

A STUDY ON IMPACT OF INDUSTRY 4.0 IN THE INDIAN COMPANIES

Submitted in partial fulfillment of the requirements for the award of

MASTER OF BUSINESS ADMINISTRATION

by

DEEPAN EDWARD DASAN M
Register No.40410041



SCHOOL OF MANAGEMENT STUDIES

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC | 12B Status by UGC | Approved by AICTE
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119**

APRIL 2022



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited with "A" grade by NAAC | 12B Status by UGC | Approved by AICTE
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119

www.sathyabama.ac.in

SCHOOL OF MANAGEMENT STUDIES

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **DEEPAN EDWARD DASAN M 40410041** who carried out the project entitled —**A study on impact of industry 4.0 in the Indian companies**” under my supervision from January 2022 to March 2022.

Dr. TR. KALAI LAKSHMI, M.A.,M.B.A.,M.Phil.,Ph.D.,

Internal guide

External Guide

Dr. BHUVANESWARI .G
Dean – School of Management Studies

Submitted for Viva voce Examination held on_____

Internal Examiner

External Examiner

DECLARATION

I **DEEPAN EDWARD DASAN M (40410041)** hereby declare that the Project Report entitled —**A study on impact of industry 4.0 in the Indian companies**” done by me under the guidance of **Dr. TR. KALAI LAKSHMI** is submitted in partial fulfillment of the requirements for the award of Master of Business Administration degree.

DATE:

PLACE:

DEEPAN EDWARD DASAN M

ACKNOWLEDGEMENT

I am pleased to acknowledge my sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. I am grateful to them.

I convey my sincere thanks to **Dr. G. Bhuvaneswari, Dean - School of Management Studies** and **Dr. A. Palani, Head - School of Management Studies** for providing me necessary support and details at the right time during the progressive reviews.

I would like to express my sincere and deep sense of gratitude to my Project Guide **Dr. TR.KALAI LAKSHMI** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of my project work.

I wish to express my thanks to all Teaching and Non-teaching staff members of the **School of Management Studies** who were helpful in many ways for the completion of the project.

DEEPAN EDWARD DASAN M

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE NO.
	ABSTRACT	(i)
	LIST OF TABLES	(ii)
	LIST OF CHARTS	(iii)
1	INTRODUCTION	1
	1.1 .Introduction	2
	1.2 .Industrial revolution	2
	1.2.1 First industrial revolution	2
	1.2.2 Second Industrial revolution	2
	1.2.3 Third Industrial revolution	3
	1.2.4 Fourth Industrial revolution	3
	1.2.5 Four themes that summarize industry 4.0	3
	1.2.6 Industry 4.0 Technologies & applications	4
	1.3 Industry profile	6
	1.3.1 Manufacturing industry	6
	1.3.2 IT Industry	6
	1.3.3 Financial Sector	6
	1.3.4 Agriculture Industry	6
	1.3.5 Healthcare	7
	1.3.6 FMCG	7
	1.4 Need for study	7
	1.5 Scope of the study	7
	1.6 Objective of the study	7
	1.6.1 Primary objective	7
	1.6.2 Secondary objective	7
	1.7 Limitation of the study	8
2	REVIEW OF LITERATURE	9
3	RESEARCH METHODOLOGY	12
	3.1 Research Design	12

	3.2.Sampling Technique	12
	3.3. Sources of Data	12
	3.4. Questionnaire Development	12
	3.5. Secondary data Sources	12
	3.6.Structure of the questionnaire	12
	3.7.Sample Size	12
	3.8.Period of study	12
	3.9 Analytical tools	13
	DATA ANALYSIS AND INTERPRETATION	15
4	4.1 Percentage Analysis	15
	4.2.Chi Square	44
	4.3.Anova	45
	4.4.REGRESSION	46
	FINDINGS,SUGGESTIONS AND CONCLUSION	46
5	5.1.Findings of the Study	46
	5.2.Suggestions & Recommendations	49
	5.3.Conclusion	50
	REFERENCES	51
	ANNEXURE I – QUESTIONNAIRE	55
	ANNEXURE II- ARTCILE	61

ABSTRACT

This study aims to assess the impact of industry 4.0 on the Indian Companies in the India. The main purpose of this study is to understand the potential drivers, and barriers faced by Indian Companies while practicing of industry 4.0 In this survey, we used a quantitative survey method using a Google Forms survey from the target individuals who are all managerial level workers with a sample of 55 respondents. The survey found that 46% are implemented industry 4.0 and they wanted to know more about its potential. This study attempted to us Opportunity to differentiate in the market, The company has an innovative spirit, so it has to try new concepts It's part of our market leader status, Market requirements and competitive pressure Optimization and automation lead to enhanced productivity, Real-time data for real-time supply chains in a real-time economy as potential drivers to embrace industry 4.0 and also calculated the impact of industry 4.0 elements in productivity and efficiency, profitability, employment, Quality and revenue. Finally, this study recommends a learning opportunity for workers to know about what technology has been used in their company. Adequate amount of training to overcome insufficient technical skills and more man power to handle data and cyber security Some companies have implemented Industry 4.0 but yet to be advanced and some have to implement for its better future.

LIST OF TABLE

TABLE NO.	PARTICULARS	PAGE NO.
1.1	INDUSTRY 4.0 TECHNOLOGIES & APPLICATIONS	5
4.1.1	GENDER OF THE RESPONDENTS	15
4.1.2	JOB POSITIONS OF THE RESPONDENTS	16
4.1.3	LOCATION OF THE COMPANIES	17
4.1.4	COMPANY'S EXPERIENCE	18
4.1.5	SIZE OF THE COMPANY	19
4.1.6	INDUSTRY OF THE RESPONDENT COMPANY	20
4.1.7	COMPANY'S ANNUAL TURNOVER	21
4.1.8	COMPANY'S AWARENESS ABOUT INDUSTRY 4.0	22
4.1.9	REASON TO EMBRACE INDUSTRY 4.0.	23
4.1.10	STRATEGY FOR THE INDUSTRY 4.0	27
4.1.11	IMPORTANT INDUSTRY 4.0 TECHNOLOGY USED IN COMPANIES	28
4.1.12	IMPACT OF INDUSTRY 4.0 IN COMPANIES	31
4.1.13	IMPACT INFLUENCED BY ELEMENTS OF INDUSTRY 4.0	33
4.1.14	BENEFITS BY IMPLEMENTING INDUSTRY 4.0 IN COMPANIES	35
4.1.15	CHALLENGES BY IMPLEMENTING INDUSTRY 4.0 IN COMPANIES	38
4.1.16	KNOWLEDGE ABOUT INDUSTRY 4.0 ELEMENTS	41
4.2	CHI SQUARE	44
4.3	ONE WAY ANOVA	45

LIST OF CHARTS

CHARTS NO.	PARTICULARS	PAGE NO.
1.1.1	INDUSTRIAL REVOLUTION	2
1.1.2	KEY THEMES OF INDUSTRY 4.0	3
4.1.1	GENDER OF THE RESPONDENTS	15
4.1.2	JOB POSITIONS OF THE RESPONDENTS	16
4.1.3	LOCATION OF THE COMPANIES	17
4.1.4	COMPANY'S EXPERIENCE	18
4.1.5	SIZE OF THE COMPANY	19
4.1.6	INDUSTRY OF THE RESPONDENT COMPANY	20
4.1.7	COMPANY'S ANNUAL TURNOVER	21
4.1.8	COMPANY'S AWARENESS ABOUT INDUSTRY 4.0	22
4.1.9	REASON TO EMBRACE INDUSTRY 4.0.	24
4.1.10	STRATEGY FOR THE INDUSTRY 4.0	27
4.1.11	IMPORTANT INDUSTRY 4.0 TECHNOLOGY USED IN COMPANIES	28
4.1.12	IMPACT OF INDUSTRY 4.0 IN COMPANIES	31
4.1.13	IMPACT INFLUENCED BY ELEMENTS OF INDUSTRY 4.0	33
4.1.14	BENEFITS BY IMPLEMENTING INDUSTRY 4.0 IN COMPANIES	35
4.1.15	CHALLENGES BY IMPLEMENTING INDUSTRY 4.0 IN COMPANIES	38
4.1.16	KNOWLEDGE ABOUT INDUSTRY 4.0 ELEMENTS	41

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The industry 4.0 is bringing about the convergence of Information Technology(IT) and Operational Technology(OT) creating interconnectivity between autonomous manufacturing equipment and product computer systems. Industry 4.0 refers to a new phase in the Industrial Revolution that focuses heavily on interconnectivity, automation, machine learning, and real-time data. Industry 4.0, also sometimes referred to as IIoT or smart manufacturing, marries physical production and operations with smart digital technology, machine learning, and big data to create a more holistic and better connected ecosystem for companies that focus on manufacturing and supply chain management. While every company and organization operating today is different, they all face a common challenge the need for connectedness and access to real-time insights across processes, partners, products, and people. Robotics, Artificial Intelligence, Augmented/Virtual Reality, Data Analytics, Cyber Security, Additive Manufacturing, Cloud Computing & Systems Integration etc.

The phrase Fourth Industrial Revolution was first introduced by a team of scientists developing a high-tech strategy for the German government. Klaus Schwab, executive chairman of the World Economic Forum (WEF), introduced the phrase to a wider audience in a 2015 article published by Foreign Affairs. "Mastering the Fourth Industrial Revolution" was the 2016 theme of the World Economic Forum Annual Meeting, in Davos-Klosters, Switzerland. On the 10 October 2016, the Forum announced the opening of its Centre for the Fourth Industrial Revolution in San Francisco. This was also subject and title of Schwab's 2016 book. Schwab includes in this fourth era technologies that combine hardware, software, and biology (cyber-physical systems), and emphasizes advances in communication and connectivity. Schwab expects this era to be marked by breakthroughs in emerging technologies in fields such as robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, the internet of things, the industrial internet of things, decentralized consensus, fifth-generation wireless technologies, 3D printing, and fully autonomous vehicles.

1.2 INDUSTRIAL REVOLUTION

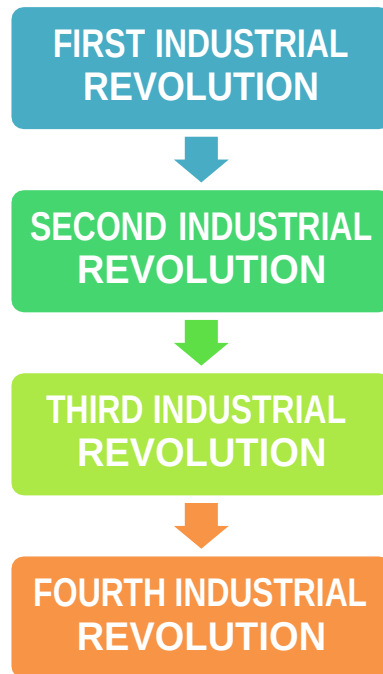


Chart1:Industrial revolution

1.2.1 FIRST INDUSTRIAL REVOLUTION

The First Industrial Revolution was marked by a transition from hand production methods to machines through the use of steam power and water power. The implementation of new technologies took a long time, so the period which this refers to was between 1760 and 1820, or 1840 in Europe and the United States. Its effects had consequences on textile manufacturing, which was first to adopt such changes, as well as iron industry, agriculture, and mining although it also had societal effects with an ever stronger middle class. It also had an effect on British industry at the time.

1.2.2 SECOND INDUSTRIAL REVOLUTION

The Second Industrial Revolution, also known as the Technological Revolution, is the period between 1871 and 1914 that resulted from installations of extensive railroad and telegraph networks, which allowed for faster transfer of people and ideas, as well as electricity. Increasing electrification allowed for factories to develop the modern production line. It was a period of great economic growth, with an increase in productivity, which also caused a surge in unemployment since many factory workers were replaced by machine.

1.2.3 THIRD INDUSTRIAL REVOLUTION

The Third Industrial Revolution, also known as the Digital Revolution, occurred in the late 20th century, after the end of the two world wars, resulting from a slowdown of industrialization and technological advancement compared to previous periods. The production of the Z1 computer, which used binary floating-point numbers and Boolean logic, a decade later, was the beginning of more advanced digital developments. The next significant development in communication technologies was the supercomputer, with extensive use of computer and communication technologies in the production process; machinery began to abrogate the need for human power.

1.2.4 FOURTH INDUSTRIAL REVOLUTION

In essence, the Fourth Industrial Revolution is the trend towards automation and data exchange in manufacturing technologies and processes which include cyber-physical systems (CPS), IoT, industrial internet of things, cloud computing, cognitive computing, and artificial intelligence. The Fourth Industrial Revolution marks the beginning of the Imagination Age.

