Study Of Identification and Implementation of Key Industry 4.0 Components in Indian Auto Ancillary & Allied Manufacturing Companies

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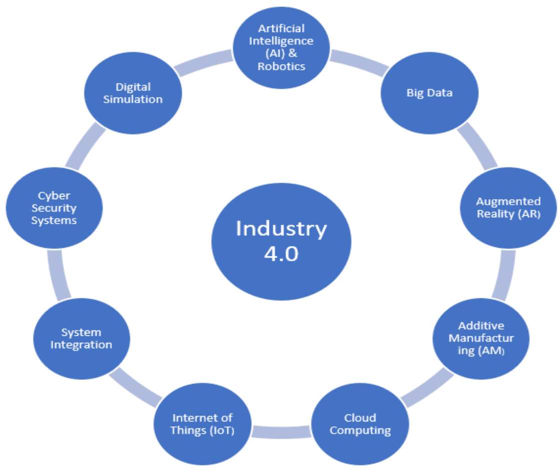
Abstract:
Research into the various aspects of Industry 4.0 is of the utmost significance for determining the course of both the future of manufacturing and the development of new technologies. As we progress farther into the realms of artificial intelligence, the Internet of Things, data analytics, and automation, it is becoming increasingly important to have a comprehensive understanding of the complexities of these components and how they are integrated into various industrial processes. This type of study not only helps businesses become more innovative and competitive, but it also makes it easier for them to establish production methods that are both effective and environmentally friendly. Researchers can uncover novel solutions to optimise supply chains, enhance product customization, improve resource allocation, and ultimately pave the way for a smarter, more interconnected industrial landscape that can meet the challenges and demands of the modern world if they can decipher the potential of these components. This can be done by figuring out what their potential is and then applying that knowledge. Industry 4.0 has been helping the manufacturing world with several benefits which is not restricted to improved productivity, predictability, qualitative improvement, financial benefits, safety benefits and improved customer satisfaction. The study intends to identify the importance of the key components under industry 4.0 and measure the impact of components under Industry 4.0 on financial performance and quality performance. The also measures the satisfaction of implementation of components under Industry 4.0 and identify the reasons for not implementing Industry 4.0 by Indian Auto Ancillary & Allied Manufacturing companies.

Keywords - Industry 4.0, Key Components, Implementation

Introduction:

Industry 4.0, also known as the fourth industrial revolution, is a revolutionary concept in the realm of manufacturing and production. It entails the incorporation of digital technologies, automation, data analytics, and the Internet of Things (IoT) into a variety of different industrial processes. Industry 4.0 is frequently referred to as the fourth industrial revolution. It foresees a shift in the paradigm in which interconnected machines, sophisticated analytics, and the flow of data in real time would enable industrial systems that are more efficient, adaptable, and responsive. By exploiting the potential of linked smart systems within the manufacturing landscape, this development attempts to increase productivity, optimise resource utilisation, enable predictive maintenance, and establish new business models. These goals can be accomplished by creating new business models.

Figure 1: Main Pillars of Industry 4.0 Concept



***Source: Internet (smequest.com* / INDUSTRY4.0 (smequest.com))

1.2 Components of Industry 4.0

The following are the components of Industry 4.0.

1. **Robotics and Artificial Intelligence (AI)** deals with design, construction, operation and application of the robots and are generally used on tasks which are repetitive and thus allow workers to focus on more intensive duties. As per Robotics & Automation News, Artificial Intelligence (AI) & robotics have ability to increase labor productivity
2. **Big Data** is extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations for enhanced insight, decision making and process automation. The concept of "Big data" was mentioned for the first time by Roger Mougalas in 2005 (R. Magoulas & B. Lorica, 2009) . Big data is defined by using 5V characteristics which are Volume, Variety, Velocity, Value, & Veracity (R. H. Hariri et all, 2019).
3. **Augmented Reality (AR)** gives an interactive experience of real-world environment to the user by using computer-generated knowledge and is considered as integral part of Industry 4.0. AR can help or orientation, training and maintenance since it has the capability of connecting both physical and virtual world. Apart from this AR can help New Product Development, 3D modelling & prototyping, Customer demonstration and simulations.
4. **Additive manufacturing (AM)** is also commonly known as 3D printin. additive manufacturing is the process of building an object by depositing material in multiple layers. Additive manufacturing has the capability of producing smaller and customized parts.
5. **Cloud Computing** will be deployed for data management and functionality. As the data generation will increase, the demands are best met in the Cloud. Cloud also offers the necessary agility for the supply chain in Industry 4.0
6. **Internet of Things (IoT)** is a concept that refers to the connections between physical objects, such as sensors or machines, and the Internet (Sengupta, Gupta, and Vinayak 2017; Riggins and Keskin 2017). IoT comprises several connected data sources that generate data and communicate with each other effectively (N. Benkamoun, W. ElMaraghy, A. L. Huyet, and K. Kouiss, 2014)

