CHAPTER 2

LITERATURE REVIEW

2 Literature review

2.1 Introduction

The industry 4.0 revolution has had a pan industry impact on the world. (Kiel et al., 2017). Harnessing its impact has become the key focus area of all industrial sector (Brunheroto et al., 2021). The pillars of industry 4.0 include -IoT (Internet of things), Additive manufacturing, robots, cloud manufacturing, artificial intelligence, and big data analytics (Martinelli et al., 2021) shown in Fig. 2.

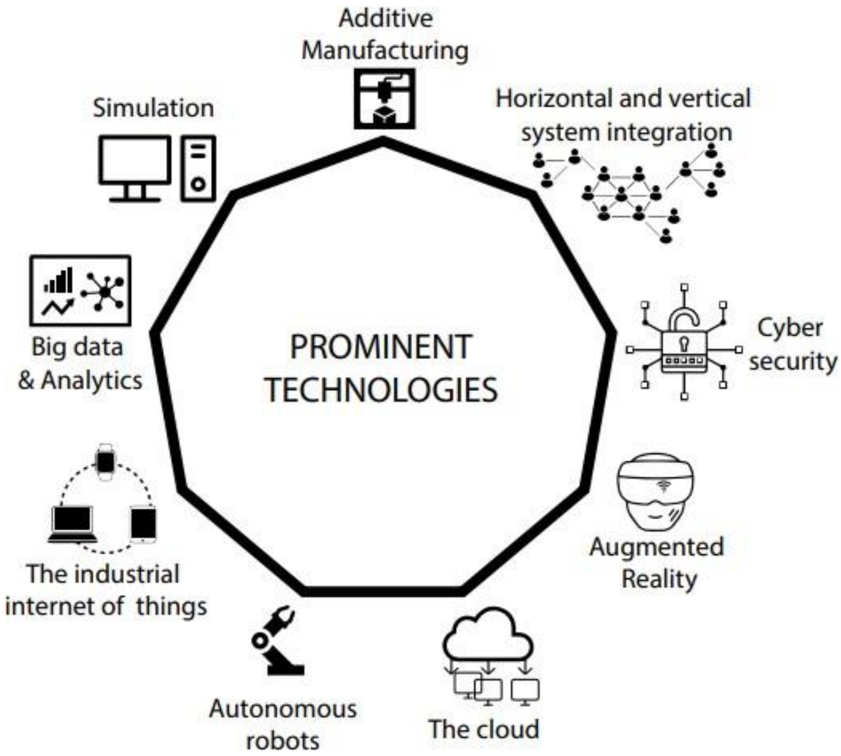

Figure 2: Industry 4.0 technologies.

(Astrid et al., 2017)

Industry 4.0 has been segmented in these categories (Weyer et al., 2015) specifically, Smart Machine, Smart Product, and Augmented Operator. A "smart product" is an intelligent and proactive component that can actively seek for the resources and information needed to carry out an order, made possible by sensors and controllers linked to bigger cloud systems. (Kamble et al., 2018).The key component of an adaptable and self-organizing manufacturing system that can reason, adjust, and get over the issues with mass customization that centralized planning was unable to handle is the smart machine. (Pereira & Romero, 2017).

Cloud manufacturing is powered by the industrial internet of things (IIOT), a complete technology that networks an organization's systems and physical assets. (Sivathanu, 2019). A PEW research center report of 2014 states that wearable computing and IoT will dominate global technologies by 2025 (Ashima et al., 2021). Certainly, the IIoTs can revolutionize SMEs in a big way (Brunheroto et al., 2021). The field of robotics in healthcare uses IoT as the enabler and is $90.4 billion business in the US (Awad et al., 2021).

The Covid -19 effect on lifestyle and workplace changes has had a huge impact on investments in IoT and IOT in healthcare, agriculture, manufacturing, logistics (Umair et al.,2021).

According to a 2020 WEF report from the GSMA, IoT applications have contributed to a 0.2% increase in total productivity. According to a 2018 WEF report, 85% of IoT implementation worldwide can contribute to achieving SDGs (sustainable development goals). IOT enhances an organization's business and operational skills by facilitating smooth communication through automated value chain capabilities. (Manavalan & Jayakrishna, 2019). IOT has a cross functional application and can be extensively used in Manufacturing, R&D, Supply Chain, Logistics, Quality Management, etc. for data enabled decision making.

2.2 Technological Background

The industrial internet of things is widely understood as any kind of connectivity. (Aceto et al., 2020). All technologies that have been developed to link machines and hardware require the Internet of Things. (Y. Cui et al., 2021). A network of intelligent components that boost productivity in an industrial setting is known as the IIoT. IIOT is a subset of IoT (W. Z. Khan et al., 2020). Cloud-based production solutions are enabled by IoT. It might also be viewed as a framework that gives machines computational power. (Seetharaman et al., 2019). An IoT system has sensors which sense change in environment and pass this information through devices such as Rasberry Pi, Arduino or Beagle Bone to the cloud or remote server (Subeesh & Mehta, 2021). IOT provides seamless collaboration through automated value chain capabilities which increases business & operational capabilities of the organization (Manavalan & Jayakrishna, 2019). Number of literature review studies has consistently shown that interest in IOT from the Industry 4.0 technologies has been highest since its inception and this is going to see upward trend for the near future (Bigliardi et al., 2021; Ghobakhloo et al., 2021; Rejeb et al., 2020)

2.3 Related work

With the global impact of IoT and IoTs growing rapidly, there have been some key reviews on the applications and adoption IoT and IoT. Security systems for IoT based food chains (Duan et al., 2020) highlights various concern areas for block chain applications in IoT based agriculture. (N. Khan et al., 2021) review the impact of IoT on sustainability in agriculture as also highlighted in the coffee crop digitization (Sott et al., 2021). Manufacturing reviews (Paschou et al., 2020) have highlighted the servitization of manufacturing through IoT and IOT adoptions. The social science view of manufacturing (Klerkx et al., 2019) lays a foundation on various issues related to adoption of IoT, while different maturity models (da Silva et al., 2021) are used to highlight the adoption of IoT and IOT. All technologies of I 4.0 have been reviewed for their applications in manufacturing (Sahoo & Lo, 2022) Specific technologies such as robotics and their adoption in manufacturing (Ramasubramanian et al., 2022) have also been reviewed. (Mendoza P. & Cuellar, 2020) have discussed the challenges in adoption of industry 4.0. Technical reviews (Mendonça et al., 2022) focused on adoption of digital twins. We found several reviews which have explored the research work on various I4.0 technologies including IoT. Adoption of IoT in services have also been studied in areas of higher education (Almaadeed & Ponnamma, 2020) and logistics (Abdirad & Krishnan, 2020).