1.2.5 FOUR THEMES ARE PRESENTED THAT SUMMARIZE AN INDUSTRY 4.0

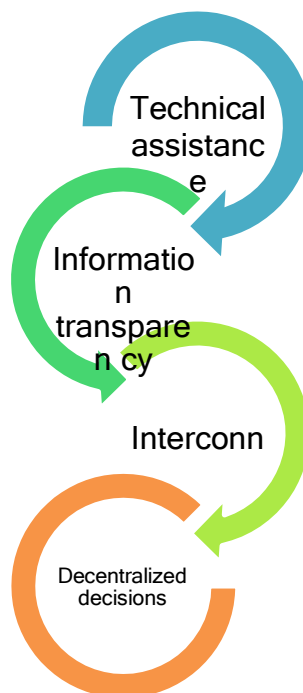


Chart 2: key themes of industry 4.0

- Interconnection — the ability of machines, devices, sensors, and people to connect and communicate with each other via the Internet of things, or the internet of people (IoP)[25]
- Information transparency — the transparency afforded by Industry 4.0 technology provides operators with comprehensive information to make decisions. Inter-connectivity allows operators to collect immense amounts of data and information from all points in the manufacturing process, identify key areas that can benefit from improvement to increase functionality[25]
- Technical assistance — the technological facility of systems to assist humans in decision-making and problem-solving, and the ability to help humans with difficult or unsafe tasks[26]
- Decentralized decisions — the ability of cyber physical systems to make decisions on their own and to perform their tasks as autonomously as possible. Only in the case of exceptions, interference, or conflicting goals, are tasks delegated to a higher level

1.2.6 INDUSTRY 4.0 TECHNOLOGIES AND APPLICATIONS

Table 1 Industry 4.0 technologies and applications

Industry 4.0 technologies	Applications of technologies
IoT's	The convenience of data collection from multiple sources on energy, pollution, efficiency, machine utilization, etc.; cost reduction in manufacturing; technology up-gradation as per ethical and sustainable standards; information on product life cycle can be accessed to promote reuse.
Cloud computing	All-time anywhere access of available data; transparency and responsiveness of the supply chains; easy sharing of important

	data; support from supply chain partners in improving ethical and sustainable operations, technology up-gradation, data on product life cycle can be stored & retrieved as per CE philosophy.
Flexible manufacturing	Reduction in lead time; increased productivity and quality; improved machine utilization; more efficient energy consumption, ethical and sustainable processes.
Additive manufacturing	Negligible scrap generation; environment-friendly process; highly flexible and consistent (intricate designs are easy to produce); testing and prototyping becomes easy, accurate, and affordable for SMEs.
Big Data Analytics	Data gathered from multiple IoTs based devices can be analyzed to get information & trends; data can be used for programming AI devices; machine & human resources utilization can be optimized; traceability of products will improve CE integration & ethical sustainability of operations.
Augmented Reality (AR)	Enables smooth integration of the workforce and resources available within the digital environment; it compounds the real world without substituting it; increased versatility, speed, efficiency, and ethical sustainability of processes; even semi-skilled workforce can work on high-end technologies.
Cyber-Physical Systems (CPS)	Machines utilization will improve; data/information on machine tools can be used to improve overall performance; user-friendly human-machine interaction for sustainable operations; autonomous decision-making; perform a task that is difficult for humans
Autonomous Robots	Suitability for industrial use in risky surroundings; enhanced versatility, ethical and sustainability of manufacturing operations

1.3 INDUSTRY PROFILE

1.3.1 Manufacturing Industry:

India's gross domestic product (GDP) at current prices stood at Rs. 51.23 lakh crore (US\$ 694.93 billion) in the first quarter of FY22, as per the provisional estimates of gross domestic product for the first quarter of 2021-22. The manufacturing GVA at current prices was estimated at US\$ 97.41 billion in the first quarter of FY22. India has potential to become a global manufacturing hub and by 2030, it can add more than US\$ 500 billion annually to the global economy.

1.3.2 IT Industry profile:

India is the world's largest sourcing destination with largest qualified talent pool of technical graduates in the world. According to National Association of Software and Service Companies (Nasscom), the Indian IT industry's revenue is estimated to reach US\$ 194 billion in FY21, an increase of 2.3% YoY. The sector is the largest employer within the private sector. According to Gartner estimates, IT spending in India is estimated to reach US\$ 93 billion in 2021 (7.3% YoY growth) and further increase to US\$ 98.5 billion in 2022. As of FY21, the IT industry employed 4.5 million people

1.3.3 Financial Sector:

The Government of India has introduced several reforms to liberalise, regulate and enhance this industry. The Government and Reserve Bank of India (RBI) have taken various measures to facilitate easy access to finance for Micro, Small and Medium Enterprises (MSMEs). India is expected to have 6.11 lakh HNWI's in 2025.

1.3.4 Agriculture Industry:

The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the food processing industry. Indian food and grocery market is the world's sixth largest, with retail contributing 70% of the sales. The Indian food processing industry accounts for 32% of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. The total agricultural and allied products exports stood at US\$ 41.25 billion in FY21.

1.3.5 Healthcare:

The healthcare market can increase three-fold to Rs. 8.6 trillion (US\$ 133.44 billion) by 2022. In Budget 2021, India's public expenditure on healthcare stood at 1.2% as a percentage of the GDP

1.3.6 FMCG:

Fast-moving consumer goods (FMCG) sector is India's fourth-largest sector with household and personal care accounting for 50% of FMCG sales in India. Growing awareness, easier access and changing lifestyles have been the key growth drivers for the sector.. Semi-urban and rural segments are growing at a rapid pace and FMCG products account for 50% of the total rural spending.

1.4 NEED FOR STUDY

Regardless of a rapid growth industry 4.0, studies associated with the identification and analysis of its elements, potential drivers, barriers, and benefits are lacking in order to fill that gap this study helps in the analysis of these elements and provide a overview about how Indian companies have adopted and practicing industry 4.0.

1.5 SCOPE OF THE STUDY

The study looks into the Indian companies and their response to Industry 4.0. The scope of the study is limited to Indian Companies and their practices, challenges and opportunities in implementing industry 4.0 in India.

1.6 OBJECTIVE OF THE STUDY

1.6.1 PRIMARY OBJECTIVE

- To analyse the impact of industry 4.0 elements and their benefits.

1.6.2 SECONDARY OBJECTIVE

- To understand the potential drivers, and barriers faced by Indian Companies while practicing of industry 4.0
- To identify the key Technology majorly used by industries.

1.7 LIMITATIONS OF THE STUDY

- There were restrictions in the time available to conduct the research, which, in turn, meant that the number of respondents had to be kept relatively small.
- The present research was conducted using a small sample size of 55 respondents. Therefore, the sample does not represent the majority of the population and The geographical location was specific to India. the results might be indicative of issues experienced in other regions in India and the rest of the world

CHAPTER 2

REVIEW OF LITERATURE

Devendra A. Patil1 (2020),The result of this technological advancement getting by industry 4.0 all manufacturer chooses the location as per the technological development and customer base and demand analysis. It gives greater transparency and accuracy between all suppliers, manufacturers, logistics, warehouses, and fulfillment are overcome unnecessary costs. Advance machine learning help to predict the demand for different products at high accuracy.

Ghadge A (2020),The internet of things plays a critical part in industry 4.0 and is also referred to as the industrial internet of things not just IIOT but other significant Technologies like Cloud Computing, artificial intelligence(AI) Computer-aided design and manufacturing (CAD/CAM), intelligence Enterprises resource planning, Programmable Logic controllers, automation industrial robot, sensors, are additive manufacturing simulations are the other innovative models of data exchange plays a critical role in digitalizing supply chains , drivers and barriers.

Zeng J., Huang J., Pan L (2020), Industry 4.0 factories have machines which are supported by wireless connectivity and sensors. These sensors are connected to a system that can visualise and monitor the entire production line and can also make its own decisions. Industry 4.0 uses smart manufacturing processes for the manufacturing of essential disposable items to fulfil the shortage of COVID-19 pandemic. It provides a smart supply chain of medical disposables and equipment during this crisis by which the patients can receive the required essential medical items, in time.

Ruan Q., Yang K., Wang W., Jiang L., Song J(2020).Industry 4.0 is a smart system, used as a flexible production line for almost entire production processes real-time information provided by Artificial intelligence (AI), Internet of Things (IoT) and other digital technologies. Designing and development of any medical part are done rapidly using advance designing software and further used digital manufacturing technologies like 3D printing to print the required parts.

Manuel Zimmermann (2019),Technologies employed in industry 4.0 projects tend to reduce exposure to the current supply chain risks such as error caused by manual

processes on all function of machinery likewise several benefits like increased flexibility predictive maintenance or associated with these technologies

Alejandro Germán Frank(2019),The second layer of Industry 4.0 technologies, which we called —base technologiesll since they support all the other ‘Smart’ dimensions discussed above. The base technologies are composed by the so-called new ICT,which includes Internet of Things (IoT), cloud services, big data and analytics These technologies are considered base because they are present in all the dimensions and in different technologies of such dimensions. They leverage the Industry 4.0 dimensions and make the interconnectivity possible as well as they provide the intelligence of the new manufacturing systems.

Kerin and Pham, (2019) Industry 4.0 comprises of different technologies like internet of things (IoT), cloud computing, additive manufacturing, cyber security with blockchain, augmented reality with artificial intelligence (AI), big data, system integration, simulation and autonomous robot.

Chiara Cimini (2018),The implementation of smart technologies and Industry 4.0 proposes new paradigms in industrial management and engineering. The advent of Industry 4.0 involves different types of impacts on different areas of the manufacturing industry. Used Assessment matrix: to find technologies for Industry 4.0 and impacts in the supply chain

Luthra and Mangla, (2018), Industry 4.0 and sustainability are relatively recent emerging technological and organizational trends that are influenced by or influence improving productivity and sustainable production.

Müller (2018), These Industry 4.0 technologies are relatively novel in developing countries, and in small and medium firms. Broader acceptance requires further in-depth understanding and developments especially for underrepresented populations; including Industry 4.0 impact on sustainability.

Dalenogare (2018), The term —Industry 4.0ll was first coined at the Hanover Fair in 2011. Subsequently, in 2013, the German government adopted it as a strategic initiative to revolutionize the manufacturing industry ,Recently, Industry 4.0 has gained increasing attention due to its numerous benefits to manufacturing organizations.

Liao(2017),Digital technologies mainly refer to modern information and communication technologies, such as cloud computing, blockchain, big data analytics, and simulation.

Song and Wang (2017), New sensor-based technologies help SMEs in continuously monitoring machine utilization, energy needs, and staff training. By thorough analysis of different Industry 4.0 technologies, data from various IoTs devices can be processed for improving the sustainability of manufacturing operations.

Dr andreas H. Glas (2016), The Technologies of industry 4.0 example sensor Technology Robotics 3D printing extra or expensive investments 20 technology or still being developed and not get made their peak of maturity.

F. Zezulka (2016),The Industry 4.0 is used for three, mutually interconnected factors: Digitization and integration of any simple technical — economical relation to complex technical — economical complex networks Digitization of products and services offer New market models.

Gibson (2014),Industry 4.0 technologies may be grouped into physical and digital technologies. Physical technologies mainly refer to manufacturing technologies such as additive manufacturing.

Brettel (2014), From the operational perspective, digital technologies, such as CPS, are proposed to reduce set-up times, labor and material costs and processing times, resulting in higher productivity of production processes.

Dombrowski and Wagner (2014),A holistic system of information technologies, people, machines and tools, which allows the flow of goods, services and data in a controlled way, through the value chain, with operations with a high degree of autonomy and high capacity to transmit useful information to decision-making.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 RESEARCH DESIGN

Research design is the framework of research methods and techniques chosen by a researcher. The design allows researchers to hone in on research methods that are suitable for the subject matter and set up their studies up for success.

3.1.1.Descriptive Research Design

In a descriptive design, a researcher is solely interested in describing the situation or case under their research study. It is a theory-based design method which is created by gathering, analyzing, and presenting collected data. This allows a researcher to provide insights into the why and how of research. Descriptive design helps others better understand the need for the research.

3.2 SAMPLING TECHNIQUE

3.2.1 Convenience Sampling Method

Convenience sampling is a method adopted by researcher where they collect market research data from a conveniently available pool of respondents. It is the most commonly used sampling technique as it's incredibly prompt, uncomplicated, and economical.

3.3 SOURCES OF DATA

3.3.1 Primary Data

Primary data is a type of data that is collected by researcher directly from main sources through interviews, surveys, experiments, etc.

3.3.2 SECONDARY DATA SOURCES

Secondary data refers to data that was collected by someone other than the user. Common sources of secondary data for Journal, Books, Websites, organizational records and data that was originally collected for other research purposes.

3.4 QUESTIONNAIRE

The research questionnaire attempted to record the responses of the respondents mainly on the key deliverables, derived from the survey conducted, and a few questions have been included to measure the impact of industry 4.0, Important factors used, benefits and challenge to implement industry 4.0.

3.5 STRUCTURE OF QUESTIONNAIRE

A questionnaire is a research instrument that consists of a set of questions or other types of prompts that aims to collect information from a respondent. A research questionnaire is typically divided into three sections. The first section related to the demographic profile of the respondents, the second section related to the company profile of the respondents and third section included questions related to the research objective and hypothesis. Open-ended, long-form questions offer the respondent the ability to elaborate on their thoughts. Close ended questions are defined as question types that ask respondents to choose from a distinct set of pre-defined responses.

3.9 SAMPLE SIZE

Sample size is a count of the individual samples or observation in any statistical settings such as a scientific experiment or a public opinion survey. The sample size for this research study is 55 collected from the Managers who are all in different manager level in various companies.

3.7 PERIOD OF STUDY

The period of study is 2 months which is from January, 2022 to April , 2022.

3.8 ANALYTICAL TOOLS

The analytical tools used are Simple percentage analysis and SPSS for testing the hypothesis by Chi-Square and one way anova.

3.8.1 Percentage analysis

Research questions are always answered with a descriptive statistic: generally either percentage or mean. Percentage is appropriate when it is important to know how many of the participants gave a particular answer. Generally, percentage is reported when the responses have discrete categories

3.8.2 Chi-square test

A Chi-square test is a hypothesis testing method. Two common Chi-square tests involve checking if observed frequencies in one or more categories match expected frequencies. This test is conducted by IBM SPSS software v26.

3.8.2 One way ANOVA

The one-way analysis of variance (ANOVA) is used to determine whether there are any statistically significant differences between the means of two or more independent (unrelated) groups (although you tend to only see it used when there are a minimum of three, rather than groups).

CHAPTER 4

DATA ANALYSIS AND INTERPRETATION

4.1 PERCENTAGE ANALYSIS

Table 4.1.1: Gender of the respondents

S.No	Gender	No of Respondents	Percentage
1.	Male	43	78.00%
2.	Female	12	22.00%
TOTAL		55	100%

Source: Primary data.

