the global economy, the automotive industry is one of the most relevant and challenging markets. In this market, the majority of enterprises focus on robots and artificial intelligence, with human intervention being limited in order to establish a zero-tolerance quality level. The gain of rising automation in the automobile sector is that a higher-quality commodity will be assembled and delivered, production can skyrocket, and business profits can grow due to lower overhead costs, both of which will benefit working-class people. In the recent past, several businesses have introduced Kaizen, Poka-Yoke, 5S, and Quality Control programmes in manufacturing, and both of these have produced very positive outcomes, as well as assisting companies in finding waste reduction opportunities and enhancing the performance of production processes.

5. Azizi, Amir (2015), has conducted research on “Evaluation Improvement of Production Productivity Performance using Statistical Process Control, Overall Equipment Efficiency, and Autonomous Maintenance”, To thrive in this dynamic environment, manufacturing firms are increasingly focused on improving production efficiency in terms of sustainability by reducing costs and producing high-quality products. The organisation would have planned periodical servicing of the equipment in order to ensure high productivity output during the year. The product consistency will be maintained, and the system efficiency will benefit as a result of this. If these procedures are not implemented in the manufacturing sector, there is a risk of developing nonconforming products, which would have an effect on total production efficiency, resulting in lower-quality product supplies, consumer rejection, and a significant financial impact on the business. Any business now has a dedicated department called Engineering & Utility, which is responsible for all facets of campus maintenance.

6. Chin, SangyoonKim, Kyungrai, Kim, Yea Sang (2004), has conducted research on “A process-based quality management information system”, A vital department of every organisation or institution is the Quality Management Information System. Only if we have developed proper quality processes would the organization's or institute's performance run smoothly. Many Global Institutes also grant ISO certificates to certify Quality Control Programs introduced in their respective workplaces, independent of sector. This will be renewed every year following an audit to ensure that the framework is running in compliance with the specifications, which are revised on a daily basis. If something is found to be unsatisfactory after the audit, the auditor will submit a non-conformance report (NCR) to make the required changes, which should be clarified during the next audit. Aside from external audits, organisations can create internal audits of cross-functional divisions by trained staff to conduct those audits twice a year. This method of audit would help in the management of the organization's processes in all divisions.

7. Choomlucksana, Juthamas, Ongsaranakorn, Monsiri, Suksabai, Phrompong (2015), has conducted study on “Improving the Productivity of Sheet Metal Stamping Subassembly Area Using the Application of Lean Manufacturing principles”, Companies will frequently discover methods and tools that use improved technology to boost efficiency and maintain consistency. Many companies have now adopted the lean manufacturing concept, which has helped them eradicate duplication and semi-practices. In addition, most companies have implemented Lean and other high-quality technologies and techniques, such as visual control, Poka-Yoke, Kaizen, and 5s, to aid in identifying waste-reduction opportunities and improving manufacturing process efficiency and cost-cutting.

Some of the basic elements of lean manufacturing:

- Levelled Production.
- Continuous Improvement.
- Total Productive Maintenance (TPM).
- Streamlining Processes.
- Develop Error-Proof Processes.

8. Md.MazedulIslamKhan, Adnan Maroof (2013), has conducted study on “Minimization of reworks in quality and productivity improvement in the apparel industry”, In today's dynamic environment, rework in quality and product improvement is a must for survival in every field. Any consumer expects a high-quality product at a fair price with a limited lead time. Garment producers would enhance their processes by manufacturing high-quality garments the first time and reducing waste. Rework in quality and product improvement is a must in today's competitive world for survival in any region. Any customer wants a high-quality product at a reasonable price and a short delivery period. Producers of clothes will improve their operations by making high-quality garments the first time and reducing waste. Rejection and rework would be minimized as a result of this. It should be emphasized and followed in every development and quality meeting platform. Production and quality management are a team project, and each employee must provide their all to ensure that a high-quality product exits their plant. In addition, the organization must keep its manufacturing, storage, and shipping areas clean and dry. The shipper should be in charge of ensuring that the product is shipped in good shape and on time to the customer.

There should be at least four types of quality control in every industry:

- Acceptance sampling is a technique for determining whether or not a product
- The procedure to follow.
- Process management.
- Maps of influence.