However, dedicated literature reviews on overall themes on adoption of IoT in manufacturing are limited and required a deep dived structured approach. Growing interest from the manufacturing domain towards the IOT adoption also demands thorough understanding of drivers, barriers, and factors to reap the potential performance improvements. In line with this, we believe that it is utmost important to recalibrate and classify the evolving body of knowledge to point towards the future research themes and ways to sustainably achieve the technology deployment benefits.

Systematic literature review method (Tranfield et al., 2003) has been applied while studying the body of existing knowledge available in the domain of IOT adoption in the manufacturing sector. Based on thorough quality assessment criteria, 71 articles have been shortlisted for further analysis on underlying IOT adoption themes. This chapter explores four review questions:

- RQ1. What are the emerging themes in research on IOT adoption in manufacturing?
- RQ.2 How can we categorize them based on adoption models being used for study?
- RQ3. What are the various analysis tools being used with these adoption models?
- RQ4. What are the various determinants being studied in the various adoption models?

With the aid of descriptive analysis, the first research question is investigated through themes such as quantitative versus qualitative studies, nations producing IOT adoption research at a remarkable rate, manufacturing-related industries attracting extraordinary interest, and changes in research interest over time. To document the insights gleaned from the second research question, we have tallied the frequencies of 14 commonly used adoption models in the shortlisted publications. The software that is used to carry out the approaches and the analysis technique are the focus of the third research question, which is about analysis tools. It is documented in tabular form. The final research topic, which focuses on the factors influencing the adoption models, is clarified by grouping the publications that made the short list with their corresponding theoretical models into three categories: moderating, independent, and dependent variables. Through this work, we have suggested potential avenues for future research and addressed existing gaps in the literature regarding the use of IOT in the manufacturing sector.

The following information determines how the rest of the chapter is broken into parts: While part 3 discusses the chapters' descriptive nature to understand the thematic evolution around the selected studies, section 4 looks at the adoption models, determinants, and tools used to study the adoption behavior observed. Section 2 describes the research methodology, exclusion inclusion criteria, and quality assessment method followed for shortlisting the articles. Section 5, which concludes, highlights the theme's conclusions and future study directions.

2.4 Research Method

Based on the gap highlighted earlier, we have followed two stage approach for the systematic literature review. Stage 1 follows 5 step process to formulate the research questions and analysis based on the method suggested as shown in Fig. 3 (Denver & Tranfield 2009).(Buchanan & Bryman, 2009) Stage 2 involves PRISMA method for screening and finalizing articles for exploring the research questions.

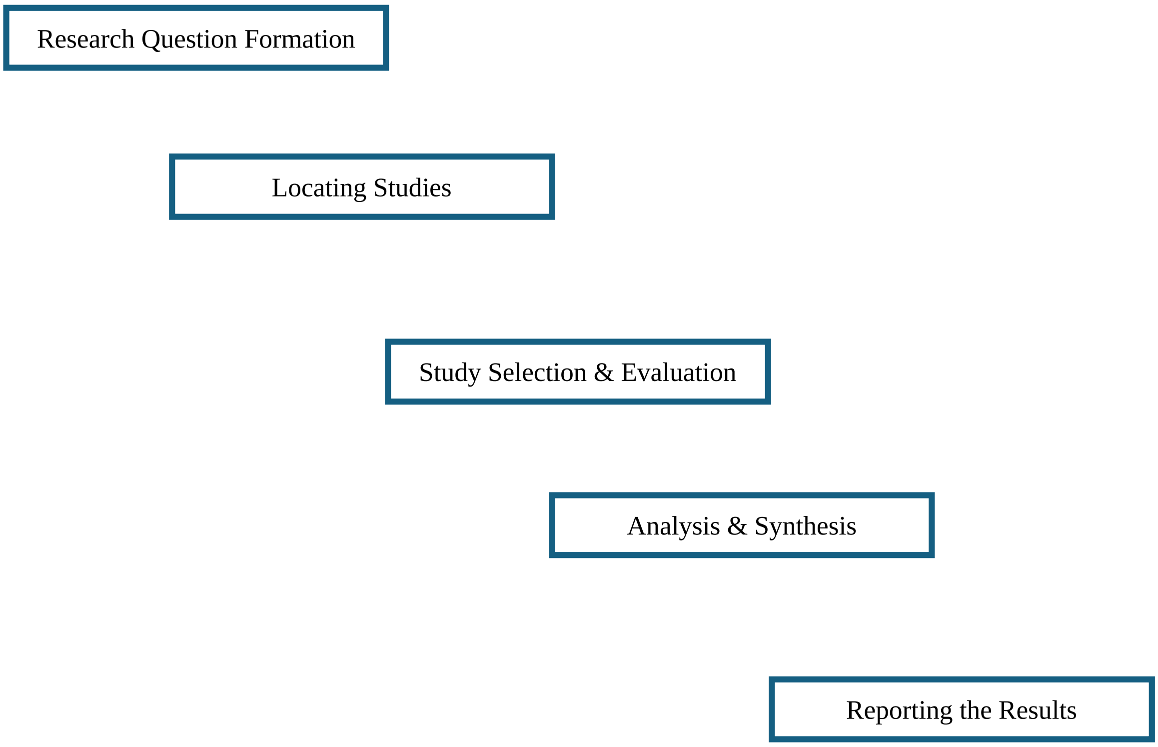

Figure 3: Five step review process.

2.5 PRISMA methodology for location and synthesis of data

We used the PRISMA method for the study selection and evaluation process (Moher et al.,2009).

The PRISMA approach followed is summarized (Ahmetoglu et al., 2022) in Fig 4.