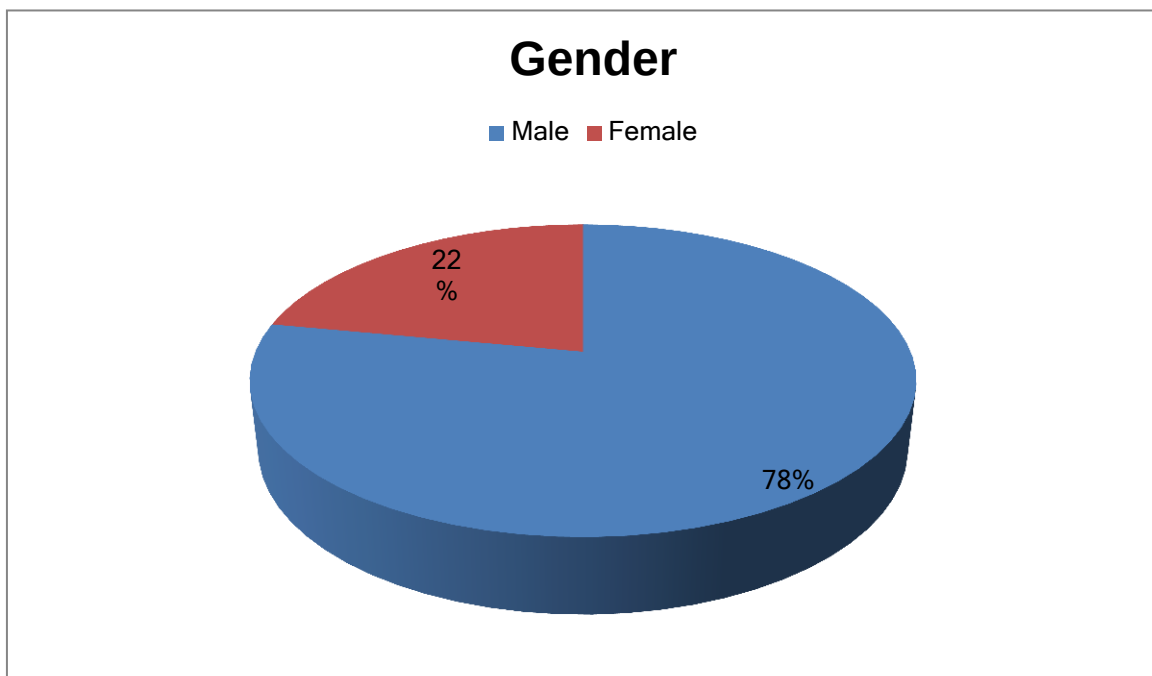


Chart 4.1.1: Gender of the respondents

INTERPRETATION

From the above table it is interpreted that the number of male respondent is 78% and female respondent is 22%.

INFERENCE

Majority (78%) of the respondents are Male.

Table 4.1.2: Job positions of the respondents

S	Job Position	No of respondents	Percentage
1.	Owner	13	23%
2.	Senior level Manager	11	20%
3.	Mid level Manager	15	28%
4.	Low level Manager	16	29%
TOTAL		55	100%

Source: Primary data

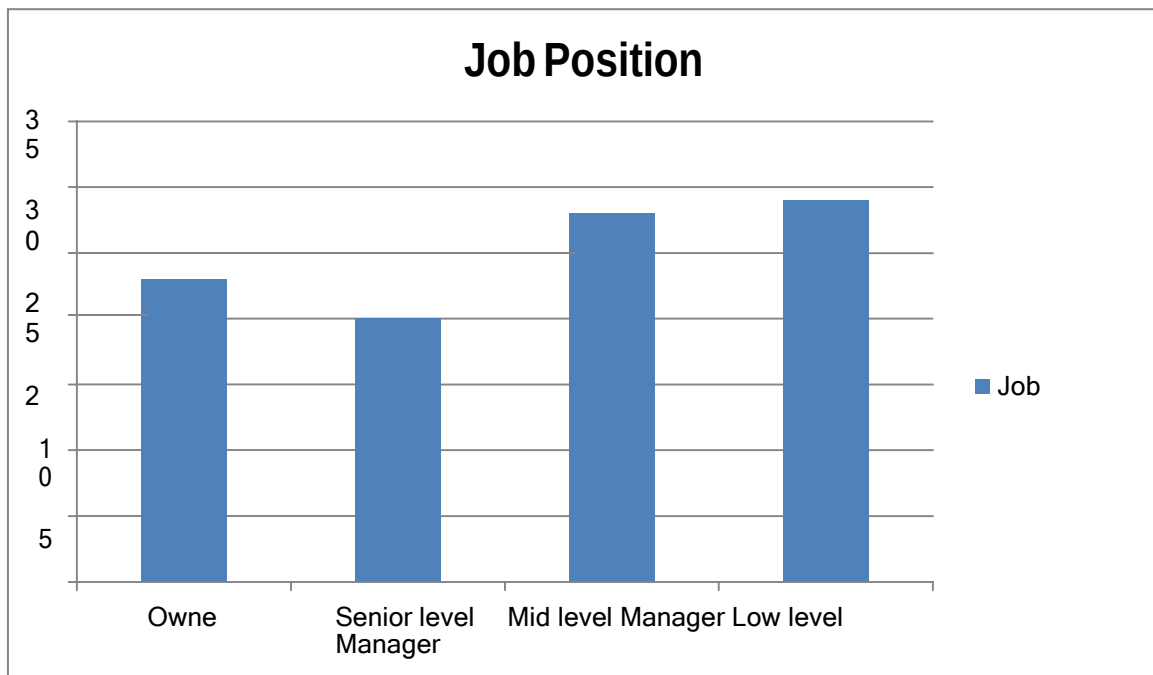


Chart 4.1.2: Job Positions of the respondents

INTERPRETATION

From the above table it is interpreted that the number of responds were, 29% is Low level Managers, 15% is Mid level managers, 13% is owners and 11% is Senior level Managers.

INFERENCE

Majority (29%) of the respondents were Low level Managers.

Table 4.1.3:Location of the companies

S. No	Location of the companies	No of respondents	Percentage
1.	Chennai	25	45%
2.	Bangalore	8	14%
3.	Hyderabad	4	7%
4.	New Delhi	6	11%
5.	Mumbai	7	13%
6.	Pune	5	10%
TOTAL		55	100%

Source: Primary data

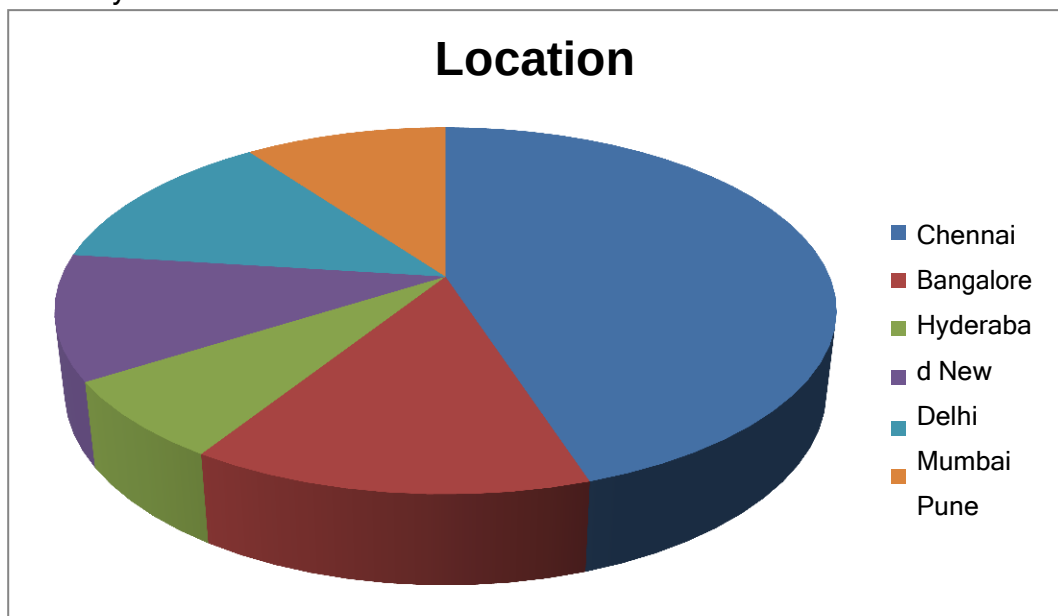


Chart 4.1.3: Location of the companies

INTERPRETATION

From the above table it is interpreted that the Location of the companies were 45 % is Chennai , 14% is Bangalore, 7% is Hyderabad, 13% Mumbai ,11% is New Delhi and 10% is pune.

INFERENCE

Majority (45%) of the respondents are from Chennai

Table 4.1.4: Company's Experience

S.No	Company's Experience	No. of Respondents	Percentage
1.	1 to 5 years	14	25%
2.	5 to 10 years	12	22%
3.	10 to 20 years	13	23%
4.	20 to 30 years	9	17%
5.	Above 30 years	7	13%
TOTAL		55	100%

Source: Primary data

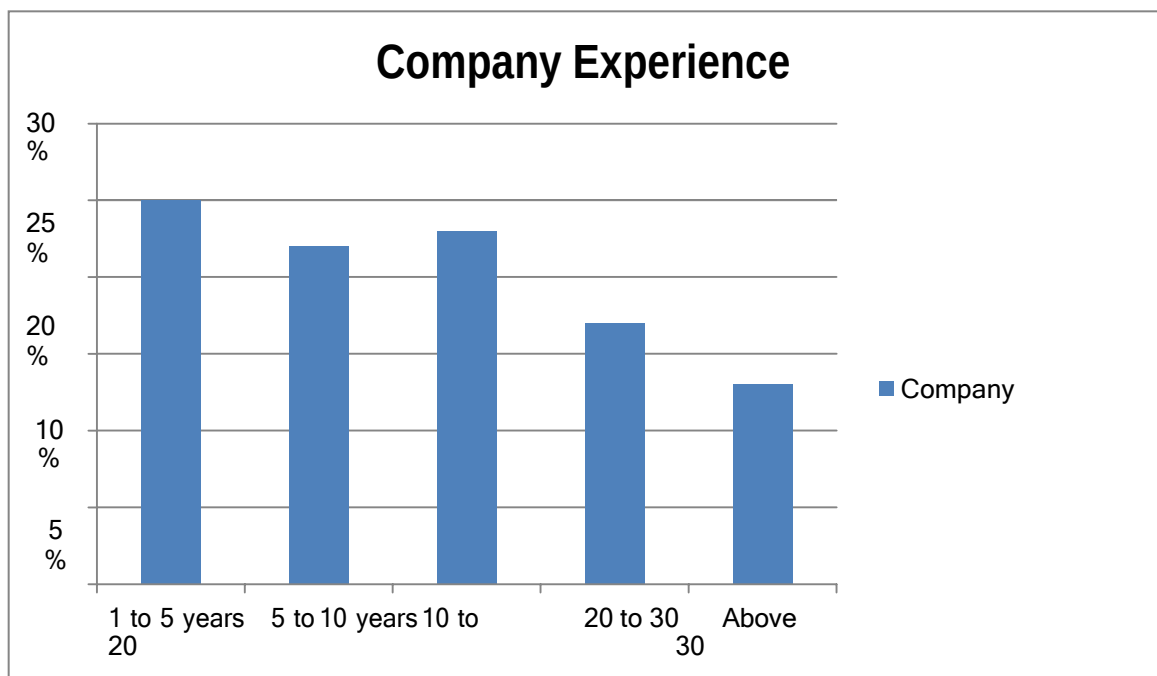


Chart 4.1.4: Company's Experience

INTERPRETATION

From the above table it is interpreted that the company's Experience were 25% is 1 to 5 years, 23% is 10 to 20 years, , 22% is 5 to 10 years, 17% is 20 to 30 years and 13% is above 30 years.

INFERENCE

Majority (25%) of the respondents company's experience is 1 to 5 years.

Table 4.1.5: Size of the company

S.No	Size of the company	No of Respondents	Percentage
1.	Micro Enterprises	7	13%
2.	Small Enterprises	16	29%
3.	Medium sized Enterprises	15	27%
4.	Large Enterprises	17	31%
TOTAL		55	100%

Source: Primary data

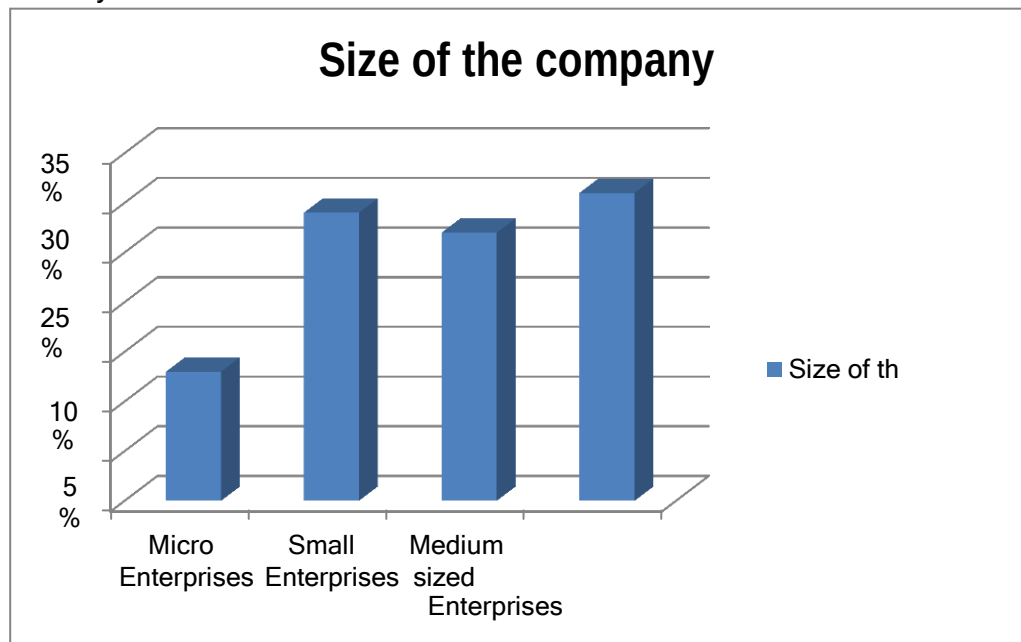


Chart 4.1.5: Size of the company

INTERPRETATION

From the above table it is interpreted that the 31% is Large Enterprises, 29% is small enterprises, 27% is Medium sized Enterprises and 13% is Micro Enterprises.

INFERENCE

Majority (31%) of the respondents employee are from Large scale enterprises.