As Pritish S Shinde & Chetana B Patil (2022), Important components of IoT include
1. Sensor or devices
2. Network and connectivity
3. Data processing unit
4. Application or user interface

The Internet of Things (IOT) has widespread application in areas of retail, transportation, healthcare, industrial, energy, defense, agriculture, smart homes etc.

7. **System Integration**: System Integration involves the combination of various computing systems and software packages which are linked together to create a larger system. This helps the system to work at its optimum level. System Integration increases value to a system by creating new functionalities through the combination of sub-systems and software applications. System Integration can be deployed in following formats
- Horizontal System Integration (inter-company integration)
- Vertical System Integration (intra-company integration)
- End to End Integration

8. **Cybersecurity** becomes important due to the increased dependence on interconnected devices and data leaves the supply chain incredibly vulnerable and thus, the Industry 4.0 enterprise must constantly make cybersecurity a top priority.

9. **Digital Simulations** is a way of running a real or virtual process or a system to find out or guess the output of the modelled system or process. Simulations are done by using real-time data to represent the real world in a simulation model, which include humans, products and machines. adjustments to the operation systems (self-organisation) can also be done through simulations.

1.3 Indian Automobile Industry

The automotive industry consists of range of organizations with objective of designing, developing, validating, manufacturing, marketing, selling and distributing vehicles. Vehicles are of various types which includes
- Two wheelers
- Three wheelers
- Passenger Cars
- Light Commercial Vehicle (LCV)
- Medium and Heavy-Duty Commercial Vehicle (MHCV)

The automotive value chain covers all the activities starting from conception of product till final delivery. The automotive value chain spans across different geographies of the country and comprises of **Auto Original Equipment Manufacturers (OEM)** and **Auto Ancillary Suppliers** also known as **Auto Component Suppliers.** As per Society of Indian Automobile Manufacturers (SIAM) Report, the automotive value chain contributes **6% of the country's National GDP, 49% of the national Manufacturing GDP** and provides over 30 million jobs as on Financial Year 2021-22 (FY22).

1.3.1.The Auto Original Equipment Manufacturers (OEM)

One of the key Industry body representing Indian automobile manufacturers is **The Society of Indian Automobile Manufacturers** (SIAM). The Original Equipment Manufacturers (OEM) rolls out more than 25.9 million vehicles per annum (Society of Indian Automobile Manufacturers (SIAM) FY2023 report) and is largely served by organized sector of automobile component manufacturer. Auto Original Equipment Manufacturers (OEM) consists of manufacturers cars, motorbike, Three Wheelers, light commercial vehicle, trucks, buses, construction and agricultural equipment and other vehicle. As per this report, Passenger Vehicles contributes more than 4.57 million vehicles per annum in terms of production while Commercial Vehicle contributes more than 1.03 million vehicles in terms of production. Two wheelers contribute almost more19.45 million per annum of total vehicle produced in a year while 3-wheelers are more 0.8 million vehicles per annum

1.3.2. Indian Auto-Ancillary & Allied Manufacturing Companies

Auto Ancillary companies or **Auto Component Industry** are companies that specialize in manufacturing different types of auto parts equipment used in a vehicle such as a transmission, engine parts, shock absorbers, gears, springs, tyres, Electrical Vehicle (EV) components, wiring systems, chassis, electronics & lights, battery, brakes, suspension, bearings, pistons, wheels, headlamps, axle shafts, and air conditioning parts, etc

India's **auto component industry** is one of the key sectors which drives macroeconomic growth and employment. The various players of industry are spread across various clusters in the country, and it comprises players of different sizes ranging from large corporations to small and medium enterprises (SME). The auto components industry accounts for 2.3% of India's GDP and provides direct employment to 3.7 million people (ACMA report). By 2026, the automobile component sector is expected to contribute 5-7% of India's GDP. Multinationals and SME's play a dominant role in the auto component industry and contribute towards India's economic growth and for the 'Make in India' program.

