Received: 17 January 2024 | Revised: 20 March 2024 | Accepted: 31 March 2024 | Published online: 15 April 2024

RESEARCH ARTICLE

Journal of Comprehensive Business Administration Research
2024, Vol. 00(00) 1–12
DOI: 10.47852/bonviewJCBAR42022482

BON VIEW PUBLISHING

A Structural Equation Model Study for Adoption of Internet of Things for the Growth of Manufacturing Industries in Australia

Abhishek Mitra[1], Arumugam Seetharaman[2,*] and Koilakuntla Maddulety[3]

[1]*S P Jain School of Global Management, Australia*

[2]*S P Jain School of Global Management, Singapore*

[3]*S P Jain School of Global Management, India*

Abstract: This research study delves into the integration of IoT within the Australian manufacturing sector, analyzing five key factors influencing adoption and drawing comparisons with Rogers' innovation theory. Its objectives encompass assessing how competitiveness, regulatory support, management support, manufacturing growth, and cost savings affect IoT adoption. Methodologically, the research journey includes defining the problem, conducting a thorough literature review, crafting a research proposal, executing pilot and main studies, validating findings, and ultimately composing the final thesis. Quantitative data obtained from a large pool of over 500 respondents shed light on the positive impacts of competitiveness, regulatory support, and cost savings on IoT adoption. Additionally, the study employs Importance-Performance Map Analysis (IPMA) to underscore the significance of management support in successful IoT implementation. Despite facing limitations such as common method bias and constraints on generalizability, the research underscores the transformative potential of IoT in enhancing operational efficiency and decision-making within Australian manufacturing. Overall, the study's findings confirm the significant influence of key factors on IoT adoption, affirming its potential to drive competitiveness, regulatory compliance, cost efficiency, and growth within the Australian manufacturing landscape.

Keywords: Internet of Things, competitiveness, cost savings, manufacturing growth, regulatory support

1. Introduction

In our rapidly advancing world, the pace of technological evolution has reached unprecedented levels, reshaping the global manufacturing industry and transforming working conditions. Within this dynamic landscape, Australia is experiencing a significant surge in the adoption of the Internet of Things (IoT). Notably, data from the Australian Bureau of Statistics reveal a substantial uptick in the utilization of IoT devices, surging from 7.3 million in 2018 to 9.2 million in 2020, marking a noteworthy increase of 25.3%.

This surge is primarily attributed to the burgeoning popularity of interconnected home devices, including smart thermostats, voice-activated digital assistants, and integrated security systems. Simultaneously, the enterprise sector in Australia is actively embracing IoT solutions as organizations seek to optimize operational efficiencies, elevate customer experiences, and curtail overall operational costs. The pervasive influence of IoT extends across diverse industries such as agriculture, healthcare, transport, and manufacturing, each harnessing the power of IoT to drive enhanced efficiency. This technological paradigm shift is not merely confined to a singular sector; rather, it is permeating through various domains, catalyzing advancements that promise to redefine and elevate standards of productivity and effectiveness, enhanced customer interactions, and cost-effectiveness. The government's National IoT Strategy plays a pivotal role in driving this trend, propelling industry expansion, and creating new avenues for growth. The upward trajectory of IoT adoption rates in Australia is anticipated to persist in the years ahead. This positive trend is poised to endure as an increasing number of companies, industries, and individuals acknowledge the substantial potential of IoT in enhancing their operations and fueling innovation. In manufacturing, data-driven IoT implementation is revolutionizing the supply chain. While challenges exist in harnessing data, a quantitative analysis explores IoT adoption factors in Australian industries, emphasizing sectors like mining, construction, manufacturing, agriculture, and healthcare. By embracing IoT, organizations can boost productivity, minimize downtime, and make informed decisions. However, alongside these benefits, there is a need to address cybersecurity risks associated with IoT proliferation. Despite challenges, IoT offers significant growth prospects in Australia's ICT landscape. This paper undertakes a quantitative analysis of the influential factors driving the adoption of the IoT within the manufacturing domain of Australian industries. The examination extends to encompass a meticulous assessment of the