Table 4.1.6: Industry of the respondents company

S.No	Industry	No of Respondents	Percentage
1.	Manufacturing	11	20%
2.	Software/IT service	10	18%
3.	Financial Sector	8	13%
4.	Agriculture	2	3%
5.	Healthcare	5	10%
6.	FMCG	5	10%
7.	Education & Training	6	11%
8.	Textiles	1	2%
9.	Logistics	6	11%
10.	Miscellaneous	1	2%
TOTAL		55	100%

Source: Primary data

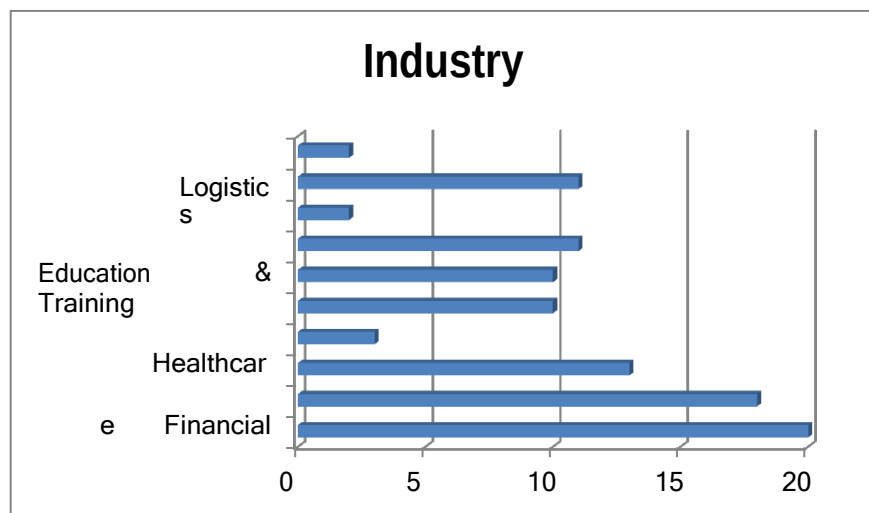


Chart 4.1.6: Industry

INTERPRETATION

From the above table it is interpreted that 20% is Manufacturing industry, 18% is Software/IT industry, 13% is finance sector, 11% is logistics and education, 10% is healthcare and FMCG, 3% is agriculture and 2% from textile.

INFERENCE

Majority (20%) of the respondents are from Manufacturing Industry.

Table 4.1.7: Company's Annual turnover

S.No	Company's Annual turnover	No of Respondents	Percentage
1.	Below 50 Lakhs	6	11%
2.	50Lakhs to 5 Crore	7	13%
3.	5 crore to 10 Crore	6	11%
4.	10 Crore to 50 Crore	8	15%
5.	50 to 100 Crore	4	7%
6.	100 crore to 250 crore	10	18%
7.	Above 250	14	25%
TOTAL		110	100%

Source: Primary data

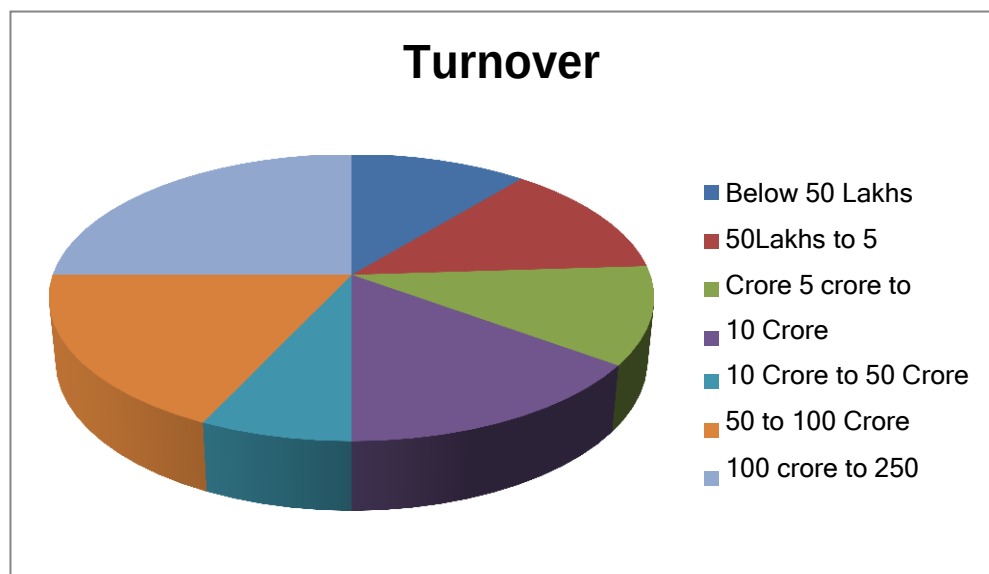


Chart 4.1.7: Company's Annual turnover

INTERPRETATION

From the above table it is interpreted that the annual turnover of the respondents companies were 25% is Above 250, 18% 100 crore to 250 crore, 15% is 10 Crore to 50 Crore, 13% is 50Lakhs to 5 Crore, 11% is Below 50 Lakhs and 5 crore to 10 Crore and 7% is 50 to 100 Crore

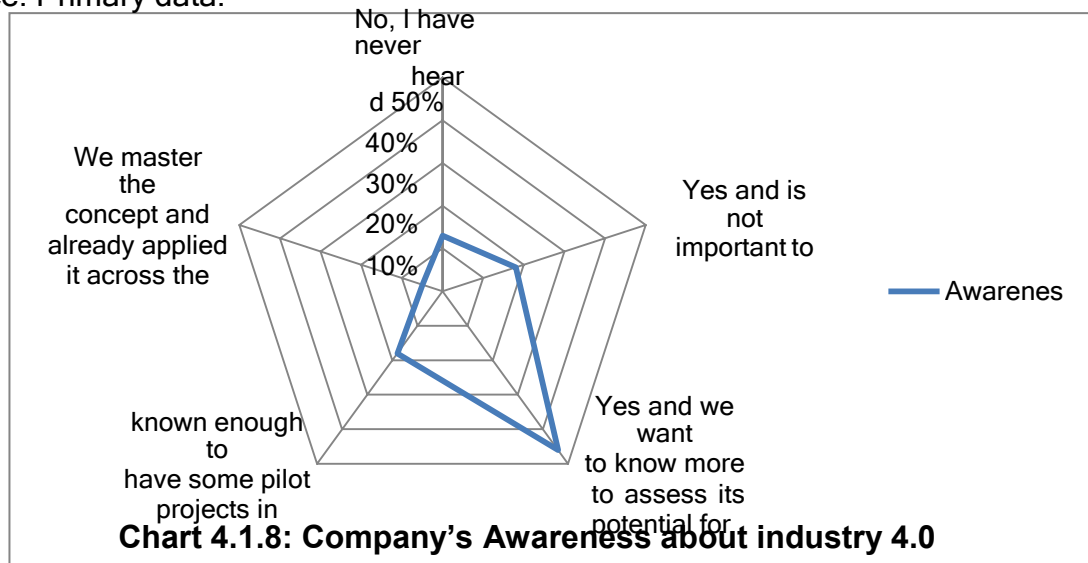
INFERENCE

Majority (25%) of the respondents Company's Annual turnover are Above 250.

Table 4.1.8: Company's Awareness about industry 4.0

S.No	Awareness about industry 4.0	No of Respondents	Percentage
1.	Yes and we want to know more to assess its potential for the company	25	46%
2.	Yes and is not important to the company	10	18%
3.	known enough to have some pilot projects in progress	10	18%
4.	We master the concept and already applied it across the company	3	5%
5.	Need to implement	7	12%
TOTAL		55	100%

Source: Primary data.



INTERPRETATION:

From the above table it is interpreted that the 46% is Yes and we want to know more to assess its potential for the company, 18% is known enough to have some pilot projects in progress and Yes and is not important to the company, 13% is No, I have never heard and 5% is We master the concept and already applied it across the company.

INFERENCE

Majority (46%) of the respondents were companies were Yes and we want to know more to assess its potential for the company.

Table 4.1.9: Reason to embrace Industry 4.0.**SA-Strongly agree, A-Agree, N- Neutral, D-Disagree, SD- Strongly Disagree**

Reason	SA	%	A	%	N	%	D	%	SD	%
Opportunity to differentiate in the market	21	38	26	47	7	13	1	2	0	0
The company has an innovative spirit, so it has to try new concepts	26	47	20	36	8	14	1	2	0	0
It's part of our market leader status	22	40	25	45	7	13	1	2	0	0
Market requirements and competitive pressure	22	40	23	42	9	16	1	2	0	0
Optimization and automation lead to enhanced productivity	18	33	26	47	10	18	1	2	0	0
Real-time data for real-time supply chains in a real-time economy	23	42	23	42	8	14	1	2	0	0
Advanced maintenance and monitoring possibilities will enable greater business continuity	19	37	28	51	6	10	2	3	0	0
Real-time monitoring, IoT-enabled quality improvement and cobots (collaborative robots) will lead to higher quality products	21	39	24	43	10	18	0	0	0	0
Superior sustainability and better working conditions	22	40	24	43	9	16	0	0	0	0
Earn the trust and loyalty the modern consumer with personalization opportunities	21	38	24	43	8	14	2	3	0	0

Source: Primary data.

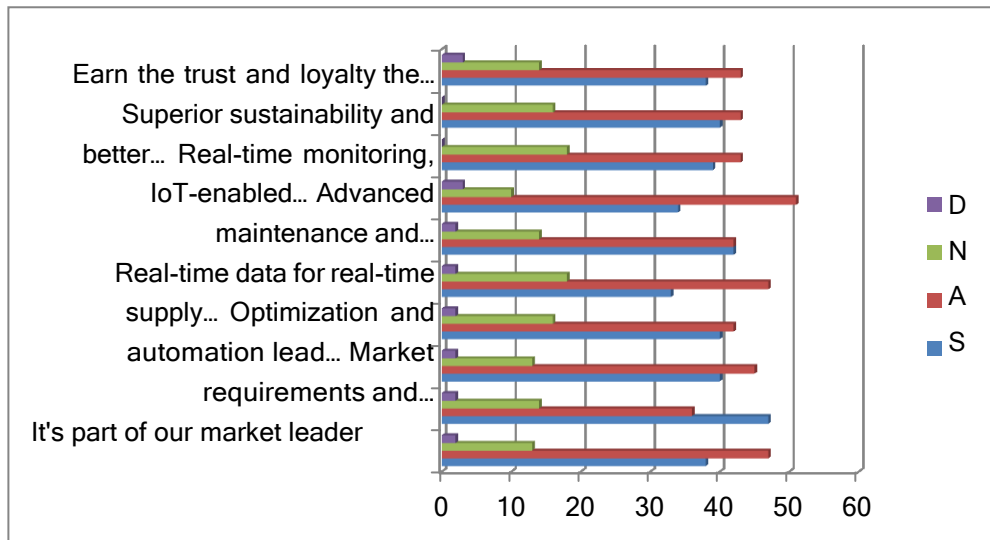


Chart 4.1.9: Reason to embrace Industry 4.0.

INTERPRETATION

- 47% agreed with its Opportunity to differentiate in the market made them to embrace industry4.0, 38 strongly agreed with its Opportunity to differentiate in the market made them to embrace industry4.0, 13% are neutral with its Opportunity to differentiate in the market made them to embrace industry4.0 and 2% disagreed with its Opportunity to differentiate in the market made them to embrace industry4.0
- 47% strongly agreed with its The company has an innovative spirit, so it has to try new concepts made them to embrace industry4.0,36% agreed with its The company has an innovative spirit, so it has to try new concepts made them to embrace industry4.0, 14% stays neutral with its The company has an innovative spirit, so it has to try new concepts made them to embrace industry4.0 and 2% disagreed with its The company has an innovative spirit, so it has to try new concepts made them to embrace industry4.0
- 45% agreed with its It's part of our market leader status made them to embrace industry4.0, 40% strongly agreed with its It's part of our market leader status made them to embrace industry4.0,13% stays neutral with its It's part of our market leader status made them to embrace industry4.0 and 2% disagreed with its It's part of our market leader status made them to embrace industry4.0.
- 42% agreed with its Market requirements and competitive pressure made them embrace industry4.0,40% strongly agreed with its Market requirements and competitive pressure made them embrace industry4.0,16% stays neutral with its Market requirements and competitive pressure made them embrace industry4.0

industry4.0 and 2% disagreed with its Market requirements and competitive pressure made them embrace industry4.0.

- 47% agreed with its Optimization and automation lead to enhanced productivity made them to embrace industry4.0,33% strongly disagree with its Optimization and automation lead to enhanced productivity made them to embrace industry4.0,18% stays neutral with its Optimization and automation lead to enhanced productivity made them to embrace industry4.0 and 2% with its Optimization and automation lead to enhanced productivity made them to embrace industry4.0.
- 42%strongly agreed and also agreed with its Real-time data for real-time supply chains in a real-time economy made them to embrace industry4.0,14% neutral with its Real-time data for real-time supply chains in a real-time economy made them to embrace industry4.0 and 2 % disagreed with its Real- time data for real-time supply chains in a real-time economy made them to embrace industry4.0.
- 51% agreed with its Advanced maintenance and monitoring possibilities will enable greater business continuity made them to embrace industry4.0,37% with its Advanced maintenance and monitoring possibilities will enable greater business continuity made them to embrace industry4.0,10% stays neutral with its business continuity made them to embrace industry4.0 and 3% disagreed with its Advanced maintenance and monitoring possibilities will enable greater business continuity made them to embrace industry4.0.
- 43% agreed with its Real-time monitoring, IoT-enabled quality improvement and robots (collaborative robots) will lead to higher quality products made them to embrace industry 4.0,39% strongly agreed with its Real-time monitoring, IoT-enabled quality improvement and robots (collaborative robots) will lead to higher quality products made them to embrace industry 4.0 and 18% stays neutral with its Real-time monitoring, IoT-enabled quality improvement and robots (collaborative robots) will lead to higher quality products made them to embrace industry 4.0.
- 43% agreed with its Superior sustainability and better working conditions made them to embrace industry 4.0,40% with its with its Superior sustainability and better working conditions made them to embrace industry 4.0 and 16% stays neutral with its Superior sustainability and better working conditions made them

- 43% agreed with its Earn the trust and loyalty the modern consumer with personalization opportunities made them to embrace industry4.0, 38% with its Earn the trust and loyalty the modern consumer with personalization opportunities made them to embrace industry4.0, 14% stays neutral with its Earn the trust and loyalty the modern consumer with personalization opportunities made them to embrace industry4.0 and 3% disagreed with its Earn the trust and loyalty the modern consumer with personalization opportunities made them to embrace industry4.0

INFERENCE

- Majority (47%) agreed with its Opportunity to differentiate in the market made them to embrace industry4.0.
- Majority (47%) strongly agreed with its The company has an innovative spirit, so it has to try new concepts made them to embrace industry4.
- Majority (45%) agreed with its It's part of our market leader status made them to embrace industry4.0.
- Majority (42%) agreed with its Market requirements and competitive pressure made them embrace industry4.0
- Majority (47%) agreed with its Optimization and automation lead to enhanced productivity made them to embrace industry4.0.
- Majority (42%) strongly agreed and also agreed with its Real-time data for real-time supply chains in a real-time economy made them to embrace industry4.0.
- Majority (51%) agreed with its Advanced maintenance and monitoring possibilities will enable greater business continuity made them to embrace industry4.0.
- Majority (43%) agreed with its Real-time monitoring, IoT-enabled quality improvement and robots (collaborative robots) will lead to higher quality products made them to embrace industry 4.0.
- Majority (43%) agreed with its Superior sustainability and better working conditions made them to embrace industry 4.0.
- Majority (43%) agreed with its Earn the trust and loyalty the modern consumer with personalization opportunities made them to embrace industry4.0.