The Automotive Component Manufacturers Association of India (ACMA) is the apex body representing the interest of the Indian Auto Component Industry. It has membership of over 800 manufacturers contributing to more than 85 % of the auto component industry's turnover in the organized sector. Automobile Component Manufacturers Association (ACMA) forecast that auto component exports from India is expected to reach US$ 30 billion by 2026 and auto component industry is projected to record US$ 200 billion in revenue by 2026.

Literature Review

1. **Cleiton R. Mendes et al (2018),** in their research paper "Application of Big Data and the Internet of Things in Industry 4.0", intend to understand the potential of big data and the Internet of Things in manufacturing companies. objective in this study was to investigate the adoption of big data and IoT technologies. The researchers investigated the production process of an auto parts company where the data collection is currently manual and automatic. The HMI includes devices that assist operators in manufacturing activities such as touch screens and augmented reality. Connectivity includes systems that connect devices and collect and analyze data from a scanned factory, which includes both big data and IoT technologies.

2. **Rudenko. R et all (2022)** conducted review on Internet of Things, Industry 4.0 and Cybersecurity. The paper highlights that Industrial revolution faces challenges of cybersecurity and cyber-attacks can cause damage to organisations and customers. The paper also aims to review existing technologies about cybersecurity in intelligent manufacturing and also introduce architecture of Internet of Things (IoT) and smart manufacturing.

3. **Cevat Özarpa & İsa Avci (2022)** studied Industry 4.0 and Cybersecurity at Automobile manufacturing and smart factories in Turkey. In this study, they examined cyber-attacks in the automotive industry and cyber threats in automobile factories. In addition, they proposed layered protection by investigating how to take precautions against these attacks and threats. This study is limited to the geography of turkey.

4. **Nguyen Tuan Thanh Le and Manh Linh Pham (2021)** have reviewed two promising technologies for Industry 4.0, which is Big Data Analytics (*BDA)* and Machine Learning (*ML)*. They focused on the data aspect of smart manufacturing which massive in size and fast and thus cannot be managed by conventional methods. The authors believe these potential advanced technologies can enable fully automated production on a large scale in near future.

5. **D'Costa, A.P. (2011)** examined on how the investment pattern has changed for Indian auto industry and further argues that industrial relations climate has played important role for this pattern. The paper draws some policy implications for employment security and lessons for other countries in these turbulent times.

6. **Manuel Sanchez et al (2020)** in their study considered several works that intended to solve problems of autonomic integration in Industry 4.0 and proposes an approach to analyze the integration challenges in the context of Industry 4.0 using five

integration levels, which are connection, communication, coordination, cooperation, and collaboration (5C). Additionally, this paper presents a case study from an integration perspective. Among other aspects, the case study contemplates autonomy, self-organizing, in order to turn a traditional industry into a smart factory regarding the Industry 4.0 concept.

7. Christos Alexakos et al, (2020) studied the integration issues and challenges in the manufacturing environment. These challenges are faced due to large number of devices and varied type of equipment which need to interoperate and participate in a common automation and control context. The paper presents a proposed approach for the integration in the industrial environment utilizing Automation ML for shop floor modeling. The paper also presents the overall system architecture followed and details both its configuration and run time execution.

8. Rabab Benotsmane & György Kovács (2019), studied and summarized the economic and social operational requirements and impacts of Smart Factories. They also compared the characteristics of the traditional factory and the Smart Factory are compared. Their study introduced a real case study for Simulation of the operation of two collaborating robots applying AI. The paper does not cover all benefits and user experience in field of Engineering Technology sector, and it all does not speak on various applications like Chatbots, eCommerce, product testing.

Summary of Literature Review

From the literature studied, it is found that there are fewer studies on identification and implementation of Key Industry 4.0 components for Indian Auto Ancillary and Allied Manufacturing companies.

Research Methodology

a. Data collection

The study is based on secondary as well as primary data collected through a questionnaire. Questionnaire is used to gather primary data by mailing Google Form to the respondents. Secondary data is gathered from books, personal sources, journals, newspapers, websites.