*Corresponding author: Arumugam Seetharaman, S P Jain School of Global Management, Singapore. Email: seetha.raman@spjain.org

cost implications and revenue dynamics associated with the technology, specifically within sectors such as mining, construction, manufacturing, agriculture, and healthcare. The adoption of IoT is poised to yield substantial benefits, including heightened productivity, diminished downtime, and a reduction in unplanned maintenance for organizations operating in these sectors. The infusion of IoT promises a paradigm shift by introducing data-driven transparency, thereby elevating the quality of decision-making processes. Furthermore, the study underscores the vast potential for IoT industry development, positioning it as a pivotal subset within the information and communication technology (ICT) sector in the country. A focused emphasis is placed on addressing the cybersecurity risks entailed by the accelerated uptake of IoT, underscoring the necessity for comprehensive measures to safeguard against potential threats. This nuanced approach not only affirms the affirmative impact of IoT adoption but also acknowledges the imperative need for a vigilant and secure technological landscape.

In this paper, a quantitative analysis of the factors influencing the adoption of the IoT in the manufacturing domain of Australian industries is mentioned. It analyzes the cost implications and revenue of the technology on the organizations that might benefit from it like mining, construction, manufacturing, agriculture, and healthcare. Such adoption of IoT would impact higher productivity and reduce downtime and unplanned maintenance. The data-driven transparency will result in better decision-making with such technology in place. There are ample new opportunities for the IoT industry development (as a major ICT sector subset) in this country focusing mainly on the risks of cyber security associated with enhanced uptake of IoT.

1.1. Digitalization

Comprehensive integration of automation is instrumental in formulating solutions within semi-automated states, promising elevated levels of productivity, flexibility, and speed. While speculation surrounds the potential cost savings in total manufacturing expenses, precise figures are subject to variation across different countries. Within the value chain context, reduced costs and heightened efficiency emerge as pivotal outcomes of digitalization. Therefore, digitalization plays a crucial role in maintaining competitive advantages and augmenting the competitiveness of organizations in the manufacturing industry. Notably, manufacturing companies are compelled not only to digitalize existing services and product lines but also to adapt to the development of innovative digital products and services. Evidently, the traditional business models in mass production industries face significant challenges due to rapid digital advancements and growth. Furthermore, digitalization in the industrial domain has brought forth numerous opportunities, concurrently introducing risks and challenges that necessitate strategic consideration. Those challenges must be appraised when considering the capability of Industry 4.0 applications (PwC, 2015).

1.2. Internet of Things

IoT, utilizing integrated sensor technologies for real-time data capture and sharing, is a rapidly evolving technology impacting connected devices across various domains such as thermostats, automobiles, utilities, and air units. Its primary goal is to enable everyday items to interact online, fostering practical applications in smart homes, workplaces, and advanced transit networks (Mazhelis et al., 2012). Initially introduced in 1999 by Kevin Ashton, IoT facilitates machine-to-machine communication, encompassing surveillance, industry, healthcare, customers, and digital homes.

Anticipated to reach 74 billion connected systems by 2025, IoT research focuses on addressing privacy and cybersecurity concerns. Despite variations in theoretical frameworks, there is no consensus on the most accurate indicators or hypotheses for IoT adoption (Nguyen et al., 2021). IoT's potential extends to automating processes, reducing human data entry, and offering services for intelligent homes (Nižetić et al., 2020). The future impact of IoT is vast, with consumer-based innovations anticipated to drive user growth and meet diverse consumer needs (Sundmaeker et al., 2010).

Market interest and customer approval are crucial factors determining the feasibility and future of IoT applications Despite insightful research on specific IoT adoption, a comprehensive understanding of the IoT ecosystem is limited without considering various situations and adopting conventional communication system administration models.