Table 4.1.10: Strategy For the industry 4.0

S.No	Strategy For the industry 4.0	No. of Respondents	Percentage
1.	Implemented and Continuously updated	13	23%
2.	Implemented	22	40%
3.	In planning	12	22%
4.	No specific strategy	8	15%
TOTAL		55	100%

Source: Primary data.

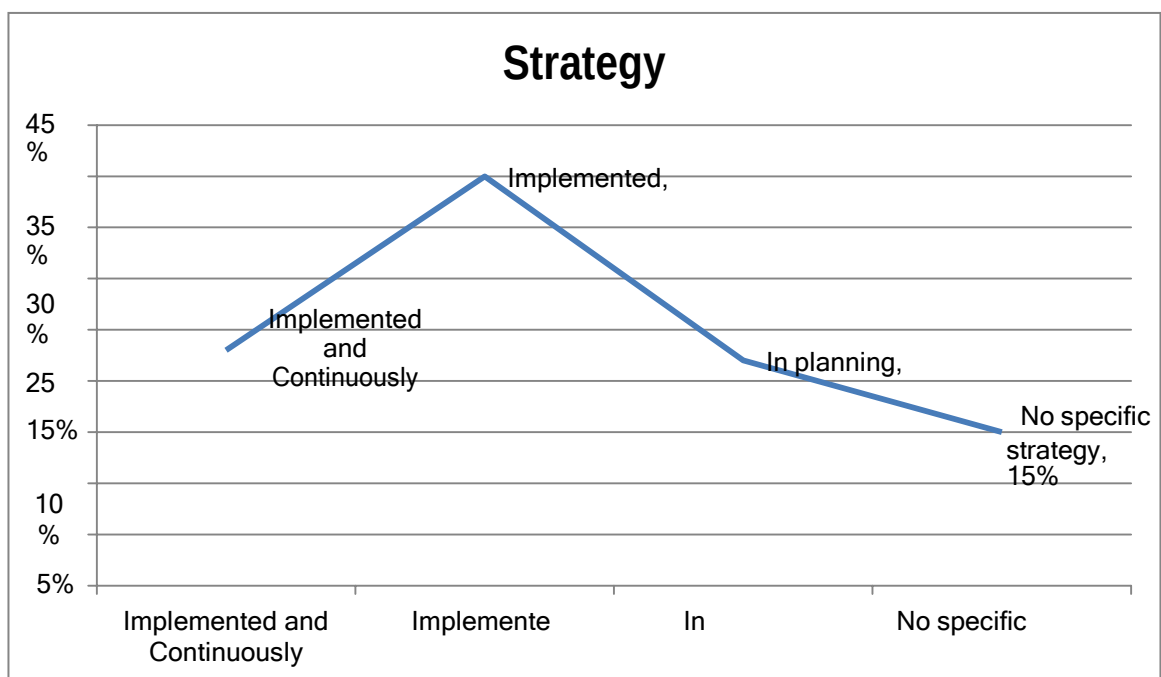


Chart 4.1.11: Strategy For the industry 4.0

INTERPRETATION

From the above table it is interpreted that the 40% is Implemented, 23% is Implemented and Continuously updated, 22% is In planning and 15% is No specific strategy.

INFERENCE

Majority (50%) of the respondents are Implemented the Strategy For the industry 4.0.

Table 4.1.11: Important Industry 4.0 Technology used in companies

VI- Very Important, I-Important, N- Neutral, NI-Not Important, NVI-Not Very Important

Important Technology	VI	%	I	%	N	%	NI	%	NVI	%
Big Data	20	36	25	45	9	16	1	2	0	0
Cloud computing	17	31	28	51	8	14	1	2	1	2
Robotics	17	31	26	47	10	18	2	3	0	0
Artificial Intelligence	22	40	24	43	9	17	0	0	0	0
Data Analytics	19	34	28	51	5	6	3	5	0	0
Cyber Security	22	40	23	41	9	16	1	2	0	0
Additive Manufacturing	12	22	26	47	15	27	2	3	0	0
Systems Integration	19	34	26	47	8	14	2	3	0	0

Source: Primary data.

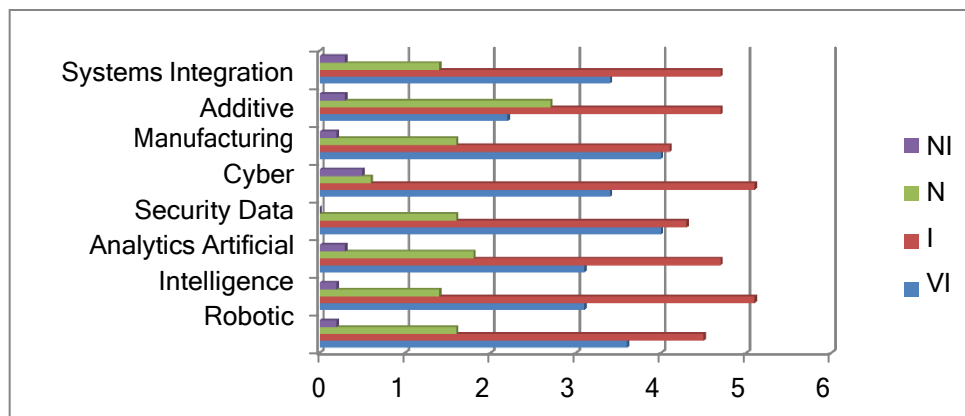


Chart 4.1.11: Important Industry 4.0 Technology used in companies

INTERPRETATION

- 45% considered that big data is important for their company,36% considered that big data is very important for their company,16% stayed neutral with big data and only 2% considered big data is not important for their company.
- 51% considered that cloud computing is important for their company,31% considered that cloud computing is very important for their company,14% stayed neutral with cloud computing and only 2% considered cloud computing is not important and not very important for their company.
- 47% considered that robotics is important for their company,31% considered that robotics is very important for their company,18% stayed neutral with robotics and only 3% considered robotics is not important for their company.
- 43% considered that artificial intelligence is important for their company,40% considered that artificial intelligence is very important for their company,17% stayed neutral with artificial intelligence.
- 51% considered that Data analytics is important for their company,34% considered that Data analytics is very important for their company,6% stayed neutral with Data analytics and only 35% considered Data analytics is not important for their company.
- 41% considered that cyber security is important for their company,40% considered that cyber security is very important for their company,16% stayed neutral with cyber security and only 2% considered cyber security is not important for their company.
- 47% considered that additive manufacturing is important for their company,22% considered that additive manufacturing is very important for their company,27% stayed neutral with additive manufacturing and only 3% considered additive manufacturing is not important for their company.
- 47% considered that system integration is important for their company,34% considered that system integration is very important for their company,14% stayed neutral with system integration and only 3% considered system integration is not important for their company.

INFERENCE

- Majority (45%)considered that big data is important for their company.
- Majority (51%) considered that cloud computing is important for their company.

- Majority (47%) considered that robotics is important for their company.
- Majority (43%) considered that artificial intelligence is important for their company.
- Majority (51%) considered that Data analytics is important for their company.
- Majority (41%) considered that cyber security is important for their company.
- Majority (47%) considered that additive manufacturing is important for their company
- Majority (47%) considered that system integration is important for their company.

Table 4.1.12: Impact of Industry 4.0 in companies

VL-Very Low, L-Low, N- Neutral, H-High, VH-Very High

Factor	VL	%	L	%	N	%	H	%	VH	%
Productivity & Efficiency	2	3	2	3	12	22	24	43	15	27
Profitability	1	2	4	7	21	38	20	36	9	16
Employment	1	2	8	14	17	31	21	38	8	14
Quality	2	3	3	5	16	29	23	41	11	20
Revenue growth	2	3	5	9	16	29	19	34	13	24

Source: Primary data

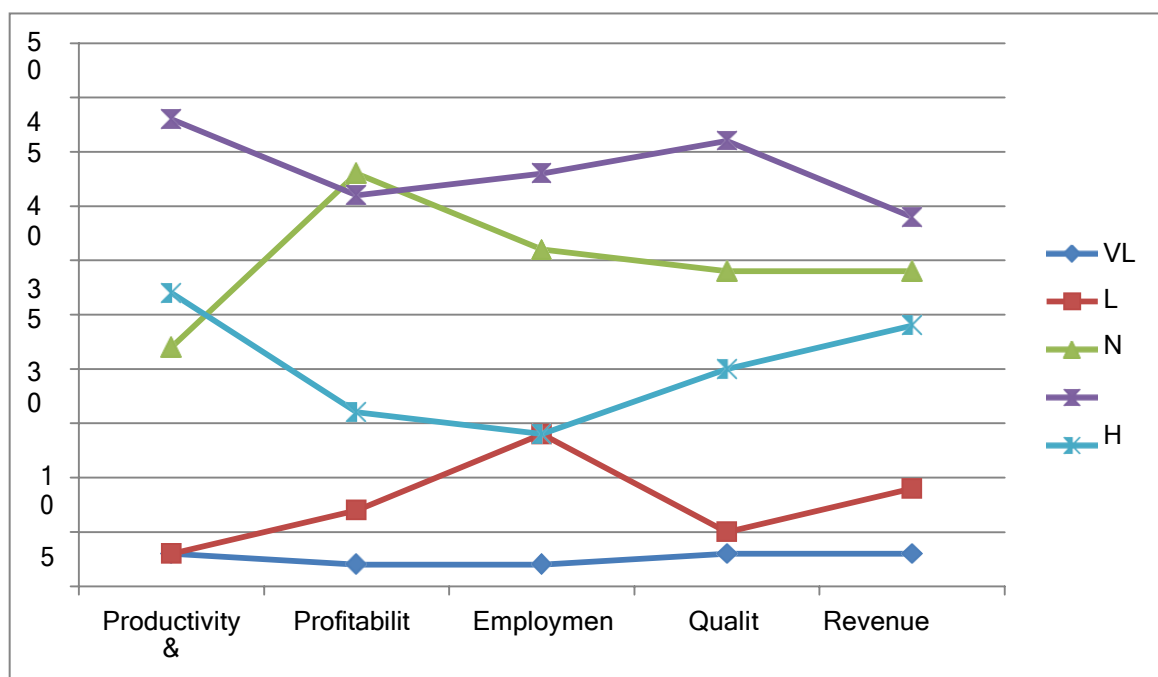


Chart 4.1.13: Impact of Industry 4.0 in companies

INTERPRETATION

- 43% are considered industry 4.0 has high impact on Productivity & Efficiency, 27% are considered industry 4.0 has very high impact on Productivity & Efficiency, 22% stayed neutral on impact on Productivity & Efficiency, 3% are considered industry 4.0 has low on Productivity & Efficiency and 3% are considered industry 4.0 has Very low on Productivity & Efficiency.

- 38% are considered industry 4.0 has neutral impact on profitability,36%. are considered industry 4.0 has high impact on profitability,16% considered has high impact on profitability,7% are considered industry 4.0 has low on profitability and 2% are considered industry 4.0 has Very low on profitability.
- 38% are considered industry 4.0 has high impact on employment,31%. are considered industry 4.0 has neutral impact on employment,14% considered has high impact on employment,4% are considered industry 4.0 has low on employment and 2% are considered industry 4.0 has Very low on employment.
- 41% are considered industry 4.0 has high impact on Quality,29%. are considered industry 4.0 has neutral impact on Quality,20% considered has high impact on Quality,5% are considered industry 4.0 has low on Quality and 3% are considered industry 4.0 has Very low on Quality.
- 34% are considered industry 4.0 has high impact on Revenue growth,29%.are considered industry 4.0 has neutral impact on Revenue growth,24% considered has high impact on Revenue growth,9% are considered industry 4.0 has low on Revenue growth and 3% are considered industry 4.0 has Very low on Revenue growth.

INFERENCE

- Majority (43%) are considered industry 4.0 has high impact on Productivity & Efficiency.
- Majority (38%) are considered industry 4.0 has neutral impact on profitability.
- Majority (38%) are considered industry 4.0 has high impact on employment.
- Majority (41%) are considered industry 4.0 has high impact on Quality.
- Majority (34%) are considered industry 4.0 has high impact on Revenue growth.

Table 4.1.13: Impact influenced by Elements of Industry 4.0

BC-Big data /Cloud computing, IOT- Internet of things, AR- Autonomous robots, AM – Additive Manufacturing , SS- Smart Sensors, AI- Artificial Intelligence

Elements	BC	%	IOT	%	AR	%	AM	%	SS	%	AI	%
Productivity and efficiency	30	26	32	27	14	12	17	14	12	10	11	9
Profitability	25	26	34	35	11	11	9	9	7	7	6	6
Employment	25	26	29	30	17	18	13	14	4	4	7	7
Quality	26	26	27	27	17	17	8	8	11	11	10	10
Revenue Growth	23	22	34	32	17	16	10	9	9	8	12	11

Source: Primary data.