The questionnaire consists of questions related to the level of importance of key components under Industry 4.0, the impact of components Industry 4.0 components on the overall financial performance of the organization, the impact of components Industry 4.0 components on the overall quality performance of the organization, and satisfaction on implementation with Industry 4.0.

b. Research Design

A cross-sectional analysis was conducted to determine the existence and magnitude of causal effects of independent variables on dependent variables of interest at a specific time point.

Independent Variable: Industry 4.0 & its components

Dependent Variables

The dependent variables are

- **Implementation**: Components of Industry 4.0
- **Performance :** Financial and Quality

Sample Design

The sampling design used in this research is a convenience sampling method with a sample size of 30 industries from the Indian Auto Ancillary & Allied Manufacturing sector.

Statistical tools

The data was analysed using the IBM SPSS software, and descriptive statistics and inferential statistics were used for objectives and hypothesis testing. The reliability statistics is obtained to validate the Likert scale used in the questionnaire. The analysis of the data is done using the Friedman test and One-way ANOVA.

Descriptive Statistics:

In the process of analysis of primary data collected from the respondents of various Indian auto ancillary companies. The size of the company is classified and presented in the following table.

Q5. Size of the Company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Micro Company	2	4.5	4.5	4.5
	Small Company	7	15.9	15.9	20.5
	Medium Company	20	45.5	45.5	65.9
	Large Company	15	34.1	34.1	100.0
	Total	44	100.0	100.0	

The above table indicates the distribution of company sizes among the 44 respondents. There are 2 respondents (4.5%) who work for micro companies, 7 respondents (15.9%) work for small companies, 20 respondents (45.5%) work for medium companies, and the remaining 15 respondents (34.1%) work for large companies.

Importance of Key Components:

To study the level of importance of key components, information is collected from 9 different questions. The responses given to questions are classified and presented in the following table.

Qs. No.	Statement	Not Important	Partly Important	Important	Most Important
11.1	Artificial Intelligence (AI) & Autonomous Robots	1	14	18	11
11.2	Big Data	3	13	19	9
11.3	Augmented Reality	5	24	15	0
11.4	Additive Printing (3D printing)	10	17	15	2
11.5	Cloud Computing	1	16	20	7
11.6	Internet of Things	4	2	18	20
11.7	System Integration	2	3	22	17
11.8	Cyber Security	3	7	16	18
11.9	Simulation	2	13	19	10

The above responses are rated as follows.
Not Important = 1
Partly Important = 2
Important = 3
Most Important = 4

The above responses are used to calculate the mean score of the level of importance of key components using the formula given below.

$$\text{importance of key components} = \frac{\text{Sum of rating of 9 questions}}{\text{Maximum rating (36)}} \times 100$$

Using the above formula mean score of the importance of key components is calculated for each respondent and subsequently for all 44 respondents. The descriptive statistics are obtained and presented in the following table.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Importance of Key Components	44	33.33	94.44	70.1389	13.7541
Valid N (listwise)	44				

The above table indicates that the mean score of the level of importance of key components is 70.14%. The minimum score obtained is 33.33% and the maximum score is 94.44%. The standard deviation of the variable is 13.75.

To study the overall financial performance of the company, information is collected from 9 different questions. The responses given to these questions are classified and presented in the following table.

Overall Financial Performance:

Qs. No.	Statement	Did not Implement	Poor	Average	Good	Excellent
12.1	Artificial Intelligence (AI)	14	0	9	15	6
12.2	Big Data	15	1	10	14	4
12.3	Augmented Reality	17	3	13	9	2
12.4	Additive Printing (3D printing)	16	5	11	11	1
12.5	Cloud Computing	13	1	12	8	10
12.6	Internet of Things	6	1	4	15	18
12.7	System Integration	10	1	5	18	10
12.8	Cyber Security	8	1	9	14	12
12.9	Simulation	11	2	9	11	11

The above responses are rated as follows.
Did not Implement= 0
Poor = 1
Average = 2
Good = 3
Excellent =4

The above responses are used to calculate the mean score of overall financial performance using the formula given below.

$$\text{Mean score of overall financial performance} = \frac{\text{Sum of rating of 9 questions}}{\text{Maximum rating (36)}} \times 100$$

Using the above formula mean score of overall financial performance is calculated for each respondent and subsequently for all 44 respondents. The descriptive statistics are obtained and presented in the following table.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Overall Financial Performance Valid N (listwise)	44 44	.00	100.00	51.7677	25.5508

The above table indicates that the mean score of overall financial performance is 51.77%. The minimum score obtained is 0.00% and the maximum score is 100.00%. The standard deviation of the variable is 25.55.