1.3. Internet of Things in manufacturing sector of Australia

Australia, as a continental mainland, has witnessed substantial economic growth for over two decades. Despite this, critics of the market economy often attribute the efficiency of Australian industries and workforces to external factors rather than internal enhancements. The persistently weak productivity growth has resulted in an economy marked by high prices, potentially rendering Australia less competitive in crucial global markets in the post-pandemic future.

A special report by Australian Computer Society (2018) emphasized that demographic and productivity factors, as fundamental drivers of economic growth, could render Australia a stagnant economy by 2030. In this context, IoT technology, proven in Australia since 2018, presents an opportunity to counter this downward trajectory. Steadily adopting this technology has the potential to significantly enhance productivity, minimize unexpected downtimes in manufacturing industries, and bolster the country's overall economy. However, failure to leverage these technological benefits effectively may lead to a substantial decline in global competitiveness.

Major industries in Australia, including construction, mining, healthcare, manufacturing, and agriculture, stand to potentially benefit by AUD 100–300 billion over a period of 10 to 15 years. This could result in an average productivity increase of nearly 2% across all major facets of these industries.

Specifically, manufacturing industries have the potential to benefit significantly, with an estimated AUD $80 billion from IoT technology. Operating in integrated platforms where machines communicate with each other and sensors provide closed and open feedback loops, manufacturing stands to gain substantial advantages. Since 2018 and extending into the post-pandemic era of 2022, IoT technology has been steadily adopted in various sectors, including wastewater treatment plants, mining, and small and medium enterprises in process industries. Customers are already experiencing the benefits through small proof-of-concept projects, embracing an efficient work approach and validating data seamlessly across diverse platforms.

The thesis expounds on how the adoption of IoT, considering variables identified from focused literature on manufacturing industries, has the potential to foster a more robust economy for Australia in the future.

2. Research Significance and Research Questions

In Australia, Industry 4.0 discussions raised questions from the customer's perspective. Organizations, especially in manufacturing, are adopting new technologies for agility. The application of IoT in Australian manufacturing is seen as crucial for economic growth and global competitiveness. The lack of pragmatic use of emerging technologies has hindered progress in the past. A report PwC (2015) warns of Australia slipping to 23rd place in GDP (PPP) by 2030 due to poor productivity. This research explores IoT opportunities and risks in various industries, emphasizing the need for effective adoption to avoid lagging behind in the global market. In today's intricate business landscape, organizations require flexibility and agility. Adopting new methods and business models is crucial for staying competitive. With the advent of future technologies, organizations are becoming more agile, particularly in manufacturing, supply chain, and logistics domains (Caputo et al., 2016; Papert & Pflaum, 2017).

The application of IoT in Australian manufacturing is poised to elevate economic growth opportunities, enhancing productivity and driving economic advancement. Failure to effectively adopt and leverage this technology may result in Australia lagging behind in global competitiveness.

Australian industries are undergoing a significant transformation, especially in manufacturing supply chains, emphasizing data accuracy and utilization. While data availability at manufacturing levels has been prevalent, the lack of pragmatic use of emerging technologies, attributed to insufficient government support in regulating frameworks, has hindered progress. The past 25 years saw economic prosperity driven by external factors rather than internal enhancements. The PwC report of 2018 highlights concerns about Australia slipping to 23rd place in GDP (PPP) in the G20 by 2030 due to poor productivity.

This research delves into IoT opportunities within broad business and economic contexts. It analyzes cost implications and revenue for industries like mining, construction, manufacturing, agriculture, and healthcare. Despite the risks associated with increased IoT uptake, there are significant prospects for IoT industry development as a major subset in Australia's ICT sector.

From several literature studies and previously identified research gaps, the exploration of certain important questions became the long-term benefits for the adoption of IoT. The five important research questions were formulated below:

a) What role does competitiveness play in shaping the adoption of IoT technology in Australia?
b) In what manner do regulation and security concerns impact the adoption of IoT?
c) Is the adoption of IoT by manufacturing industries fundamentally steered by the pursuit of cost savings?
d) In what manner does the management support endorses the adoption of IoT in the manufacturing industries?
e) What major factors on the demand side would drive such IoT adoption?