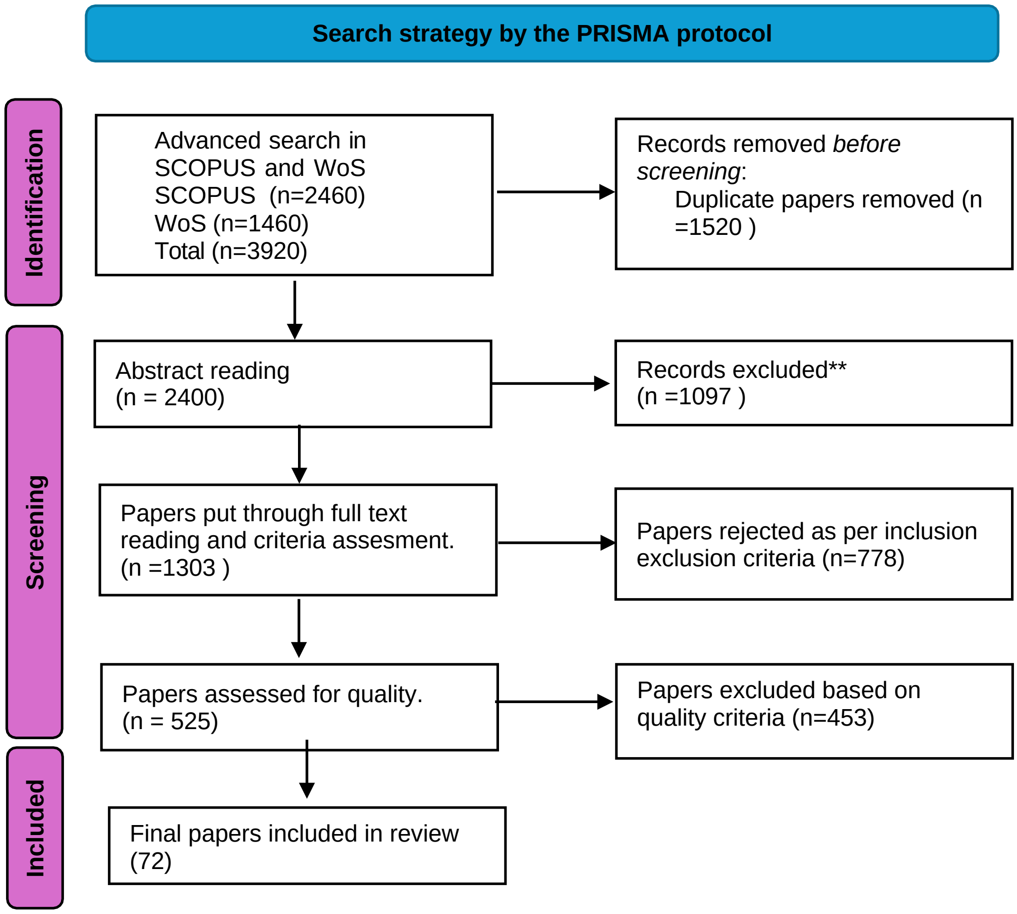

Figure 4: PRISMA process.

2.5.1 Locating studies

SCOPUS and Web of Science database was used as the source for locating studies (Fahimnia et al., 2015). The main key words were "IoT" , "Internet of things", "adoption", "acceptance", "manufacturing", "production". The operators "AND", "OR" were used and after multiple iterations (Niknejad et al., 2020), the iterations are listed below (de Oliveira Neto et al., 2023). We used the operator "TITLE-ABS-

KEY” in the advance search option of SCOPUS to ensure search the string in all portions of the paper. Language restriction was English (L. Zhou et al., 2015)

We restricted our focus area to Computer science, Engineering, Business management and accounting, Decision sciences, Energy (Asghari et al., 2019).

The final search string which was used for this review

“TITLE-ABS-KEY ("IOT" OR "internet of things") AND "adoption" OR "acceptance" OR "intention")) AND LIMIT-TO (SRCTYPE, "j")) AND LIMIT- TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re")) AND LIMIT-TO (LANGUAGE, "English"))”

2.5.2 Study selection and evaluation

The first search produced (2460+1960) n=3920 papers on WoS and Scopus. 2400 papers were obtained after a first screening for duplicates eliminated 1520 papers. After reviewing abstracts, we removed papers that didn't apply to our topic (n = 1097), leaving us with 1303 papers. After that, we evaluated the manuscript using exclusion and inclusion criteria using approaches that were comparable.

Inclusion Criteria:

- Articles with specific focus on IOT and the Adoption models (Chauhan et al., 2022)
- Articles about the manufacturing industry (Bouranta et al., 2022), (Psomas & Antony, 2019)
- Articles published on or before November 2022
- Studies limited to document type Journal articles & peer reviewed (Kaur et al., 2021)

Exclusion Criteria:

- Research articles that have the same title or Digital Object Identifier (DOI) (Kumar et al., 2019), (Ruparel et al., 2020)

- Articles mentioning “IOT” and/or “Adoption” but not proposing/exploring models (Chauhan et al., 2022)
- Studies that focus on technical or engineering aspect of IOT (Chauhan et al., 2022)
- Books, websites, and gray literature (master’s theses, conferences, books, reports, working papers from research groups, technical reports, and doctoral dissertations, etc.) (Bouranta et al., 2022), (Arun et al., 2021) This led to exclusion of n=778 papers and giving us a set of 525 papers.

2.5.3 Quality assessment

These papers were put through a quality assessment. The quality assessment methodologies used (Al-rawashdeh et al., 2022), suggest that the assessment of quality (QA) refers to an accurate evaluation of the overall quality of the chosen papers (n=525). To enhance the search process, various initiatives were undertaken during the assessment (Busalim & Hussin, 2016). To prevent any potential impact Based on earlier searches, the web searches were carried out in private browsing mode. The writers by hand identified relevant papers and articles from their initial searches. Moreover, after reviewing the abstracts in detail (Cogollo Flórez et al., 2017), they determined which publications to include and which ones to exclude. Additionally, the authors formulated five QA criteria to create a quality process for this SLR, which are presented below.

- Does the topic of the paper pertain to adoption and applications of IoT technology in manufacturing sector?
- Does the study utilize theoretical constructs and frameworks?
- Does the document specifically describe the research methodology used?
- Is the process for gathering data for study clearly presented in the paper?

The papers are categorized. "High", "medium", and "poor" are the three quality levels.(Al-rawashdeh et al., 2022). A score of 1 is assigned to research that fully meets the quality requirement according to the resulting load score at the beginning of the investigation. A score of 0.5 is given to research that partially fulfills the criteria for consideration. Any item that is not in line with a quality standard determined by the five assessment factors is given a score of 0. The maximum loaded score for each paper based on the criteria is 5, while the minimum loaded score is 0 for each paper. Based on this quality analysis, we arrived at the final dataset of 71 papers. We indicate the quality scores of the final set of papers below in Fig 5.