Overall Quality Performance:

To study the overall quality performance of the company, information is collected from 9 different questions. The responses given to these questions are classified and presented in the following table.

Qs. No.	Statement	Did not Implement	Poor	Average	Good	Excellent
13.1	Artificial Intelligence (AI)	13	0	6	17	8
13.2	Big Data	16	0	10	13	5
13.3	Augmented Reality	18	4	8	14	0
13.4	Additive Printing (3D printing)	16	4	9	13	2
13.5	Cloud Computing	14	0	10	13	7
13.6	Internet of Things	6	1	3	16	18
13.7	System Integration	10	1	4	21	8
13.8	Cyber Security	9	2	9	19	5
13.9	Simulation	11	1	8	14	10

The above responses are rated as follows.
Did not Implement= 0
Poor = 1
Average = 2
Good = 3
Excellent =4

The above responses are used to calculate the mean score of overall quality performance using the formula given below.

$$\text{Mean score of overall quality performance} = \frac{\text{Sum of rating of 9 questions}}{\text{Maximum rating (36)}} \times 100$$

Using the above formula mean score of overall quality performance is calculated for each respondent and subsequently for all 44 respondents. The descriptive statistics are obtained and presented in the following table.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Overall Quality Performance Valid N (listwise)	44 44	.00	94.44	51.7045	24.6072

The above table indicates that the mean score of overall quality performance is 51.70%. The minimum score obtained is 0.00% and the maximum score is 94.44%. The standard deviation of the variable is 24.60.

Satisfaction:

To study the satisfaction of the company, information is collected from 13 different questions. The responses given to these questions are classified and presented in the following table.'

Qs. No.	Statement	DNI	VD	DS	NT	SA	VS
14.1	Business Analytics, Planning & Decision Making	9	2	0	4	18	11
14.2	Productivity Improvement	6	2	0	7	16	13
14.3	Better Inventory Management	8	2	0	4	19	11
14.4	Improved Profitability	8	2	0	3	19	12

14.5	Improved Competitiveness	8	2	0	4	19	11
14.6	Reduced Downtime, Predictive Analysis & Maintenance	7	2	0	6	18	11
14.7	Smart Manufacturing	10	2	0	2	20	10
14.8	Quality Improvement	8	2	0	4	19	11
14.9	Improved Safety	9	2	0	4	22	7
14.10	Improved Ecological Benefits & Reduced Energy Consumption	8	1	1	11	14	9
14.11	Improved Customer Satisfaction	8	2	0	4	17	13
14.12	Product & Process Design	9	1	1	8	17	8
14.13	Other Benefits	11	0	3	5	18	7

DNI - Did Not Implement, VD - Very Dissatisfied, DS - Dissatisfied, NT - Neutral,
SA - Satisfied, VS - Very Satisfied
The above responses are rated as follows.
Did Not Implement = 0
Very Dissatisfied = 1
Dissatisfied = 2
Neutral = 3
Satisfied =4
Very Satisfied =5

The above responses are used to calculate the mean score of satisfaction using the formula given below.

$$\text{Mean score of satisfaction} = \frac{\text{Sum of rating of 13 questions}}{\text{Maximum rating (65)}} \times 100$$

Using the above formula mean score of satisfaction is calculated for each respondent and subsequently for all 44 respondents. The descriptive statistics are obtained and presented in the following table.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Satisfaction	44	.00	100.00	64.4755	31.8587
Valid N (listwise)	44				

The above table indicates that the mean score of satisfaction is 64.47%. The minimum score obtained is 0.00% and the maximum score is 100.00%. The standard deviation of the variable is 31.86.

Reliability Statistics:

The reliability is checked to ensure that the measurement scale is accurate enough to measure the construct. It ensures that the scale can produce consistent and dependable results. The association between the scores obtained from different statements of the scale for which Cronbach's Alpha is calculated determines reliability analysis. Thus, if the association in reliability analysis is high, the scale yields consistent results and is therefore reliable. It is used to validate the Likert scale used in the questionnaire.