2.1. Research objectives and hypotheses

Based on the variables, the identified objectives for this research are as follows:

I. To investigate the security and regulatory support in the adoption of IoT in Australian manufacturing sector.
II. To assess degree of cost savings that might essentially drive an industry to adopt IoT.
III. To analyze how competitiveness would shape up the adoption of IoT in Australian manufacturing sector.
IV. To measure the significant influence of management support in the decision of such adoption of IoT as a technology.
V. To investigate the primary demand-side catalysts that have prompted the Australian manufacturing sector to embrace the IoT over the past five years.

2.2. Research hypotheses

From the above research framework, five direct hypotheses and six indirect hypotheses were formulated by combining the research questions and research objectives. They were as follows:

Competitive advantage effects, IoT adoption in Australian manufacturing industries.

IoT adoption may be impacted by the regulatory support by the Federal Government of Australia.

a. Regulatory support serves as a mediating factor, influencing manufacturing growth to significantly impact the adoption of IoT within the manufacturing industries of Australia.

Management support plays a significant role in the adoption of IoT in Australian manufacturing industries.

a. Manufacturing growth acts as a mediating factor, influencing the adoption of IoT within the manufacturing industries of Australia, significantly driven by management support.
b. Competitiveness serves as a mediating factor, influencing the adoption of IoT within the manufacturing industries of Australia, significantly driven by management support.

Manufacturing growth will be important in the adoption of IoT in Australian manufacturing industries.

a. Competitiveness acts as a mediating factor, influencing the adoption of IoT within the manufacturing industries of Australia, significantly propelled by manufacturing growth.
b. Cost savings function as a mediating factor, influencing the adoption of IoT within the manufacturing industries of Australia, with manufacturing growth being a significant driver.

Cost savings have a significant impact on IoT adoption in Australian Industries.

3. Literature Review

A meticulous review of existing literature was conducted to synchronize with the impending global transformation and the widespread integration of IoT. This systematic process facilitated a comprehensive analysis of the evolving technological culture in Australia. Drawing predominantly from secondary online sources, the review not only identified crucial research gaps but also laid a solid groundwork for the ensuing research study. At the core of this academic endeavor was the development of a conceptual model, accompanied by a coherent set of hypotheses ready for subsequent empirical validation. The thorough literature review not only bestowed a nuanced understanding but also provided a panoramic perspective on the diverse factors exerting both direct and indirect influences on the adoption of IoT within the Australian manufacturing landscape. Within this scholarly exploration, five paramount independent variables were pinpointed as pivotal drivers steering the adoption of IoT within the dynamic framework of Australian manufacturing.

3.1. Barriers to adoption of IoT

In the literature review, several barriers hindered the widespread adoption of IoT in Australia.

3.1.1. Cost savings

Adopting automation technologies, such as IoT, is imperative for organizations aiming to attain heightened efficiency in productivity and quality while minimizing investments (Sivathanu, 2019). The incorporation of automation not only decreases production costs but also indirectly impacts product prices for end-users, contributing to enhanced affordability (Ahlmeyer & Chircu, 2016). Recognizing the revenue generation and cost-saving potential of IoT, it is asserted that the Australian economy stands to benefit significantly from embracing these cutting-edge technologies (Huerta et al., 2019). This thesis seeks to delve into the affirmative relationship between cost savings and IoT adoption, aiming to quantify the positive effects on the Australian economy. The initial investment required for IoT implementation, including hardware, software, and infrastructure upgrades, can be prohibitive for many businesses in Australia.

3.1.2. Security concerns

The highlights of the paper (Mazhar et al., 2023) and the transformative impact of the IoT on connectivity and productivity while acknowledging the escalating cybersecurity threats is a good insight. It emphasizes the inadequacy of traditional security measures and advocates for AI-driven solutions, particularly machine learning and deep learning algorithms, to bolster IoT security. The paper examines IoT security intelligence, proposing innovative approaches leveraging these technologies to protect against diverse cyber threats. It also addresses key research challenges and future directions in this area. This concise summary provides valuable insights for researchers and practitioners aiming to understand and address the cybersecurity challenges posed by IoT adoption. The potential vulnerabilities in IoT devices and networks pose significant security risks, leading to concerns about data breaches, privacy violations, and cyber-attacks.