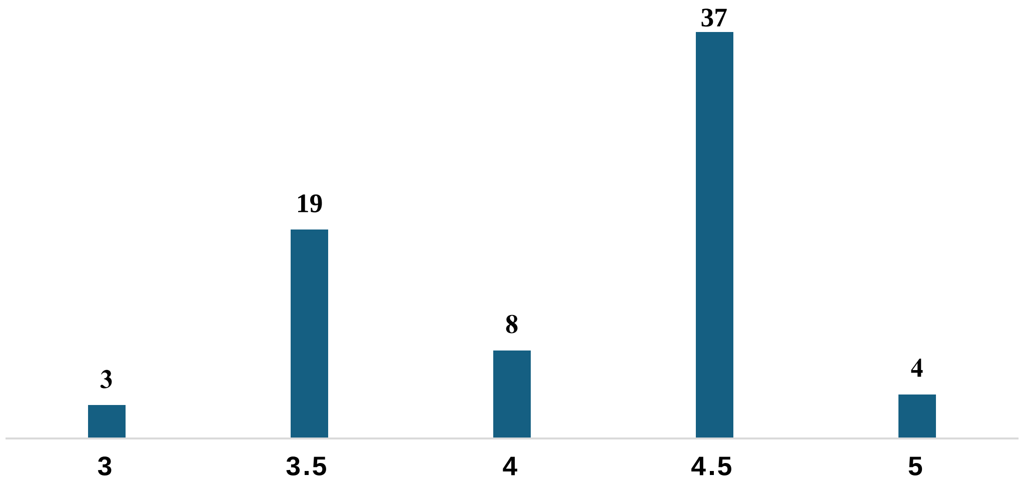

Figure 5: Quality assessment scores.

54.17% of the selected papers have a rating of 4.5 and above while 37.5% of the papers have a QA score between 3.5 and 4. 8.33% of papers have a rating below 3.5 but have still been kept because of some key inputs on one or two of the quality assessment questions. The top five publishers that contribute the most to the final dataset are shown in Table 1.

2.6 Descriptive Analysis

Table 1: Overview of publication sources

Publisher	Number of papers
Elsevier	13
MDPI	8
Taylor and Francis	7
IEEE	6
Springer	5

The number of research papers published throughout the years was divided into two groups to better understand the research interest over time. This is shown in Fig. 6. Based on our supporting studies, it can be determined that the domain has attracted a lot of attention starting in 2019 and has continued to expand at a steady pace. Given the global impact of the pandemic (R. Sun et al., 2021), IoT has made business processes smarter.

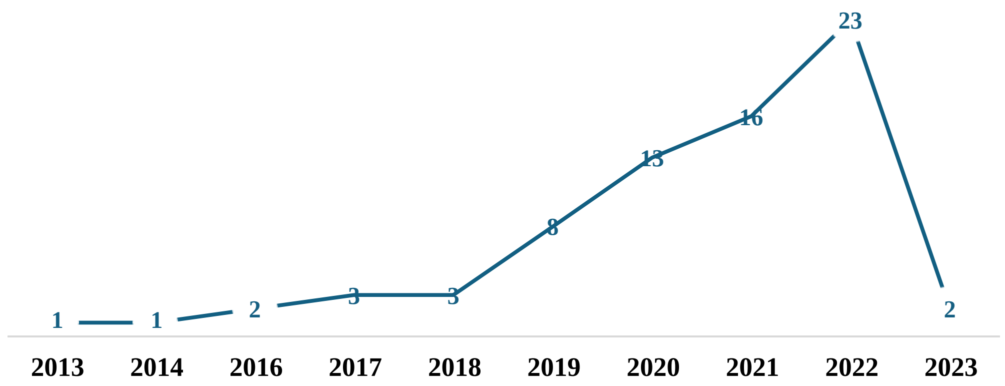

Figure 6: Growth of publication over years.

*(2023 data includes papers only for the month of January and hence the dip)

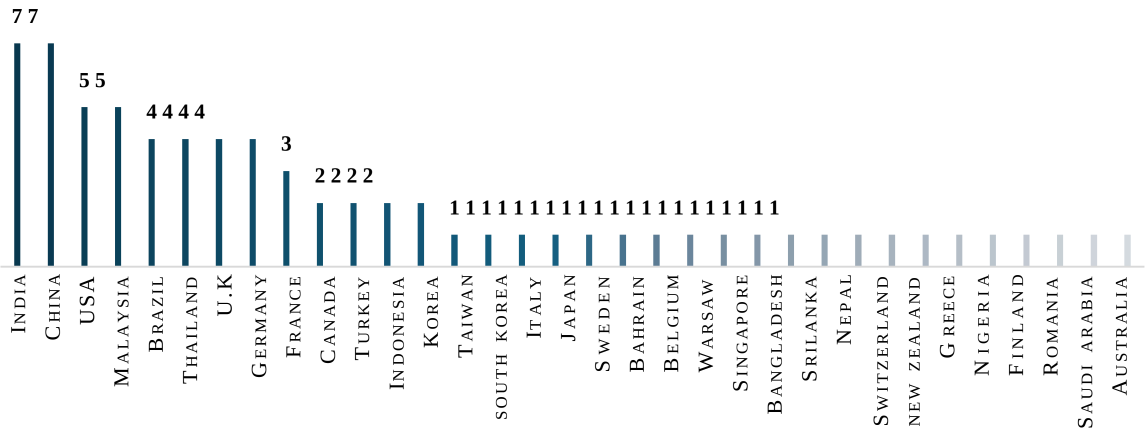

Figure 7: Research output across countries.

India has been focused on the research in the field of IoT and is matching China in the research work in this domain visible in the country wise research output comparison shown in Fig 7. This also indicates India's efforts to improve its position in the Network readiness index ratings.

2.7 Thematic Analysis

Themes are topics which is central to a research paper (T. P. Liang & Turban, 2011). Based on the final data set, the papers were categorised based on definitions (Aspers & Corte, 2021), (Paul & Criado, 2020), we find that the research themes fall in three categories namely qualitative studies, quantitative studies and literature reviews using several different methods shown in Fig. 8.