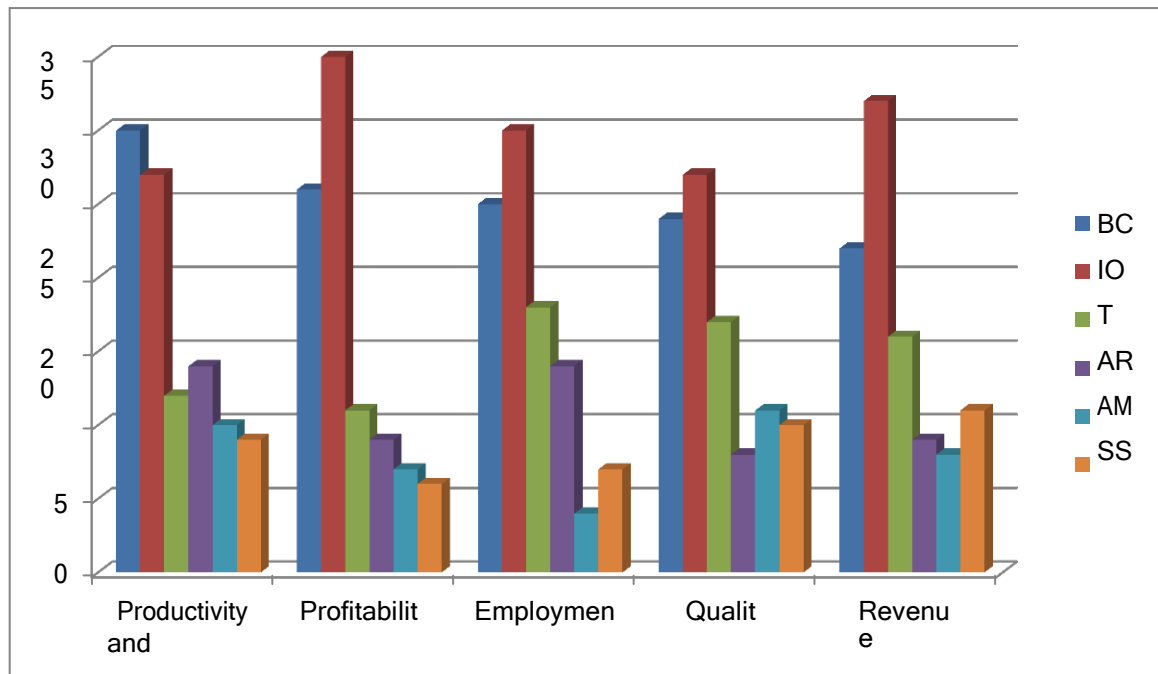


Chart 4.1.13: Impact influenced by Elements of Industry 4.0

INTERPRETATION:

From the above table it is interpreted that

- 27% considered that productivity and efficiency is influenced by Internet of things, 26% considered that productivity and efficiency is influenced by big

data, 12% considered that productivity and efficiency is influenced by autonomous robots, 14% considered that productivity and efficiency is influenced by additive manufacturing, 10% considered that productivity and efficiency is influenced by smart sensor and 9% considered that productivity and efficiency is influenced by artificial intelligence.

- 35% considered that profitability is influenced by Internet of things, 26% considered that profitability is influenced by big data, 11% considered that profitability is influenced by autonomous robots, 9% considered that profitability is influenced by additive manufacturing, 7% considered that profitability is influenced by smart sensor and 6% considered that profitability influenced by artificial intelligence.
- 30% considered that Employment is influenced by Internet of things, 26% considered that Employment is influenced by big data, 18% considered that Employment is influenced by autonomous robots, 14% considered that Employment is influenced by additive manufacturing, 4% considered that
- 27% considered that Quality is influenced by Internet of things, 26% considered that Quality is influenced by big data, 17% considered that Quality is influenced by autonomous robots, 8% considered that Quality is influenced by additive manufacturing, 11% considered that Quality is influenced by smart sensor and 10% considered that Quality influenced by artificial intelligence.
- 32% considered that Revenue Growth is influenced by Internet of things, 22% considered that Revenue Growth is influenced by big data, 16% considered that Revenue Growth is influenced by autonomous robots, 9% considered that Revenue Growth is influenced by additive manufacturing, 8% considered that Revenue Growth is influenced by smart sensor and 11% considered that Revenue Growth influenced by artificial intelligence

INFERENCE

- Majority (27%) considered that productivity and efficiency is influenced by Internet of things.
- Majority (35%) considered that profitability is influenced by Internet of things.
- Majority (30%) considered that Employment is influenced by Internet of things.
- Majority (27%) considered that Quality is influenced by Internet of things.
- Majority (22%) considered that Revenue Growth is influenced by big data

Table 4.1.14: Benefits by implementing Industry 4.0 in companies

VL-Very Low, L-Low, N- Neutral, H-High, VH-Very High

Benefits	VH	%	H	%	N	%	L	%	VL	%
Business competitiveness	21	38	25	45	7	13	1	2	1	2
Productivity and revenue	24	43	21	38	9	16	0	0	1	2
Technology development	22	40	25	45	7	13	0	0	1	2
Resource efficiency	22	40	24	43	8	14	0	0	1	2
Real-time data	23	41	24	43	7	13	1	2	0	0
Customer satisfaction	22	40	24	43	8	14	1	2	0	0
Process transparency	23	41	25	45	6	11	1	2	0	0

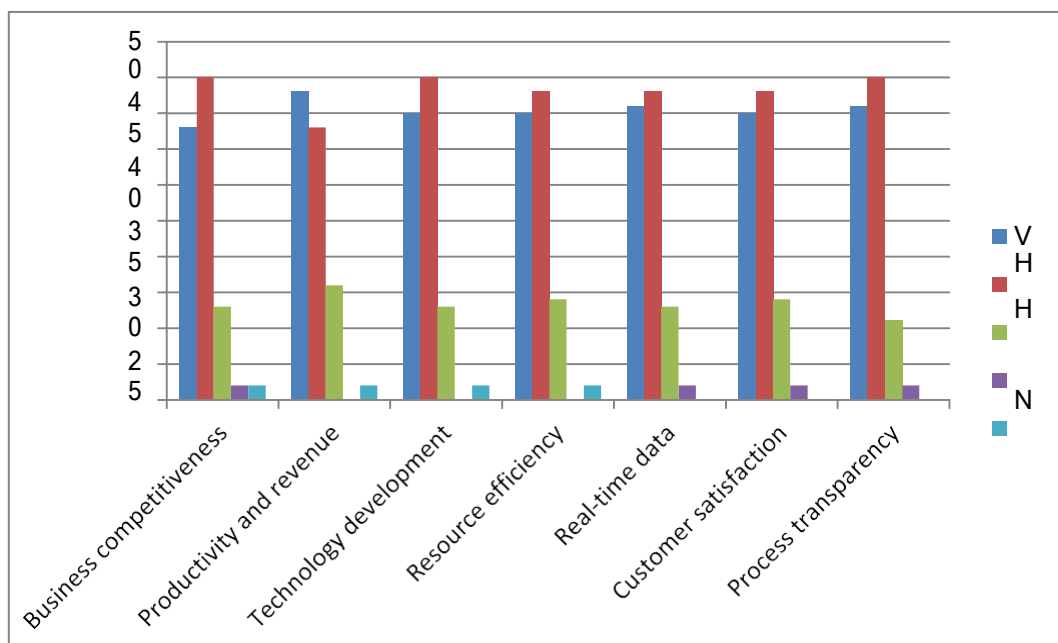


Chart 4.1.15: Benefits by implementing Industry 4.0 in companies

INTERPRETATION

From the above table it is interpreted that the

- 45% of respondents are realized high benefits as Business competitiveness,38% of respondents are realized very high benefits as Business competitiveness, 14% of respondents are realized Neutral benefits as Business competitiveness,1% of respondents are realized low & very low benefits as Business competitiveness
- 43% of respondents are realized very high benefits as Productivity and revenue,38% of respondents are realized high benefits as Productivity and revenue, 16% of respondents are realized Neutral benefits as Productivity and revenue,2% of respondents are realized low & very low benefits as Productivity and revenue.
- 45% of respondents are realized high benefits as Technology development,40% of respondents are realized very high benefits as Technology development, 13% of respondents are realized Neutral benefits as Technology development,2% of respondents are realized low & very low benefits as Technology development.
- 43% of respondents are realized high benefits as Resource efficiency,40% of respondents are realized very high benefits as Resource efficiency, 14% of respondents are realized Neutral benefits as Resource efficiency,2% of respondents are realized low & very low benefits as Resource efficiency.
- 43% of respondents are realized high benefits as Real-time data,41% of respondents are realized very high benefits as Real-time data, 13% of respondents are realized Neutral benefits as Real-time data,2% of respondents are realized low & very low benefits as Real-time data.
- 43% of respondents are realized high benefits as Customer satisfaction,40% of respondents are realized very high benefits as Customer satisfaction 14% of respondents are realized Neutral benefits as Customer satisfaction 2% of respondents are realized low& very low benefits as Customer satisfaction.
- 45% of respondents are realized high benefits as Process transparency,41% of respondents are realized very high benefits as

INFERENCE

- Majority (45%) of respondents are realized high benefits as Business competitiveness.
- Majority (43%) of respondents are realized very high benefits as Productivity and revenue
- Majority (45%) of respondents are realized high benefits as Technology development.
- Majority (43%) of respondents are realized high benefits as Resource efficiency.
- Majority (43%) of respondents are realized high benefits as Real-time data.
- Majority (45%) of respondents are realized high benefits as Process transparency.
- Majority (45%) of respondents are realized high benefits as Process transparency.

Table 4.1.15: Challenges by implementing Industry 4.0 in companies

VL-Very Low, L-Low, N- Neutral, H-High, VH-Very High

Challenges	VH	%	H	%	N	%	L	%	VL	%
Security threats	18	33	29	52	7	13	1	2	0	0
Handling Data Growth	18	33	24	44	13	24	0	0	0	0
Interoperability	15	27	29	52	10	18	1	2	0	0
Insufficient Technical Skills	19	34	28	51	6	11	2	3	0	0
Data sensitivity	12	22	27	49	14	25	2	3	0	0

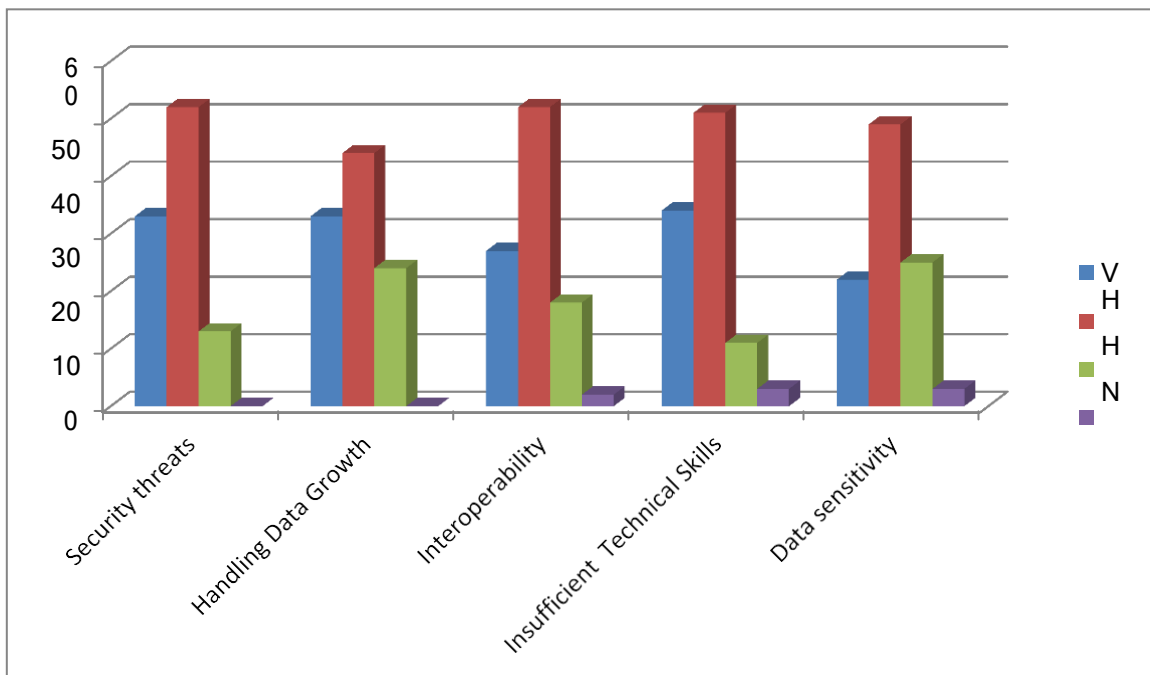


Chart 4.1.16: Challenges by implementing Industry 4.0 in companies

INTERPRETATION

From the above table it is interpreted that

- 52% of respondents are realized high challenge in Security

threats,33% of respondents are realized very high challenge in Security threats, 13% of respondents are realized Neutral challenge in Security threats,2% of respondents are realized low & very low challenge in Security threats.

- 44% of respondents are realized high challenge in Handling Data Growth,33% of respondents are realized very high challenge in Handling Data Growth, 24% of respondents are realized Neutral challenge in Handling Data Growth.
- 52% of respondents are realized high challenge in Interoperability ,27% of respondents are realized very high challenge in Interoperability, 13% of respondents are realized Neutral challenge in Interoperability,2% of respondents are realized low & very low challenge in Interoperability.
- 51% of respondents are realized high challenge in Insufficient Technical Skills,34% of respondents are realized very high challenge in Insufficient Technical Skills ,11% of respondents are realized Neutral challenge in Insufficient Technical Skills,3% of respondents are realized low & very low challenge in Insufficient Technical Skills.
- 49% of respondents are realized high challenge in Data sensitivity,22% of respondents are realized very high challenge in Data sensitivity,25% of respondents are realized Neutral challenge in Data sensitivity,3% of respondents are realized low & very low challenge in Data sensitivity.