3.1.3. Manufacturing growth with respect to lack of skills

The research article by Gekara et al. (2019) delves into Australia's digital skills landscape for the broader workforce, focusing on industries like transport, postal services, and public administration. It identifies a pressing need for improved digital competencies to bolster productivity and competitiveness. Through international frameworks and industry case studies, the study underscores the importance of government and industry collaboration in addressing digital skills gaps. A survey of human resources professionals further highlights the impact of digitalization on skill requirements. To address these challenges, the authors propose a digital skills framework aimed at pinpointing gaps and facilitating targeted training initiatives within organizations. There is a shortage of skilled professionals with expertise in IoT technologies, data analytics, and cybersecurity, limiting the ability of organizations to implement and manage IoT solutions effectively.

3.1.4. Regulatory support

The adoption of IoT is significantly influenced by the laws and regulations set by the government as evidenced by previous research (Ahlmeyer & Chircu, 2016). Such regulatory frameworks play a pivotal role in shaping the environment for IoT implementation. The potential impact of IoT adoption on a nation's economy cannot be underestimated. In the case of Australia, the current state of its economy and the ongoing transformation of the industrial landscape accentuate the importance of embracing IoT as a means to bolster economic growth. Leveraging IoT in the supply chain industry presents Australia with a prospect to enhance its economic growth. Australia's industrial landscape is experiencing a significant transformation, marked by the infusion of data-driven processes throughout the supply chain. However, the challenge extends beyond data accumulation to the effective harnessing of its potential. Maximizing the utility of this data reservoir emerges as a primary obstacle. In this context, IoT emerges as a transformative solution. Integrating IoT into the supply chain industry becomes a strategic pathway for Australia to propel its economic advancement. This study delves into the correlation between IoT adoption and regulatory support, aiming to elucidate how regulatory backing can act as a catalyst for the Australian economy. A meticulous analysis will be conducted on the alignment of the regulatory framework with IoT integration and its subsequent impact on economic indicators. Furthermore, the study aims to elucidate the potential short-term and long-term benefits that IoT adoption, reinforced by supportive regulations, can usher in for the Australian economy. Through a nuanced exploration of this relationship, the study endeavors to contribute to understanding how the strategic convergence of IoT adoption and governmental regulatory support can not only drive technological progress but also invigorate Australia's economic landscape. This research probes the relationship between IoT adoption and regulatory support, evaluating its potential to boost the Australian economy. Complex and evolving regulatory frameworks, including data protection and privacy laws, create compliance challenges for IoT deployment, particularly in highly regulated industries.

3.1.5. Lack of standards

The article by Harkin et al. (2022) presented insights from interviews with 32 stakeholders in Australia's information security, policy, IoT industry, and academia. It highlighted concerns extending beyond privacy and security to encompass societal impacts, vulnerable communities, and environmental implications of IoT. Stakeholders advocated for more robust regulation, yet no clear regulatory strategy was identified. The findings underscored the need for further regulation in consumer IoT, urging policymakers to address a broader spectrum of issues. The absence of uniform standards and protocols for IoT devices and systems hampers interoperability, making it challenging to integrate different technologies and platforms effectively.

3.1.6. Competitiveness

The adoption of any technological innovation inherently intertwines with an organization's productivity and scale, as evidenced by prior research (Caputo et al., 2016). In this context, the implementation of IoT carries profound significance. Organizations harness IoT to foresee potential equipment failures, proactively preventing downtime and thereby enhancing manufacturing growth and reliability. Integrating IoT not only reduces costs but also, through acceleration and automation, catalyzes a subsequent upsurge in productivity (Kamble et al., 2019). This strategic fusion of heightened efficiency and lowered costs bestows a distinctive competitive advantage upon organizations. Through the embrace of IoT, businesses position themselves favorably in the global market landscape. The pursuit of this advantage, coupled with the impetus to fortify Australia's economy, has spurred an escalating trend among companies towards IoT adoption. The trajectory of this adoption bears the potential to reshape industries and make substantial contributions to the nation's economic well-being. Inadequate infrastructure, such as limited network coverage and bandwidth constraints, can impede the scalability and reliability of IoT deployments, especially in remote or rural areas.