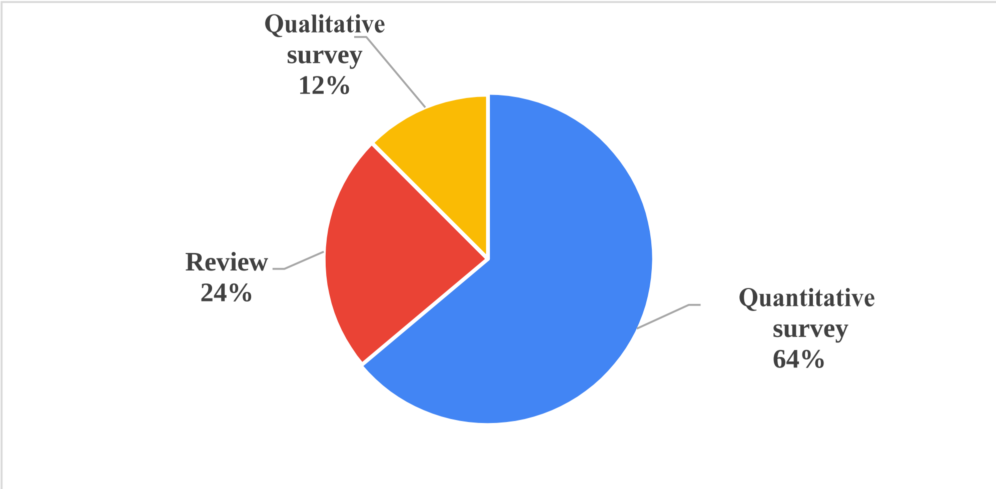

Figure 8: Research themes.

Seeing how these motifs have changed over time is fascinating. As illustrated in Fig. 9, we observe an exponential increase in the number of quantitative studies conducted to comprehend the elements affecting the uptake of new . This demonstrates how technology is changing both daily living and corporate procedures.

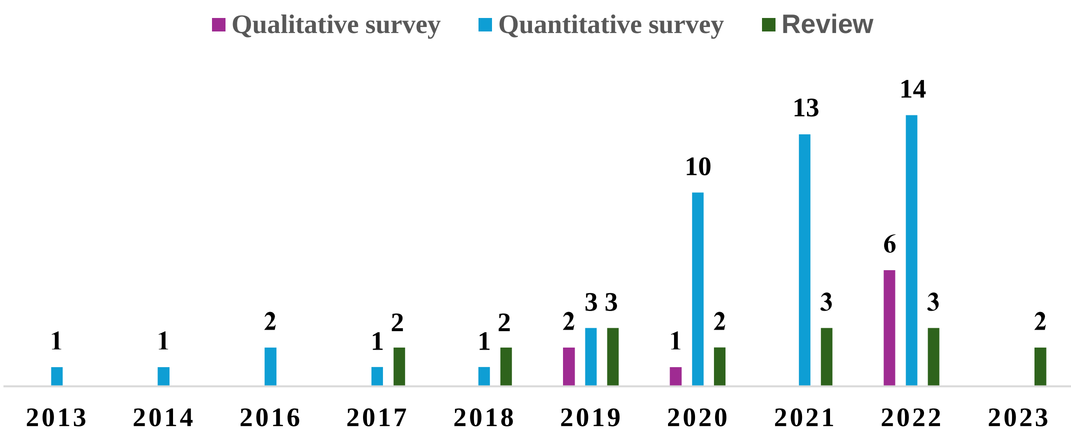

Figure 9: Research theme growth across years.

These themes are used across a range of sectors as can be seen from the below Fig. 10.

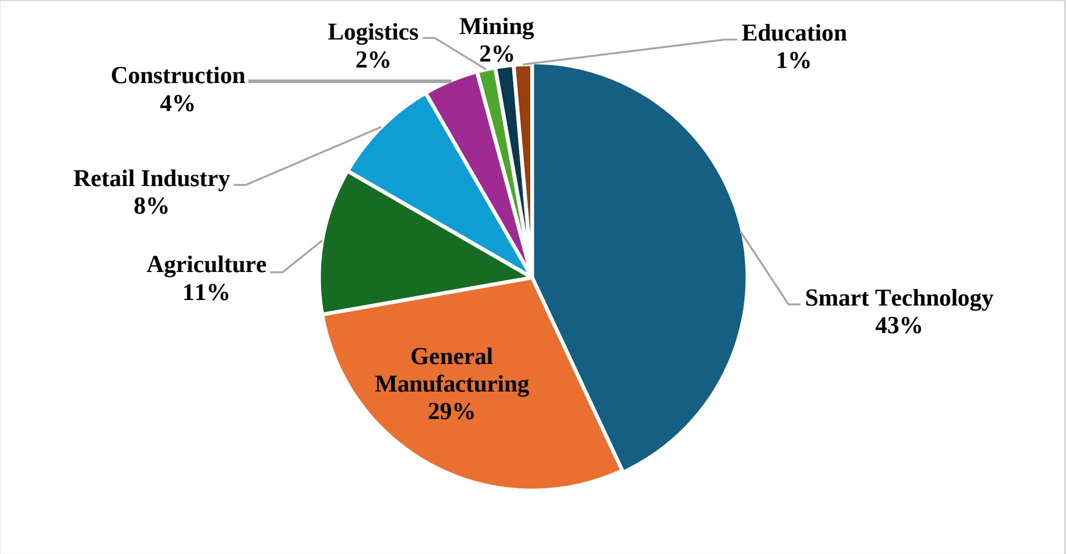

Figure 10: Research Interest across manufacturing sectors.

Qualitative surveys have focussed on studying maturity level of various manufacturing industries (Klisenko & Serral Asensio, 2022), (Gaur & Ramakrishnan, 2019) in adoption of IoT technology or have studied the challenges and enablers of IoT adoption by using MCDM (heuristic) methods (A. Singh et al., 2022), (Bestepe et.al.,2022). Case study methods to study technology adoption (Hartwein et al., 2022) explore the hierarchical challenges in technology adoption. We find the usage of Multi criteria decision making methods and maturity model development methods used in qualitative studies to determine the maturity levels, enablers and challenges in IoT adoption.

Quantitative empirical surveys have used various technology adoption models to measure behavioural attributes and their relationship to adoption of IoT at the end user as well as organization levels. Models such as TAM (Gao & Bai, 2014a), (Masood & Sonntag, 2020) have been used in measuring determinants such as social influence and behavioural control and hybrids of TAM with VAM (value addition model) (Shofolahan & Kang, 2018), TAM with ISSM (information success model) (Kim & Wang, 2021) have also been used. UTAUT is another widely used adoption model (Tűrkeș et al., 2020) studies intrinsic and extrinsic motivational factors (Tűrkeș et al., 2020) Extensions of UTAUT such as UTAUT2 have also been used in combination with Innovation diffusion theory (Chatterjee, 2019), for empirical studies on adoption behaviour. For studying adoption behaviour at an organization level, two main theories have been used. The TOE framework (Arnold & Voigt, 2019), widely used in studying adoption behaviour of various sectors. DOI theory has been used to study impact of several factors on adoption (Strong et al., 2022), (Hwang et al.,2016), and in combination with other frameworks such as TAM (Attié & Meyer-Waarden, 2022) and UTAUT2 (Chatterjee, 2019). Several other frameworks are being used increasingly. Hybrid models of TAM and UTAUT, TAM and TPB, UTAUT and DOI have also been used. One important gap we notice is very little usage of TAM and TOE hybrid in the adoption models studied and this highlights a probable gap to be explored.