Sr. No.	**Variable Name**	**No. of statements**	**Cronbach's Alpha Value**	**Results**
1.	Importance of Key Components	9	0.846	Accepted. The scale is valid and reliable.
2.	Overall Financial Performance	9	0.882	Accepted. The scale is valid and reliable.
3.	Overall Quality Performance	9	0.863	Accepted. The scale is valid and reliable.
4.	Satisfaction	13	0.977	Accepted. The scale is valid and reliable.

Interpretation: The above table indicates that the Cronbach Alpha values for all four variables are greater than 0.700. Therefore, the test of reliability is satisfied. The conclusion is the Likert Scale used in the questionnaire is reliable and accepted.

Objective 1: To identify the importance of the key components under industry 4.0.
To study the above objective the level of importance of the key components is considered and the following hypothesis is designed.

Null Hypothesis H_{01}: There is no significant difference in the level of importance of the key components under Industry 4.0.
Alternate Hypothesis H_{11}: There is a significant difference in the level of importance of the key components under industry 4.0.

To study the above null hypothesis, Friedman's test is used. The results are as follows.

Test Statistics(a)

N	44
Chi-Square	81.989
Df	8
p-value	.000

a. Friedman Test

Interpretation: The above results indicate that the p-value is 0.000. It is less than the standard p-value of 0.05. Therefore, Friedman's test is rejected. The null hypothesis is rejected and the alternate hypothesis is accepted.

Conclusion: There is a significant difference in the level of importance of the key components under industry 4.0.

Findings: To understand the finding of the hypothesis, the mean ranks are obtained and presented in the following table.

Ranks

	Mean Rank
11.1 Artificial Intelligence (AI) & Autonomous Robots	5.27
11.2 Big Data	4.90
11.3 Augmented Reality	3.20
11.4 Additive Printing (3D printing)	3.39
11.5 Cloud Computing	4.81
11.6 Internet of Things	6.22
11.7 System Integration	6.20
11.8 Cyber Security	5.93
11.9 Simulation	5.08

The above table indicates the level of importance of the key components under Industry 4.0. The component with the highest mean rank is the Internet of Things (6.22),
followed by System Integration (6.20),
Cyber Security (5.93),
Artificial Intelligence & Autonomous Robots (5.27),
Simulation (5.08).
The lowest mean rank is for Augmented Reality (3.20).

This concludes that the Internet of Things is the most important component under Industry 4.0, while Augmented Reality is considered to be the least important component.

Objective 2: To study the impact of components under Industry 4.0 on financial performance.
To study the above objective, the following null and alternate hypotheses are designed to identify the impact of components on financial performance by the size of the company.
Null Hypothesis H_{02}: There is no significant difference between the impact of components on financial performance and the size of the company.
Alternate Hypothesis H_{12}: There is a significant difference between the impact of components on financial performance and the size of the company.
To test the above null hypothesis, ANOVA is obtained and F-test is applied. The results are shown in the below table.

ANOVA
Overall Financial Performance

	Sum of Squares	df	Mean Square	F	p-value
Between Groups	2594.124	3	864.708	1.358	.270
Within Groups	25478.266	40	636.957		
Total	28072.391	43			

Interpretation: The above table indicates that the calculated p-value is 0.270. It is greater than the standard p-value of 0.05. Therefore, F-test is accepted, hence null hypothesis is accepted and the alternate hypothesis is rejected.

Conclusion: There is no significant difference between the impact of components on financial performance and the size of the company.
Findings: To understand the finding of the hypothesis, the mean scores are obtained and presented in the following table.

Descriptives
Overall Financial Performance

	N	Mean	Std. Deviation	Std. Error
Micro Company	2	45.8333	17.6776	12.5000
Small Company	7	36.1111	33.0232	12.4816

Medium Company	20	52.3611	26.3411	5.8900
Large Company	15	59.0741	19.7109	5.0893
Total	44	51.7677	25.5508	3.8519

The above table indicates the mean score of overall financial performance according to the size of the companies. The mean score for micro companies is 45.83, for small companies is 36.11, for medium companies is 52.36, and for large companies is 59.07. This concludes that the overall financial performance is uniform across different sizes of companies.

Objective 3: To study the impact of components under Industry 4.0 on quality performance.
To study the above objective, the following null and alternate hypotheses are designed to identify the impact of components on quality performance by the size of the company.

Null Hypothesis H_{03}: There is no significant difference between the impact of components on quality performance and the size of the company.