3.1.7. Management support

The examination of factors impacting IoT adoption emphasizes that companies strategically opt for IoT integration as a crucial move to attain a competitive advantage. The absence of such a competitive edge leaves the company vulnerable to challenges, hindering its potential for growth and overall success in the dynamic business landscape. In essence, IoT adoption is positioned as a proactive and strategic initiative crucial for companies seeking not only survival but also sustained growth and prosperity in their respective industries (Singh et al., 2020). Therefore, every company must develop a model that is not only easily assimilated but also agile enough to consistently uphold a competitive advantage in the ever-evolving market landscape. This entails a strategic approach to ensure not only initial absorption but ongoing adaptability to maintain a sustained edge over competitors (Carcary et al., 2018). In the context of heightened competition, the imperative for innovation becomes increasingly apparent. The adoption of IoT is posited as a strategic response to the compelling pressure for companies to innovate under such conditions. This thesis conducts a meticulous and comprehensive analysis of the nuanced correlation between competitive pressures and the pervasive adoption of IoT. The primary objective is to systematically determine the alignment of the findings with prior research outcomes in the field. This clinical exploration seeks to contribute precise insights into the intricate dynamics wherein competitive pressures act as determinants for the integration of IoT technologies in contemporary business landscapes.

Organizational inertia and resistance to change among stakeholders may hinder the adoption of IoT, particularly in traditional industries with established practices and processes. The management, as delineated in Taneja et al. (2016), intricately directs the orchestration of organizational maintenance and development. Its support stands as a pivotal factor influencing organizational decisions, constantly evolving to address both internal and external requisites. In the Australian manufacturing market, the conjunction of cost-efficient labor and automation propels Human Resources (HR) to the forefront. Significant decisions, including resource allocation, operational reengineering, and service integration, are contingent upon the endorsement of top-tier management (Ferretti & Schiavone, 2016). The support of management is imperative; without it, the prospect of adopting IoT becomes significantly less likely Addressing these barriers requires concerted efforts from industry stakeholders, policymakers, and academia to develop solutions that mitigate risks, enhance security, promote interoperability, and build the necessary skills and infrastructure for successful IoT implementation. The identified variables which stood out significantly from the literature review of articles during the secondary sources of data study are stated below as follows. The author has elaborated about the five identified independent variables in the following paragraphs.