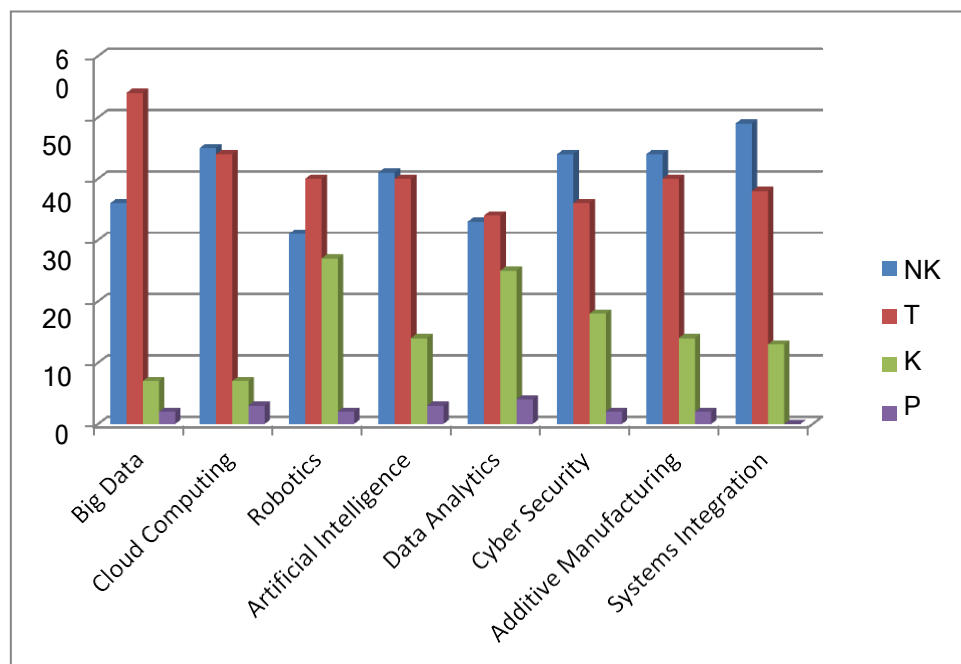
INFERENCE

- Majority (52%) of respondents are realized high challenge in Security threats.
- Majority (44%) of respondents are realized high challenge in Handling Data Growth.
- Majority (52%) of respondents are realized high challenge in Interoperability.
- Majority (51%) of respondents are realized high challenge in Insufficient Technical Skills.
- Majority (49%) of respondents are realized high challenge in Data sensitivity

Table 4.1.16: Knowledge about Industry 4.0 elements

NK-No Knowledge, TK-Theoretical Knowledge, PK- Practical Knowledge, APK-Advanced practical Knowledge.

Elements	NK	%	TK	%	Pk	%	APk	%
Big Data	20	36	30	54	4	7	1	2
Cloud Computing	25	45	24	44	4	7	2	3
Robotics	17	31	22	40	15	27	1	2
Artificial Intelligence	23	41	22	40	8	14	2	3
Data Analytics	18	33	19	34	14	25	3	4
Cyber Security	24	44	20	36	10	18	1	2
Additive Manufacturing	24	44	22	40	8	14	1	2
Systems Integration	27	49	21	38	7	13	0	0



INTERPRETATION

- 36% responded that they have no knowledge about big data,54% responded that they have theoretical knowledge about big data,7% responded that they have practical knowledge about big data and 2% responded that they have advanced practical knowledge big data.
- 45% responded that they have theoretical knowledge about Cloud Computing,44% responded that they have no knowledge about Cloud Computing,7% responded that they have practical knowledge about Cloud Computing and 2% responded that they have advanced practical knowledge about Cloud Computing.
- 40% responded that they have theoretical knowledge about Robotics,41% responded that they have no knowledge about Robotics,27% responded that they have practical knowledge about Robotics and 2% responded that they have advanced practical knowledge about Robotics.
- 41% responded that they have no knowledge about Artificial Intelligence,40% responded that they have theoretical knowledge about Artificial Intelligence,14% responded that they have practical knowledge about Artificial Intelligence and 3% responded that they have advanced practical knowledge about Artificial Intelligence.
- 34% responded that they have theoretical knowledge about Data Analytics ,33% responded that they have no knowledge about Data Analytics,25% responded that they have practical knowledge about Data Analytics and 4% responded that they have advanced practical knowledge about Data Analytics.
- 44% responded that they have no knowledge about Cyber Security,36% responded that they have theoretical knowledge about Cyber Security,18% responded that they have practical knowledge about Cyber Security and 2% responded that they have advanced practical knowledge about Cyber Security.
- 44% responded that they have no knowledge about Additive

Manufacturing,40% responded that they have theoretical knowledge about Additive Manufacturing,14% responded that they have practical knowledge about Additive Manufacturing and 2% responded that they have advanced practical knowledge about Additive Manufacturing.

- 49% responded that they have no knowledge about Systems Integration 38% responded that they have theoretical knowledge about Systems Integration,13% responded that they have practical knowledge about Systems Integration .

INFERENCE

- Majority (36%) responded that they have no knowledge about big data.
- Majority (45%) responded that they have theoretical knowledge about Cloud Computing.
- Majority (40%) responded that they have theoretical knowledge about Robotics.
- Majority (41%) responded that they have no knowledge about Artificial Intelligence.
- Majority (34%) responded that they have theoretical knowledge about Data Analytics.
- Majority (44%) responded that they have no knowledge about CyberSecurity.
- Majority (44%) responded that they have no knowledge about Additive Manufacturing.
- Majority (49%) responded that they have no knowledge about Systems Integration.

4.2 Chi-square

Table 4.2.1: The association between the No of years of existence and Implementation of industry 4.0.

Null Hypothesis (H0) – There is no association between the years of existence and Implementation of industry 4.0.

Alternative Hypothesis (H1) – There is association between the years of existence and Implementation of industry 4.0.

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
No of years in Market * Implementation of industry 4.0	55	78.6%	15	21.4%	70	100.0%

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	22.931 ^a	12	.028
Likelihood Ratio	27.283	12	.007
Linear-by-Linear Association	8.743	1	.003
N of Valid Cases	55		
19 cells (95.0%) have expected count less than 5. The minimum expected count is 1.02.			

Source: Primary data

INTERPRETATION:

Since p-value **0.028** is Lesser than 0.05.we accept the alternative hypothesis (H1) and reject the null hypothesis (H0). Therefore, there is an association between years of existence and Implementation of industry 4.0.

4.3 One way ANOVA

Table 4.3.1: The significant difference between the size of the company and the impact of industry 4.0 in productivity and efficiency

Null Hypothesis (H0) – There is no statistically significant difference between the size of the company and the impact of industry 4.0 in productivity and efficiency.

Alternative Hypothesis (H1) – There is statistically significant difference between the size of the company and the impact of industry 4.0 in productivity and efficiency.

Descriptives								
Size of the company								
	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
very low	2	1.0000	.00000	.00000	1.0000	1.0000	1.00	1.00
low	2	1.5000	.70711	.50000	-4.8531	7.8531	1.00	2.00
neutral	14	2.7857	.97496	.26057	2.2228	3.3486	1.00	4.00
high	26	2.7308	.91903	.18024	2.3596	3.1020	1.00	4.00
very high	11	3.3636	1.02691	.30963	2.6737	4.0535	1.00	4.00
Total	55	2.7636	1.03573	.13966	2.4836	3.0436	1.00	4.00

ANOVA					
Size of the company					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13.409	4	3.352	3.765	.009
Within Groups	44.518	50	.890		
Total	57.927	54			

INTERPRETATION:

Significance level **0.009**, which is below 0.05 therefore, There is a significant difference between the between the size of the company and the impact of industry 4.0 in productivity and efficiency.

CHAPTER 5

5.1. FINDINGS

- 1) Majority (78%) of the respondents are Male.
- 2) Majority (29%) of the respondents were Low level Managers.
- 3) Majority (45%) of the respondents are from Chennai
- 4) Majority (25%) of the respondents company's experience is 1 to 5years.
- 5) Majority (31%) of the respondents employee are from Large scale enterprises
- 6) Majority (20%) of the respondents are from Manufacturing Industry
- 7) Majority (25%) of the respondents Company's Annual turnover are Above 250.
- 8) Majority (46%) of the respondents were companies were Yes and we want to know more to assess its potential for the company.
- 9) Majority (47%) agreed with its Opportunity to differentiate in the market made them to embrace industry 4.0.
- 10) Majority (47%) strongly agreed with its The company has an innovative spirit, so it has to try new concepts made them to embrace industry 4.0.
- 11) Majority (45%) agreed with its It's part of our market leader status made them to embrace industry 4.0.
- 12) Majority (42%) agreed with its Market requirements and competitive pressure made them embrace industry 4.0.
- 13) Majority (47%) agreed with its Optimization and automation lead to enhanced productivity made them to embrace industry 4.0.
- 14) Majority (42%) strongly agreed and also agreed with its Real-time data for real-time supply chains in a real-time economy made them to embrace industry 4.0.
- 15) Majority (51%) agreed with its Advanced maintenance and monitoring possibilities will enable greater business continuity made them to embrace industry 4.0.
- 16) Majority (43%) agreed with its Real-time monitoring, IoT-enabled quality improvement and robots (collaborative robots) will lead to higher quality products

made them to embrace industry 4.0.

17) Majority (43%) agreed with its Superior sustainability and better working conditions made them to embrace industry 4.0.

18) Majority (43%) agreed with its Earn the trust and loyalty the modern consumer with personalization opportunities made them to embrace industry 4.0.

19) Majority (50%) of the respondents are Implemented the Strategy For the industry 4.0

20) Majority (45%) considered that big data is important for their company.

21) Majority (51%) considered that cloud computing is important for their company.

22) Majority (47%) considered that robotics is important for their company.

23) Majority (43%) considered that artificial intelligence is important for their company.

24) Majority (51%) considered that Data analytics is important for their company.

25) Majority (41%) considered that cyber security is important for their company.

26) Majority (47%) considered that additive manufacturing is important for their company

27) Majority (47%) considered that system integration is important for their company.

28) Majority (43%) are considered industry 4.0 has high impact on Productivity & Efficiency.

29) Majority (38%) are considered industry 4.0 has neutral impact on

30) Majority (41%) are considered industry 4.0 has high impact on Quality.

31) Majority (34%) are considered industry 4.0 has high impact on Revenue growth.

32) Majority (27%) considered that productivity and efficiency is influenced by Internet of things.

33) Majority (35%) considered that profitability is influenced by Internet of things.

34) Majority (30%) considered that Employment is influenced by Internet of things.

- 35) Majority (27%) considered that Quality is influenced by Internet of things.
- 36) Majority (22%) considered that Revenue Growth is influenced by big data
- 37) Majority (45%) of respondents are realized high benefits as Business competitiveness.
- 38) Majority (43%) of respondents are realized very high benefits as Productivity and revenue
- 39) Majority (45%) of respondents are realized high benefits as Technology development.
- 40) Majority (43%) of respondents are realized high benefits as Resource efficiency.
- 41) Majority (43%) of respondents are realized high benefits as Real-time data.
- 42) Majority (45%) of respondents are realized high benefits as Process transparency.
- 43) Majority (45%) of respondents are realized high benefits as Process transparency.
- 44) Majority (52%) of respondents are realized high challenge in Security threats.
- 45) Majority (44%) of respondents are realized high challenge in Handling Data Growth.
- 46) Majority (52%) of respondents are realized high challenge in Interoperability.
- 47) Majority (51%) of respondents are realized high challenge in Insufficient Technical Skills.
- 48) Majority (49%) of respondents are realized high challenge in Data sensitivity.
- 49) Majority (36%) responded that they have no knowledge about big data.
- 50) Majority (45%) responded that they have theoretical knowledge about Cloud Computing.
- 51) Majority (40%) responded that they have theoretical knowledge about Robotics.
- 52) Majority (41%) responded that they have no knowledge about Artificial

Intelligence.

53) Majority (34%) responded that they have theoretical knowledge about Data Analytics.

54) Majority (44%) responded that they have no knowledge about Cyber Security.

55) Majority (44%) responded that they have no knowledge about Additive Manufacturing.

56) Majority (49%) responded that they have no knowledge about Systems Integration.

57) There is an association between No of years in Market and Implementation of industry 4.0.

58) There is a statistically significant difference between the size of the company and the impact of industry 4.0 in productivity and efficiency.

5.2 Suggestion

It is suggested that,

- 1) To overcome security threats companies have to invest more in cyber security for the company and adopt new technologies at any cost,
- 2) For handling data growth companies have to have more manpower
- 3) More advanced technical knowledge to avoid insufficiency in technical knowledge companies have to conduct training sessions on which the employee has been working on.
- 4) Every manager or employee should have sufficient practical knowledge in industry 4.0 technology they have been working

5.3 Conclusion

Regardless of a rapid growth industry 4.0, this study is associated with the identification and analysis of its elements, potential drivers, barriers, benefits and challenges as a result of it many companies have known about the industry 4.0 and they wanted to assess more of its potential for their companies and the potential drivers to embrace industry 4.0 were opportunity to differentiate in the market, Market requirements and competitive pressure, Superior sustainability and better working conditions, most of the companies have implemented industry 4.0 with specific strategy and some are planning they believe all the

industry 4.0 elements has huge importance for their companies according to their sectors. Companies having more good impact on Productivity, profitability, employment and quality and also have equal benefits and challenges according to their sectors and to conclude it to overcome security threats companies have invest more in cyber security for the company and adopt new technologies at any cost, More advanced technical knowledge to avoid insufficiency in technical knowledge companies have to conduct training session on which the employee has been working on. as this research goes many company have implemented these technologies and some partially did according to their requirements and On the one hand, Industry4.0 as a powerful mechanism of innovative development of society and economy-has a large potential of crisis management and requires the top-priority practical implementation. The COVID-19 pandemic and crisis in 2020 have outlined new important directions of development of Industry 4.0: control of social interactions, digital monitoring of poverty, targeting of social support for population, and intellectual management in healthcare for increasing its flexibility in case of future epidemics and pandemics.