Table 2 Most frequently used adoption models

Single most frequently used models		
Organizational level	TOE and TOE hybrids with DOI and others	30%
End user level	TAM and TAM extensions	41%

The literature review highlights a set of most studied adoption models shown in Table 3.

Table 3 Glossary of adoption models

Model Code	**Full Form**	**Proposed by**	**Year**
TAM	Technology acceptance model	Davis	1989
VAM	Value addition model	Davis	2008
ISSM	Information system success model	McLean	1992
TPB	Theory of planned behaviour	Icek Ajzen	1985
UTAUT	Unified theory of acceptance and use of technology	Venkatesh	2008

Model Code	Full Form	Proposed by	Year
T-O-E	Technology , organization, environment	Fletcher	1990
Dol	Diffusion of innovation	Rogers	1962
MATH	Model of adoption of technology of households	Peterson	1985
SCOT	Social construction of technology theory	Pinch	1980
ITF	Institutional theory framework	Rowan	1977
UGT	User gratification theory	Rayburn	1985
URT	User resistance theory	Rivard	2005
DFTPM	Dual factor and technology paradox model	Bhattacharjee	2001

A summary of the papers on the manufacturing sector using these models is given in Table 4.

Table 3 Seminal papers using the glossary of adoption models.

Author	**TAM**	**VAM**	**ISSM**	**TPB**	**UTAUT**	**UTAUT2**	**TOE**	**DOI**	**MATH**	**SCOT**	**ITF**	**UGT**	**URT**	**DFTPM**
Ayodeji Emmanuel et al	√													
Mirela Cătălina Turkes et al					√									
Temidayo Oluwapelumi Shofolahan et al	√	√												
Lingling Gao Xuesong Bai et al	√													
Ki Joon et al	√		√									√		
Jina Kim et al	√												√	
Yusliza Jamalut et al							√							
Omar Ali et al	√							√						
Salem Ali Suhluli et al	√				√									
Tariq Masooda et al	√													
Nan Xu et al											√			
Maria Tsourela et al	√			√	√									
Sharad Rajbhandari et al								√						
Debajyoti Pal et al	√	√		√	√									
Yorgos Marinakis et al										√				
Nessrine Omrani et al							√				√			
Hyun Gi Hong							√							

Author	TAM	VAM	ISSM	TPB	UTAUT	UTAUT2	TOE	DOI	MATH	SCOT	ITF	UGT	URT	DFTPM
Nusrat Jahan et al	√													
Eva Kropp et al	√										√			
Baraa T. Sharef	√			√										
Namira Hasna Latifah et al							√			`				
Luis Hernan Contreras Pinochet	√													
Jui-Hsiung Chuang et al	√													
Mira Qerul Barriah Muhamad et al							√							
Sujita Jiwangkura							√							
Parul Bajaj et al					√									
Soong Kai Kit et al					√									
Sheshadri Chatterjee						√		√						
Yan M. Lopes et al	√													
Alex et al	√													
Christian Arnold et al							√							
HaijunBao et al	√													
ZamZuriyati Mohamad et al	√													
Won-jun Lee et al														√
Esther et al	√													
Sheshadri Chatterjee et al									√					
Patricia Baudier et al	√													
Yang Lu et al	√													
Robert Strong et al								√						
Ruiyu Sun et al					√									
Yan Shi et al						√								
Elodie Attié et al	√							√						
Gislene et al						√								
Runting Zhong et al					√									
Debajyoti Pal et al	√		√											

Adoption models are frameworks used to understand how and why people or organizations start using new technologies or innovations. These models identify factors that influence the adoption process and can predict the uptake of new technologies. Determinants in these models are the specific variables that directly affect the decision to adopt, such as perceived usefulness or cost. Precedents refer to earlier instances or existing examples that set a standard or guide for subsequent adoption behavior. For example, the success of a technology in one industry can serve as a precedent encouraging its adoption in another. Antecedents are the conditions or events that occur before the adoption, influencing how and why the adoption process begins. They can include cultural, economic, or technological factors that set the stage for new innovations to be considered and embraced. Together, these components help researchers and practitioners understand the complexities of adoption processes across different contexts.

Across these models that have been used, a varied number of determinants and their relationships have been established over the long period of research. The models have been broken down into their primary determinants and subsequent antecedents and moderators as shown in following Table 5.

Table 4 Models and their determinants

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
mirela catelina turkes et al (2019)	utaut	behavioral intention	intrinsic motivation	effort expectancy			
				attitude towards iot			
				perceived autonomy			
				perceived competence			
				perceived relatedness			
			extrinsic motivation	performance expectancy			
				social influence			
				facilitating conditions			
				perceived privacy			
				perceived security			
olena klisenko et al (2022)	maturity model	maturity of technology		data security			
				data management			
				infrastructure			
				standardization			
				decision making			
				strategy			
				culture			
				iot team			
				partners			
				culture			
temidayo oluwapelumi shofolahan et al (2018)	tam integrated in vam	actual system use	benefits	perceived usefulness			
				perceived enjoyment			gender
			sacrifices	perceived security risk			
				perceived technicality			
				perceived cost			

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
lingling gao xuesong bai et al (2014)	tam	behavioural intention	perceived usefulness				
			perceived ease of use				
			trust				
			social influence				
			perceived enjoyment				
			perceived behavioral control				
ki joon et al (2011)	tam,uses and gratification theory, information systems success model	usage intention	perceived usefulness	information quality	accuracy		
					currency		
				motivation	knowledge		
					technology discomfort		
			perceived ease of use	system quality	accessibility		
					reliability		
jina kim et al (2020)	user resistance theory-tam	continual intention to use	resistant attitude	perceived risk	privacy concerns		
					perceived trust		
				perceived benefits	perceived ease of use		
			perceived costs				
yusliza jamalut et al (2022)	toe	iot adoption intention	technology	perceived usefulness			
				perceived ease of use			
				perceived compatibility			
			organization	financial cost			
				lack of skills			
				human resources vulnerability			
			environment	normative pressure			
				coercive pressure			
				mimetic pressure			
				government support			
omar ali et al (2009)	doi-tam	intention to adopt and use	usability factors	usefulness ease of use			
			innovation factors	relative advantage			
				compatibility			
				complexity			
			technology factors	privacy			
				security			
			economic	cost			