4. Research Methodology

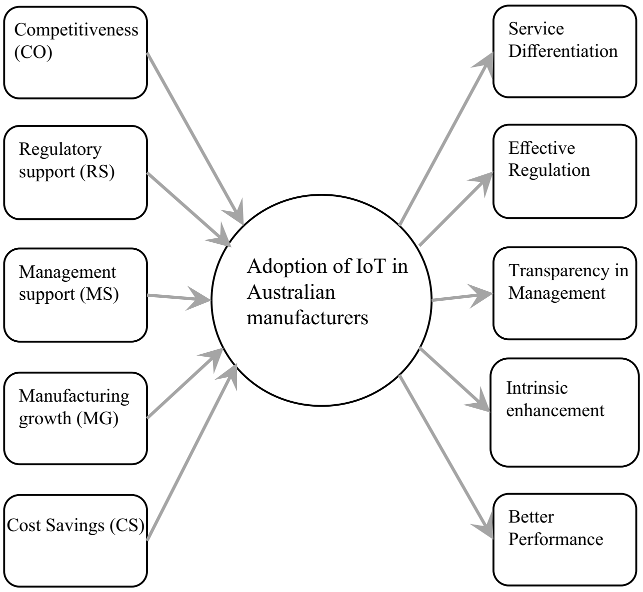
The research methodology involved the correlation of five independent variables, meticulously curated through an exhaustive literature survey. A focused examination of articles spanning the years 2018 to 2022 was specifically conducted to derive the findings. Subsequently, a systematic mapping of findings, methods, problems, and solutions was executed, facilitating the identification of research gaps and delineation of areas for future exploration. The primary data source emanated from participants engaged in focused group discussions, facilitated by an online survey deployed through Google Forms. The systematic type sampling was used from the focused group of participants. The survey garnered responses from a total of 505 participants in Australia, all possessing professional backgrounds in the fields of IoT and automation. This clinical approach ensured a methodical and precise data collection process within the specified domain of expertise. The sectors of industry focus were mainly manufacturers, agriculture manufacturers, original equipment manufacturers of IoT products such as sensors, gateways, etc., mining industry, water industry, and other manufacturing consultants and contractors. The secondary data source comprised meticulously curated and relevant articles that had already been published. These articles were systematically dissected to discern their crucial components, allowing for a comprehensive assessment of the variables. The frequency of occurrence of these variables was meticulously documented. The research progression included a pilot study preceding the main study, employing the structural equation model (SEM) for data analysis. Following the outlined research framework, the findings underwent rigorous analysis to underscore areas necessitating further research for a nuanced comprehension of the adoption of the IoT in Australian manufacturing industries.

4.1. Research framework

With the literature review, a conceptual framework model was proposed for the Adoption of IoT in Australian manufacturing industries as a dependent variable. This model is assessed through research outcomes involving service differentiation, effective regulatory support, transparent management support (Lee & Lee, 2015), enhanced manufacturing growth, cost-saving performances. The independent variables, extracted during the literature surveys, encompass competitiveness, regulatory support, management support, manufacturing growth, and cost savings. Constructing this research framework involves establishing connections between the identified independent variables and the core dependent variable.

The framework depicted in Figure 1 serves as a foundational model, assuming relationships and interactions. It is important to note that this depiction is not yet verified as an established or modified representation or the intended impact of a variable. Subsequent analysis and research will aim to validate, refine, or modify this framework, moving towards a clearer understanding of the intricate dynamics that govern the adoption of IoT within the Australian manufacturing context.

Figure 1
Research framework

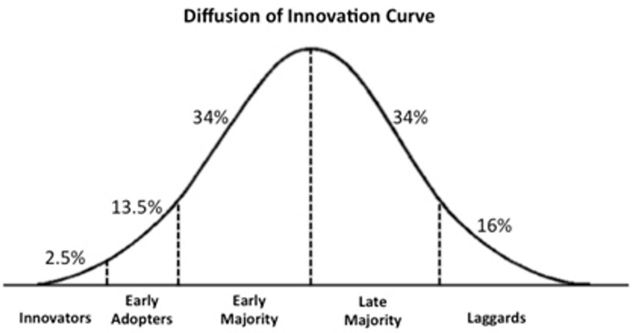


5. Roger's Theory of Diffusion

In Figure 2, Rogers's theory of diffusion is considered significant for exploring any kind of new technological growth in Industry 4.0. The rate and process through which new technological developments flourish through cultures and societies is explained by Rogers (1964) in his theory of Diffusion of Innovations (DOI).

Rogers' DOI model clarifies the answers to three important questions: what, why, and how. Related to this prototype, the primary elements that affect the spread of innovations are the innovation itself, communication networks between members that distribute the innovation, the amount of time required to pass through the process of innovation, and a social scheme that supports solving challenges with the help of innovative tools and applications. As per Rogers (1964), "this process depends greatly on human resource." To withstand itself, the innovation must be extensively adopted. In the rate of adoption, there is a point at which an innovation reaches critical mass.