Alternate Hypothesis H_{13}: There is a significant difference between the impact of components on quality performance and the size of the company.
To test the above null hypothesis, ANOVA is obtained and F-test is applied. The results are shown in the below table.

ANOVA
Overall Quality Performance

	Sum of Squares	df	Mean Square	F	p-value
Between Groups	1789.891	3	596.630	.984	.410
Within Groups	24247.391	40	606.185		
Total	26037.283	43			

Interpretation: The above table indicates that the calculated p-value is 0.410. It is greater than the standard p-value of 0.05. Therefore, F-test is accepted, hence null hypothesis is accepted and the alternate hypothesis is rejected.

Conclusion: There is no significant difference between the impact of components on quality performance and the size of the company.
Findings: To understand the finding of the hypothesis, the mean scores are obtained and presented in the following table.

Descriptives
Overall Quality Performance

	N	Mean	Std. Deviation	Std. Error
Micro Company	2	51.3889	33.3911	23.6111
Small Company	7	38.0952	33.1287	12.5215
Medium Company	20	52.2222	25.3564	5.6698
Large Company	15	57.4074	17.5891	4.5414
Total	44	51.7045	24.6072	3.7096

The above table indicates the mean score of overall quality performance according to the size of the companies. The mean score for micro companies is 51.39, for small companies is 38.09, for medium companies is 52.22, and for large companies is 57.41. This concludes that the overall quality performance is uniform across different sizes of the companies.
Objective 4: To study the satisfaction of implementation of components under Industry 4.0.
To study the above objective, the following null and alternate hypotheses are designed to identify the satisfaction on implementation of components by the size of the company.

Null Hypothesis H_{04}: There is no significant difference between satisfaction with the implementation of components and the size of the company.
Alternate Hypothesis H_{14}: There is a significant difference between satisfaction with the implementation of components and the size of the company.

To test the above null hypothesis, ANOVA is obtained and F-test is applied. The results are shown in the below table.

ANOVA
Satisfaction

	Sum of Squares	df	Mean Square	F	p-value
Between Groups	4093.955	3	1364.652	1.380	.263
Within Groups	39550.155	40	988.754		
Total	43644.110	43			

Interpretation: The above table indicates that the calculated p-value is 0.263. It is greater than the standard p-value of 0.05. Therefore, F-test is accepted, hence null hypothesis is accepted and the alternate hypothesis is rejected.

Conclusion: There is no significant difference between satisfaction with the implementation of components and the size of the company.

Findings: To understand the finding of the hypothesis, the mean scores are obtained and presented in the following table.

Descriptive
Satisfaction

	N	Mean	Std. Deviation	Std. Error
Micro Company	2	83.0769	15.2299	10.7692
Small Company	7	46.3736	44.2195	16.7134
Medium Company	20	62.6923	33.4830	7.4870
Large Company	15	72.8205	21.1876	5.4706
Total	44	64.4755	31.8587	4.8028

The above table indicates the mean score of satisfaction on the implementation of components according to the size of the companies. The mean score for micro companies is 83.08, for small companies is 46.37, for medium companies is 62.69, and for large companies is 72.82. This concludes that satisfaction with the implementation of components is uniform across different sizes of companies.

Findings of the Research:

The research is based on primary data collected from 44 Indian Auto Ancillary & Allied Manufacturing companies. The results indicated that there is a significant difference in the level of importance of the key components under Industry 4.0. The most important component under Industry 4.0 is the Internet of Things, followed by System Integration, Cyber Security, Artificial Intelligence and Autonomous Robots, and Simulation. Whereas Augmented Reality is considered to be the least important component. Also, there is no significant difference between the impact of components on financial performance, quality performance, satisfaction with the implementation of components and the size of the company. This concludes that the overall financial performance, quality performance, and satisfaction with the implementation of components are uniform across different sizes of companies.

9. Conclusion

Industry 4.0 has positive impact on financial performance and quality performance of an auto ancillary company irrespective of the side and also the satisfaction levels are uniform across all sizes of company. Fore those who have not implemented any component of Industry 4.0 , lack of knowledge of adoption and workforce related challenges are some key reasons for not implementing, while some companies want to maximize their existing investment. Auto ancillary companies can derive financial and qualitative benefits usings Industry 4.0 and work towards adoption of the I4.0 for improved productivity, qualitative performance, safety, customer satisfaction, business analytics, higher uptime and other benefits.

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