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
			factors				
			cultural factors	socio-cultural			
			contextual factors	awareness			
				infrastructure			
				information intensity			
			organization factors				size
							location
							employee knowledge
salem ali suhluli et al (2022)	tam-utaut mix	behavioural intention	security				Wiot(wearable IoT)
			social norm				
			trust				
			privacy		employee count		
tariq masooda et al (2007)	tam+ mcdm	actual use benefits and challenges	competitive advantage	company size	production volume		
			operations cost		annual revenue		
			operational efficiency	manufacturing complexity	industry		
			manufacturing flexibility		production method		
			implementation costs	attitude towardsi4.0	product mix		
			technology knowledge		awareness		
			implementation time		implementation level		
					outlook		
nan xu et al (2005)	institutional theoretical framework	organizational performance	green product innovation				
			green process innovation		coercive pressure		
			green management innovation	adoption of green iot	normative pressure		
					mimetic pressure		
maria tsourela et al (2020)	tam,tam2,utaut,dtpb-(iotam)	behaviour intention	attitude	facilitated appropriation	cyber resilience		user mode
				perceived usefulness	user character		age
				perceived ease of use	cognitive instrumentals		long term orientation
					social influence		flexibility
					trust		
sharad rajbhandari et al (2022)	toe	technology innovation decision making	government intervention	people, customer and culture			
				products			
				strategy and			

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
				leadership			
				technology			
				governance and operation			
nessrine omrani et al (2015)	institutional theory+toe	digital technology adoption	business environment				size
			internal environment				location
			innovation				growth
			digital tools				country
hyun gi hong (2006)	modified toe	user acceptance of iot	technical issues				
			user character				
			environment issues				
			cost		techno-a		
nusrat jahan et al (2022)	extended tam	intention to use	technophilia	general technology related value	techno-b		
				internet of things skill	techno-c		
eva kropp et al (2020)	institutional theory+tam	customer intention	adoption controls		mimetic pressure		
			customer controls		normative pressure		
			system characteristic s	relative advantage	coercive pressure		
				system type			
baraa t. sharef(2014)	tam+tpb	intention to use	cost saving				
			perceived value	perceived usefulness			land size
				perceived complexity			
				subjective norms			
				reliability			
namira hasna latifah et al(2023)	mcdm on toe	iot adoption	technology infrastructure				
			it expertise				
			technology integration				
			compatibility				
			relative advantage				
			ease of use				
			trialability				
			availability				
			reliability				
			top management support				
			organization readiness				
			expected benefit				

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
			cost saving				
			technical knowledge				
			acquisition cost				
			employee readiness				
			maintenance cost				
			competitive pressure				
			government regulation				
			support industry				
luis hernan contreras pinochet (2011)	tam-yaping hybrid	purchase intention	functional experience	connectivity			
				interactivity			
				sense of presence			
			emotional experience	intelligence			
				convenience			
				security			
jui-hsiung chuang et al (2020)	tam	intention to adopt iot	perceived ease of use				
			perceived usefulness				
			demographic variables	sex			
				age			
				education attainment			
				years in agriculture			
				main crop type			
			external variables	scale of agricultural land			
				annual turnover			
				product price			
				organization support			
				feeling of self-efficacy			
				sense of trust			
				perceived convenience			
mira qerul barriah muhamad et al (2021)	toe	sme readiness	people factor				
			technology factors				
			process factor				
parul bajaj et al (2023)	utaut	adoption	awareness	cost			
				convenience			
				safety			

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
				status			
soong kai kit et al (2020)	utaut	perception of using pep	effort expectancy				
			performance expectancy				
			social influence				
			facilitating conditions				
			hesitation				
sheshadri Chatterje e (2020)	idt+utaut2	quality of life	public value	government perspective	regulation		
					governance		
				people perspective	iot awareness		
					security related awareness		
					trust		
					privacy policy awareness		
					trust		
					behavioural intention		
					actual use of iot		
yan m. lopes et al (2021)	tam	operational performance	strategic logistic management				
			iot				
			revenue				
alex et al (2013)	tam	intention	trust	privacy			
				security	awareness		
christian arnold et al (2010)	toe	iot adoption	technology factors	relative advantage			
				perceived challenges			
				compatibility			
			organization factors	firm size			
				top management support			
				absorptive capacity			
			environment	competition			
				environment uncertainty			
				perceived outside support			
haijun bao et al(2012)	tam	mobile smart home adoption	perceived usefulness	perceived ease of use			
				social influence			
				perceived cost			

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
				perceived secure home environment			
				compatibility			
				perceived technology security risk			
zam zuriyati mohamad et al(2023)	tam	behavioural intention	attitude	perceived ease of use			
			quality of life	perceived ease of use			
won-jun et al(2014)	dual factor model and technology paradox theory	intention to adopt iot	satisfaction with iot service scenario	dissatisfiers	performance ambiguity		
					perceived incompetenc e		
					perceived addiction		
					perceived chaos		
				satisfiers	fulfil needs		
					perceived efficiency		
					perceived enjoyment		
					technology trust		
esther et al (2021)	tam	intention to use	perceived usefulness				age
			perceived ease of use				gender
			subjective norm				education
			privacy concern				income
			trust				
sheshadri chatterjee et al(2020)	math model	intention to use	application for personal use				gender
			application for fun				age
			status				
			friends and family influence				
			secondary sources influence				
			fear of technology advancement				
			declining cost				
			perceived ease of use				
			self-efficacy				

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
patricia baudier et al(2020)	tam	attitude towards using	perceived ease of use				age
			perceived usefulness				gender
			perceived playfulness				country
			perceived connectivity				
yang lu et al(2017)	tam spillovers model	iot behavioural intention	iot well being	challenge emotions			
			iot perceived value	deterrence emotions			
				achievement emotions			
				loss emotions			
				internet well being			
				internet perceived value			
amit kumar et al(2014)	toe	ba adoption	perceived benefits				
			technology factors	technology assets			
				compatibility			
			organization factors	top management support			
				organization data environment			
				data driven organization culture			
				perceived cost			
			environment	competition			
				industry type			
				customer orientation pressure			
detcharat sumrit(2013)	interval valued pythagorean fuzzy set	adoption readiness	top management support				
			financial capability				
			managing cyber security				
			digital business model development capacity				
			technology infrastructure capability				