9. Arul, S.Vijayaraghavan, L,Malhotra, S. K(2007), has conducted study on “Online monitoring of acoustic emission for quality control in drilling of polymeric composites”, Many industrial companies will aim to simplify and refine their operations in order to maximise efficiency and minimise rejection. In order to determine the reaction of materials in production, monitoring and diagnostic systems are important. Acoustic emission has many benefits over other approaches, such as the ability to spot a multitude of harm processes early on, until they become major issues, such as fibre breakages, friction, collisions, melting, delamination, and corrosion. It also evaluates the structure or mechanism in real-world situations. Acoustic emission sensing is often used to detect workpiece status on-line and to increase process reliability and performance by reducing defects. Drilling trials on woven glass fabric/epoxy with high-speed steel (HSS) drills were conducted to determine the relationship between AE rms and cutting parameters. The trial results indicate that acoustic emission is highly sensitive to the drilling environment's reaction.

Objectives

- To assess the utility of automation in the production process.
- To evaluate the efficiency and output on the production process.

Research Methodology

Analysis methods are the techniques, processes, or approaches used to capture evidence or information for research in order to uncover new insights or obtain a deeper understanding of a topic. The study's sample size is 20 workers, drawn from a basic random sampling methodology. The company's primary data are used to assess the feasibility of automation in the production process.

Statistical Tools used

- Chi square
- Graphs

Data Analysis and Interpretation

Process Improvement			
	Observed N	Expected N	Residual
Constantly	18	10.0	8.0
Monthly	2	10.0	-8.0
Total	20		

A total of 20 workers are shown in the process improvement table above. With a residual value of 8.0, the constant observed N is 18 and predicted N is 10. The residual value is -8.0, and the monthly observed and predicted N are 2 and 10, respectively.

Availability and Quality of Basic Infrastructure viz; Power, Water, Rail and Road			
	Observed N	Expected N	Residual
Good	5	10.0	-5.0
Excellent	15	10.0	5.0
Total	20		

The availability and efficiency of basic facilities are seen in the table above under two headings: good and excellent. The overall number of employees is 20, with observed N of 5 and 15 under the headings of good and excellent, respectively, with expected N of 10 and residual values of -5.0 and 5.0.

Suppliers Lead Time			
	Observed N	Expected N	Residual
1 week	4	6.7	-2.7
2 weeks	3	6.7	-3.7
3 weeks	13	6.7	6.3
Total	20		

Test Statistics

The following table displays the data of 20 workers over the course of three weeks, with observed N of 4,3,13 and expected N of 6.7, with residual values of -2.7,-3.7, and 6.3, respectively.

Process Improvement		Supplier lead time	Availability and quality of basic infrastructure viz; power, water, rail and road
(chi-square) 12.800 ^a		(Chi-square) 9.100 ^c	(chi-square) 5.000 ^a
(df) 1	(df)	2	(df)1
(Asymp.sig.) 0	(Asymp.sig)	0.011	(Asymp.sig) 0.025

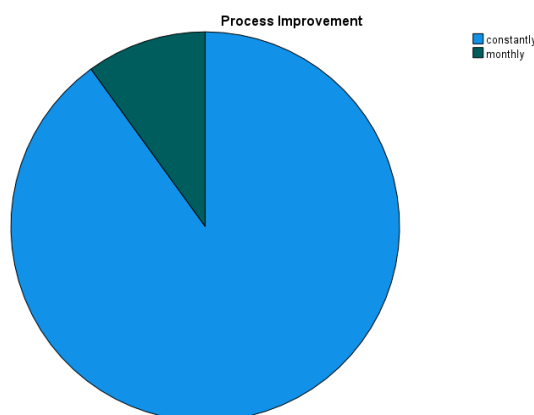


Figure 1

The pie chart above depicts 90% of constant process improvement and 10% of monthly improvement.

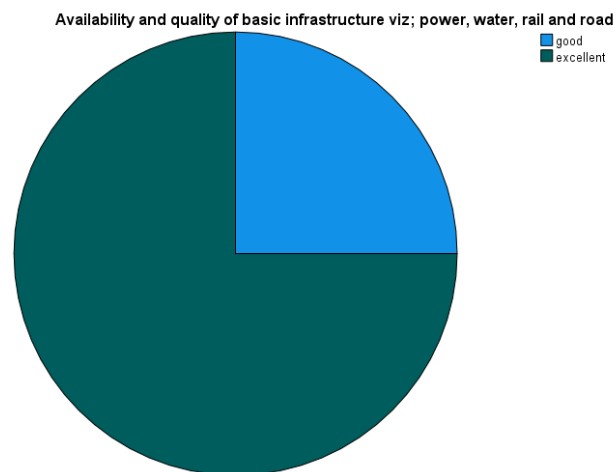


Figure 2

The graph above illustrates 25% of good availability and efficiency of basic facilities, and 75% of excellent availability and quality.