REFERENCES

- ❖ Bhatia et al. (2020); Frank et al. (2019); Kerin and Pham (2019); Thakur and Mangla (2019); Chauhan et al. (2019); Bag and Pretorius (2020)
- ❖ Frank et al. (2019); Zhou et al. (2020); Ghobakhloo (2020); Yadav et al. (2020); Cezarino et al. (2019); Pacaux-Lemoine and Trentesaux (2019) Yadav et al. (2020)
- ❖ Ford and Despeisse (2016); Bhatia et al. (2020); Thakur and Mangla (2019)
- ❖ Frank et al. (2019); Horváth and Szabó (2019); Thakur and Mangla (2019); Bag et al. (2020a); Dubey et al. (2020); Pacaux-Lemoine and Trentesaux (2019)
- ❖ Masood and Egger (2019); Ghobakhloo (2020); Yadav et al. (2020); Guarnieri and Trojan (2019)
- ❖ Pater and Gils (2003); Lass and Gronau (2020); Schleinkofer et al. (2019); Alcacer and Cruz-Machlado (2019); Bag et al. (2020d)
- ❖ Alcacer and Cruz-Machlado (2019); Ghobakhloo (2020);Yadav et al. (2020); Guarnieri and Trojan (2019)
- ❖ Rüßmann, M., Michael, Lorenz, M., Gerbert, P., Waldner, M., Justus, J., Engel, P., Harnisch, M.: Industry 4.0: The future of productivity and growth in manufacturing industries. Boston Consult. Group. 9, (2015).
- ❖ Zuehlke, D.: SmartFactory—Towards a factory-of-things. Annu. Rev. Control. 34, 129–138 (2010).
- ❖ Khan, A., Turowski, K.: A Survey of Current Challenges in Manufacturing Industry and Preparation for Industry 4.0. In: Abraham, A., Kovalev, S., Tarasov, V., and Snášel, V. (eds.) Proceedings of the First International Scientific Conference —Intelligent Information Technologies for IndustryII (IITI'16). pp. 15–26. Springer International Publishing (2016).
- ❖ Park, H.S.: From Automation to Autonomy - a New Trend for Smart Manufacturing. In: Katalinic, B. and Tekic, Z. (eds.) DAAAM International

Scientific Book. pp. 075–110. DAAAM International Vienna (2013).

- ❖ Syberfeldt, A., Holm, M., Danielsson, O., Wang, L., Brewster, R.L.: Support Systems on the Industrial Shop-floors of the Future – Operators' Perspective on Augmented Reality. *Procedia CIRP*. 44, 108–113 (2016).
- ❖ Mittal, S., Khan, M., Romero, D., Wuest, T.: *Smart Manufacturing: Characteristics, Technologies and Enabling Factors*. (2017).
- ❖ Brussel, H.V., Wyns, J., Valckenaers, P., Bongaerts, L., Peeters, P.: Reference architecture for holonic manufacturing systems. In: *PROSA . Computer in Industry*, Elsevier. pp. 255– 274 (1998).
- ❖ Leitao, P., Restivo, F.J.: Implementation of a Holonic Control System in a Flexible Manufacturing System. *Trans Sys Man Cyber Part C*. 38, 699–709 (2008).
- ❖ Borangiu, T.: A Service-Orientated Architecture for Holonic Manufacturing Control. In: *Towards Intelligent Engineering and Information Technology*. pp. 489–503. Springer, Berlin, Heidelberg (2009).
- ❖ Valckenaers, P., Cavalieri, S., Germain, B.S., Verstraete, P., Hadeli, Bandinelli, R., Terzi, S., Brussel, H.V.: A benchmarking service for the manufacturing control research community. *J. Intell. Manuf.* 17, 667–679 (2006).
- ❖ Reimer, H., Pohlmann, N., Schneider, W.: *ISSE 2015: Highlights of the Information Security Solutions Europe 2015 Conference*. Springer (2015).
- ❖ Lee, J.: Smart Factory Systems. *Inform.-Spektrum*. 38, 230–235 (2015).
- ❖ Lucke, D., Constantinescu, C., Westkämper, E.: Smart Factory - A Step towards the Next Generation of Manufacturing. In: *Manufacturing Systems and Technologies for the New Frontier*. pp. 115–118. Springer, London (2008).
- ❖ Davis, J., Edgar, T., Porter, J., Bernaden, J., Sarli, M.: Smart manufacturing, manufacturing intelligence and demand-dynamic performance. *Comput.*

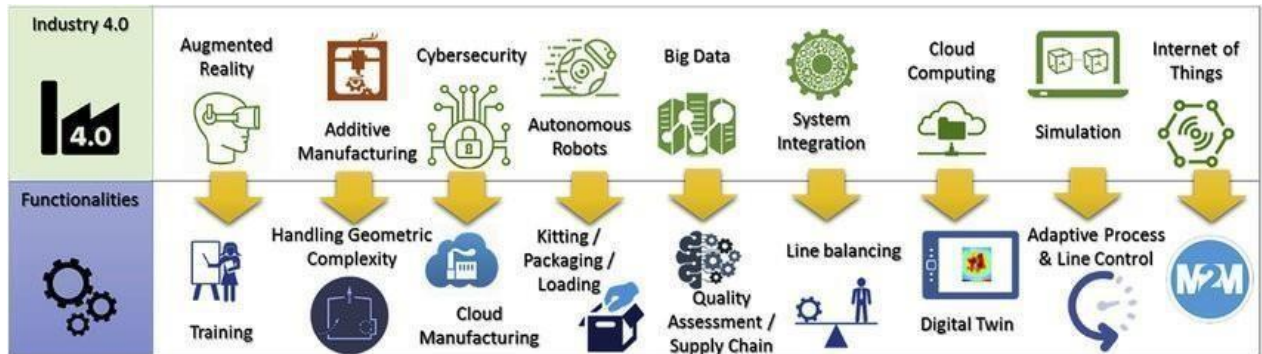
Chem. Eng. 47, 145–156 (2012).

- ❖ Plattform Industrie 4.0: Aspects of the Research Roadmap in Application Scenarios, [https://www.plattform-i40.de/I40/Redaktion/EN/Downloads/Publikation/aspects-of-the-research-roadmap.pdf? blob=publicationFile&v=10](https://www.plattform-i40.de/I40/Redaktion/EN/Downloads/Publikation/aspects-of-the-research-roadmap.pdf?blob=publicationFile&v=10).
- ❖ Schuh, G., Potente, T., Hauptvogel, A., Wesch-Potente, C.: Sustainable increase of overhead productivity due to cyber-physical-systems. Univ.-Verl. der TU (2013).
- ❖ Wang, S., Wan, J., Zhang, D., Li, D., Zhang, C.: Towards smart factory for industry 4.0: a self-organized multi-agent system with big data based feedback and coordination. Comput. Netw. (2016).
- ❖ Geissbauer, R., Vedso, J., Schrauf, S.: Industry 4.0: Building the digital enterprise, <https://www.pwc.com/gx/en/industries/industries-4.0/landing-page/industry-4.0-building-your-digital-enterprise-april-2016.pdf>.
- ❖ Arnold, C., Kiel, D., Voigt, K.-I.: How Industry 4.0 changes business models in different manufacturing industries. In: ISPIIM Innovation Symposium. p. 1. The International Society for Professional Innovation Management (ISPIIM) (2016).
- ❖ Boston Consulting Group: Man and Machine in Industry 4.0, <https://www.bcg.com/it-it/publications/2015/technology-business-transformation-engineered-products-infrastructure-man-machine-industry-4.aspx>.
- ❖ Prifti, L., Knigge, M., Kienegger, H., Krcmar, H.: A Competency Model for" Industrie 4.0" Employees. (2017).
- ❖ American Council for an Energy-Efficient Economy: Intelligent Efficiency: Opportunities, Barriers, and Solutions, <http://aceee.org/research-report/e13j>.
- ❖ Kagermann, H., Helbig, J., Hellinger, A., Wahlster, W.: Recommendations for implementing the strategic initiative INDUSTRIE 4.0: Securing the future of German manufacturing industry; final report of the Industrie 4.0 Working Group., (2013).

- ❖ Zhou, W., Piramuthu, S.: Manufacturing with item-level RFID information: From macro to micro quality control. *Int. J. Prod. Econ.* 135, 929–938 (2012).
- ❖ Broy, M., Cengarle, M.V., Geisberger, E.: Cyber-physical Systems: Imminent Challenges. In: *Proceedings of the 17th Monterey Conference on Large-Scale Complex IT Systems: Development, Operation and Management*. pp. 1–28. Springer-Verlag, Berlin, Heidelberg (2012).
- ❖ Lasi, H., Fettke, P., Kemper, H.-G., Feld, T., Hoffmann, M.: Industry 4.0. *Bus. Inf. Syst. Eng.* 6, 239–242 (2014).
- ❖ Tolio, T., Sacco, M., Terkaj, W., Urgo, M.: Virtual Factory: An Integrated Framework for Manufacturing Systems Design and Analysis. *Procedia CIRP.* 7, 25–30 (2013).
- ❖ Thoben: —Industrie 4.0 and Smart Manufacturing — A Review of Research Issues and Application Examples. *Int. J. Autom. Technol.* 11, 4–16 (2017).
- ❖ Qin, J., Liu, Y., Grosvenor, R.: A Categorical Framework of Manufacturing for Industry 4.0 and Beyond. *Procedia CIRP.* 52, 173–178 (2016).
- ❖ Neugebauer, R., Hippmann, S., Leis, M., Landherr, M.: Industrie 4.0 - From the Perspective of Applied Research. *Procedia CIRP.* 57, 2–7 (2016).
- ❖ Möller, D.P.F.: Digital Manufacturing/Industry 4.0. In: *Guide to Computing Fundamentals in Cyber-Physical Systems*. pp. 307–375. Springer International Publishing (2016).
- ❖ Schuh, G., Potente, T., Wesch-Potente, C., Weber, A.R., Prote, J.-P.: Collaboration Mechanisms to Increase Productivity in the Context of Industrie 4.0. *Procedia CIRP.* 19, 51–56 (2014).
- ❖ Crnjac, M., Veža, I., Banduka, N.: From Concept to the Introduction of Industry 4.0. *Int. J. Ind. Eng. Manag.* 8, 21 (2017).

ANNEXURE – I QUESTIONNAIRE

A simplistic definition of Industry 4.0 is the —application of the IoT, cloud computing, cyber-physical systems (CPS), and cognitive computing into the manufacturing and service environment.



1. What is your job position?

- ☐ Employee Owner
- ☐ Senior level Manager
- ☐ Mid level Manager
- ☐ Low level manager
- ☐ Other:

2. Name

3. Gender *

- ☐ Male
- ☐ Female

4. Company Name? (optional)

5. Where your company is located (Please mention a city name)?

6. How long has your company been in business

- ☐ 1 to 5 years
- ☐ 5 to 10 years

- ☐ 10 to 20 years
- ☐ 20 to 30 years
- ☐ Above 30 years

7. Size of your company

- ☐ Micro enterprises (less than 10 persons employed)
- ☐ Small enterprises (10 to 49 persons employed)
- ☐ Medium-sized enterprises (50 to 249 persons employed)
- ☐ Large enterprises

8. In which sector your company is active?

- ☐ Manufacturing
- ☐ Software / IT Services
- ☐ Financial Sector
- ☐ Agriculture
- ☐ Healthcare
- ☐ FMCG
- ☐ Education & Training
- ☐ Hotels & Restaurants Textiles
- ☐ Logistics
- ☐ Mining and metals
- ☐ Miscellaneous Other

9. What is your Company's Annual turnover?

- ☐ Below 50 lakhs
- ☐ 50 lakhs to 5 Crore

- o 5 crore to 10 crore
- o 10 crore to 50 crore
- o 50 crore to 100 crore
- o 100 crore to 250 crore
- o Above 250

10. Does your company know about the industry 4.0 concept?

- o No, I have never heard
- o Yes and is not important to the company
- o Yes and we want to know more to assess its potential for the company known enough to have some pilot projects in progress
- o We master the concept and already applied it across the company

11. What makes your company to embrace industry 4.0 challenges?

- o Opportunity to differentiate in the market
- o The company has an innovative spirit, so it has to try new concepts
- o It's part of our market leader status
- o Market requirements and competitive pressure
- o Optimization and automation lead to enhanced productivity
- o Real-time data for real-time supply chains in a real-time economy
- o Advanced maintenance and monitoring possibilities will enable greater business continuity
- o Real-time monitoring, IoT-enabled quality improvement and cobots(collaborative robots) will lead to higher quality products
- o Superior sustainability and better working conditions
- o Earn the trust and loyalty the modern consumer with personalization

opportunities

12. Has your company developed a strategy on the industry 4.0/digitaltransformation?

- ☐ Implemented and Continuously updated
- ☐ Implemented
- ☐ In planning
- ☐ No specific strategy

13. Which of the following technological areas of industry 4.0 Do you believe will be of greater importance for your company?

- ☐ Big Data
- ☐ Cloud computing
- ☐ Robotics
- ☐ Artificial Intelligence
- ☐ Data Analytics
- ☐ Cyber Security
- ☐ Additive Manufacturing
- ☐ Systems Integration

14. Rate the Impact of Industry 4.0 in your company's Productivity & Efficiency?

- ☐ Very Low impact
- ☐ Low impact
- ☐ Neutral
- ☐ High impact
- ☐ Very high impact

15. Rate the Impact of Industry 4.0 in your company's Profitability?

- ☐ Very Low impact
- ☐ Low impact
- ☐ Neutral
- ☐ High impact
- ☐ Very high impact

16. Rate the Impact of Industry 4.0 in your company's Employment?

- ☐ Very Low impact
- ☐ Low impact
- ☐ Neutral
- ☐ High impact
- ☐ Very high impact

17. Rate the Impact of Industry 4.0 in your company's Quality?

- ☐ Very Low impact
- ☐ Low impact
- ☐ Neutral
- ☐ High impact
- ☐ Very high impact

18. Rate the Impact of Industry 4.0 in your company's Revenue growth?

- ☐ Very Low impact
- ☐ Low impact
- ☐ Neutral

- ☐ High impact
- ☐ Very high impact

19. Which of these elements of industry 4.0 influenced the impact in your company?

- ☐ Big Data & Cloud Computing
- ☐ Internet of things
- ☐ Autonomous robots
- ☐ Additive Manufacturing
- ☐ Smart sensors
- ☐ Artificial Intelligence

20. Rate your company benefits by implementing industry 4.0/digital transformation?

- ☐ Business competitiveness
- ☐ Productivity and revenue
- ☐ Technology development
- ☐ Resource efficiency
- ☐ Real-time data
- ☐ Customer satisfaction
- ☐ Process transparency

21. Rate the challenges you faced in industry 4.0/digital transformation?

- ☐ Security threats
- ☐ Handling Data Growth
- ☐ Interoperability
- ☐ Insufficient Technical Skills
- ☐ Data sensitivity

22. Check your level of knowledge In relation to the Technologies listed below?

- ☐ Big Data
- ☐ Cloud Computing
- ☐ Robotics
- ☐ Artificial Intelligence
- ☐ Data Analytics
- ☐ Cyber Security
- ☐ Additive Manufacturing
- ☐ Systems Integration

23. Kindly mention your suggestion on the implementation of industry 4.0 ?