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
			change management capability				
			data management and analytics capability				
			seamless value chain integration capability				
			strategic technology roadmap				
			employee digital knowledge capacities				
			digital culture readiness				
			lean practices				
ruiyu sun et al(2021)	utaut	adoption intention	personal innovation				perceived risk
			effort expectancy				
			performance expectancy				
			social influence				
yan shi et al (1996)	utaut2	willingness to pay	willingness to adopt	personal innovativeness			
			trust	price value			
			performance expectancy	social influence			
				government support			
				effort expectancy			
elodie attié et al (2022)	tam+doi	intention to use	perceived usefulness	perceived well being			
			perceived ease of use	perceived social image			
gislene et al(2015)	utaut2	user behaviour	behavioural intention	performance expectancy			
				effort expectancy			
				social influence			
				facilitating conditions	age		
				hedonistic motivation	gender		
				price value	experience		
				habit			
Runting(2017)	utaut	intention to	performance				

author	model	pd**	ant 1**	ant 2**	ant 3**	ant 4**	m**
zhong et al(2022)		use	expectancy				
			effort expectancy				
			social influence				
			facilitating conditions				
			cost				
			perceived risk				
			trust				
			hedonistic motivation				
			product features				
debajyoti pal et al(2018)	tam+information system success model	continuance usage intention	privacy concern				
			attitude	perceived usefulness	information satisfaction	information quality	
			perceived compatibility	perceived ease of use	system satisfaction	system quality	
				perceived enjoyment	service satisfaction	service quality	

*** PD-primary determinant, ANT1-antecedent 1, ANT 2-antecedent 2, ANT 3-antecedent 3, ANT 4-antecedent 4, M-moderator*

Studying the relationships between the determinants have been done through various statistical data analysis methods shown in Fig 11.

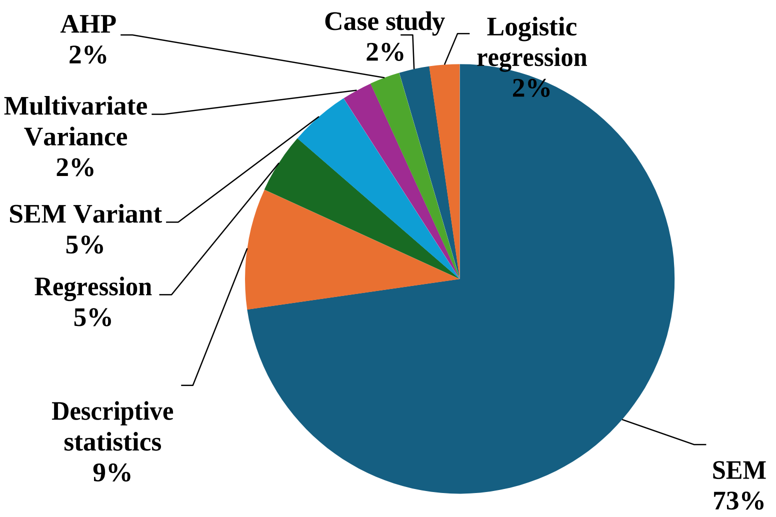

Figure 11 Data analysis methods.

A focus of structural equation modeling (SEM) and its variants as the primary analysis technique used to analyze the adoption models, aside from descriptive statistics, is indicated by the examination of the patterns presented in Fig. (Oke et al., 2022) and regression techniques (Suhluli & Ali Khan, 2022) .

The literature reviews are the third recurring theme in research projects. Review approaches such as thematic analysis, semantic analysis, bibliometric analysis, and systematic literature reviews are widely used to examine adoption barriers and delve deeply into use cases specific to a given industry.

2.8 Conclusion

To create a structured SLR related to IOT adoption in manufacturing industry, we arrived at 72 research papers after applying through exclusion inclusion criteria and quality assessment to the search query targeted towards two prominent and multidisciplinary databases. Our study aimed & addressed four research questions with the help of thematic and descriptive analysis of the selected papers. In response of RQ1, we presented descriptive analysis of the research profile and macro view of the publications. To answer RQ2 we described the content via selection of 14 theoretical adoption models and their hybrid applications. RQ3 targeted analysis methods and software tools used to explore the adoption behaviour. To address RQ4, we critically scrutinized the dependent variable, independent variable and moderating behaviour across theoretical models used to explain the adoption behaviour. The theoretical & managerial implication of this study is summarized below.

Majority of studies have explored quantitative part of the IoT adoption in manufacturing domain. Herein, researchers have largely focussed on IoT adoption and maturity models to study levels of adoption in various sectors. (Gaur & Ramakrishnan, 2019) have used the Becker's procedural method (Becket et al., 2009) to discuss the challenges in adoption of IoT and levels of maturity.

The determinants discussed are assets, products, financial feasibility, process improvement, IT landscape, people, and strategy. (Padyab et al., 2020) in their study have highlighted lack of knowledge, unclear advantage, data security and privacy risks as major barriers to adoption. (Michael Roe et. al., 2022) have highlighted customer journey, cost effectiveness and remaining competitive as the main enablers to IoT adoption in manufacturing. (A. Singh et al., 2022) have highlighted investments and skilled and knowledgeable personnel as a challenge to IoT adoption. (Amit kumar et al.,2020), in their study indicate competitive pressure as an important driving force of IoT adoption.

The second important theme has been quantitative and empirical studies using adoption models to study IoT adoption in manufacturing. As shown earlier in this paper, this theme has seen exponential growth in the last few years and thus indicates scope for future research. The various studies and the determinants studied have been highlighted in detail earlier in this paper. We have observed use of UTAUT and TAM models and their hybrids used to study IoT adoption at end user level. Theories such as ISSM, MATH, SCOR, motivational theories have been used in hybrid along with the fundamental frameworks.

2.8.1 Findings and further scope:

Research trends on IIoT adoption across industries point to a significant amount of effort in the field of empirical studies. Adoption has been examined at the end user and organizational levels using a variety of paradigms. T-O-E is the most often used framework to examine technology adoption at the organizational level, even if TAM and UTAUT are the main frameworks utilized in the field of end user adoption. Research in this domain is concentrated in sectors like agriculture, healthcare, MSMEs, and general manufacturing, while industries like textiles and telephony appear to be falling behind in terms of research output. Therefore, adopting T-O-E to explore any of these industries could expand the field of future research.