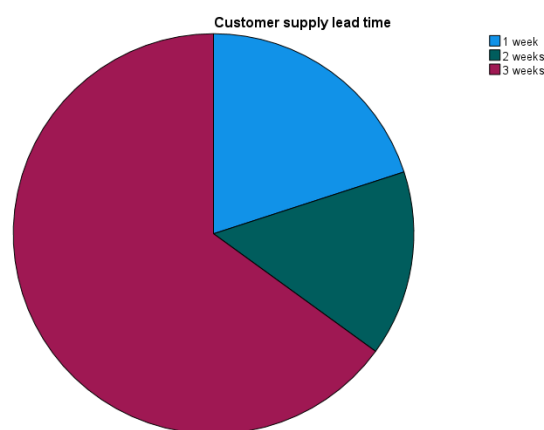


Figure 3

The graph above depicts customer supplier lead times of 20% for one week, 15% for two weeks, and 65% for three weeks.

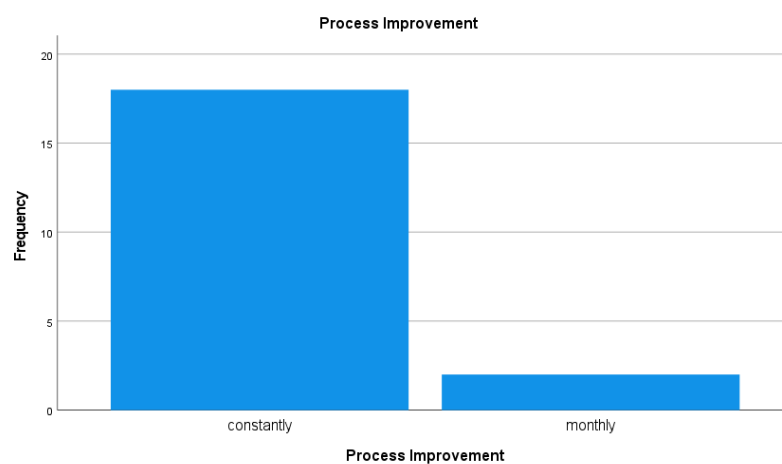


Figure 4

The above bar graph gives the data on constantly and monthly process improvement. The constantly and monthly process improvement frequency is between 0-5 and 15-20 respectively.



Figure 5

The above graph gives data on the customer supply lead time for 3 weeks having frequency between 2.5 and 5.0 for 1st and 2nd week and above 12.5 for 3rd week.

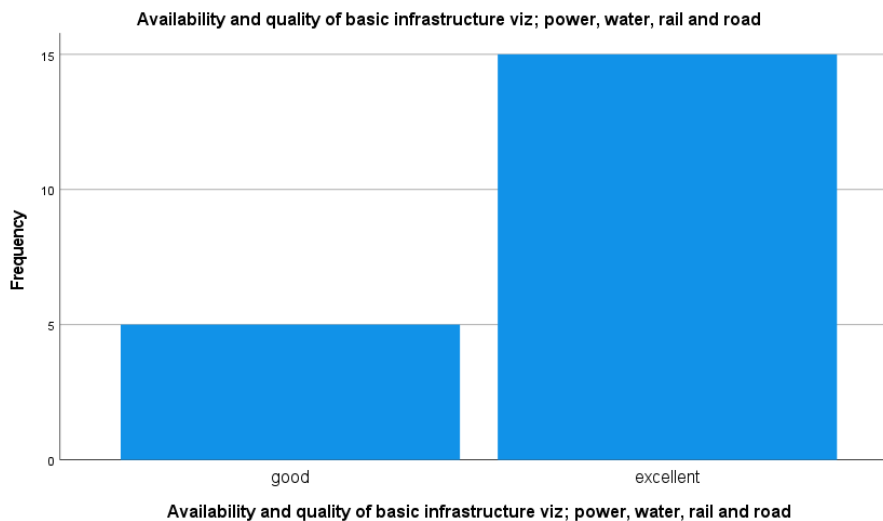


Figure 6

The above bar graph provides data on the availability and quality of basic infrastructure under heads good and excellent the frequency of good is 5 and excellent is 15.

Conclusions

The term "automation" was coined in the automobile industry around 1946 to describe the increased use of electronic devices and controls in automated assembly lines. The study concluded that the use of automation lets businesses increase their efficiency by reducing mistakes and improving productivity and pace, and that businesses can also produce results that exceed human capabilities. The automobile industry is currently one of the most competitive markets, as it necessitates a systemic rise in productivity. The problems are immense, and the best way to solve them is to optimise products or processes. As a result of this report's study and conclusions, it can be concluded that manufacturing process automation and optimization play an important role in increasing efficiency.

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