Figure 2
Roger's curve of diffusion



With the intention to regulate innovations using a social system, five categories were defined by Rogers to organize the different stages of a person's adoption process. The criterion for adopter categorization is innovativeness, which is defined as the degree to which an individual adopts a new idea. The five categories of adopters are innovators, early adopters, early majority, late majority, and laggards. Rogers places these categories on a bell-shaped curve, characterizing a continuum which is normally distributed, with the following proportions: innovators 2.5%, early adopters 13.5%, early majority 34%, late majority 34%, and laggards 16% (Rogers, 1964).

The categories are described as follows:

Innovators: These are the people who are usually the first to try innovation. They are risk-takers and are often the first to develop new ideas.
Early adopters: These individuals represent opinion leaders. They are agile and visionary and understand the need for change. They are very comfortable with adopting new ideas and embracing new opportunities.
Early majority: This group likes to see the evidence before adoption. However, they accept and adopt new ideas before the average person.
Late majority: This group of adopters is cynical of change. They will only embrace innovation after it has been tried by the majority.
Laggards: This group is very challenging to convince. They are averse to change, bound by tradition, and very conservative.

From Figure 2, the Rogers curve can be used to understand the adoption of IoT. IoT is a network of interconnected devices that can collect and exchange data, enabling them to communicate with each other and with external systems. With the proliferation of IoT devices in society, understanding the adoption of these technologies by different groups of people is important for businesses. By using the Rogers curve, businesses can gain insights into which groups are most likely to adopt IoT and when they are likely to do so. This can help inform product development and marketing decisions and ensure that resources are allocated to the right audiences at the right time. Based on Rogers' theory of DOI, the survey instrument for this research had a section questioning the participant about the rate at which they generally embrace technology.

6. Survey of Population

The survey questionnaires were tailored for a focused group with cohesive expertise in automation and IoT, encompassing individuals with substantial experience in the Australian industries. A sample size comprising 505 data points was meticulously collected within the Australian demographic. The study population encompassed a diverse range of professionals, including senior management, experienced professionals, C-level executives, graduate trainees, junior management, and owners of IoT companies. All these professionals exhibited a direct or indirect connection to the IoT field and have demonstrated progressive work experience in Australia, actively contributing to efficiency advancements in their respective domains.

In below Figure 3, the study carried out shows that almost 92.6% were from region Australia and other parts of APAC region where the Australian entities had their overseas offices. The researcher did not influence any regional respondents.

Figure 3
Location

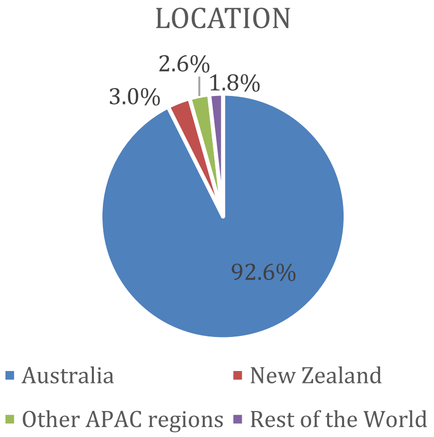
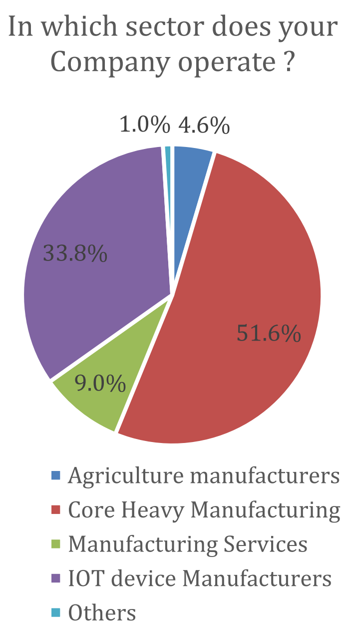


Figure 4 depicts below the sector of the respondents from the industries. IoT device manufacturers and core heavy manufacturers comprised of the 51.6%, rest 9% from manufacturing service companies and agriculture manufacturers a 4.6% and IoT device manufacturing companies of 33.8% which sums up to be a whopping number of 99% from the overall manufacturing sector.

Figure 4
Sector of operation

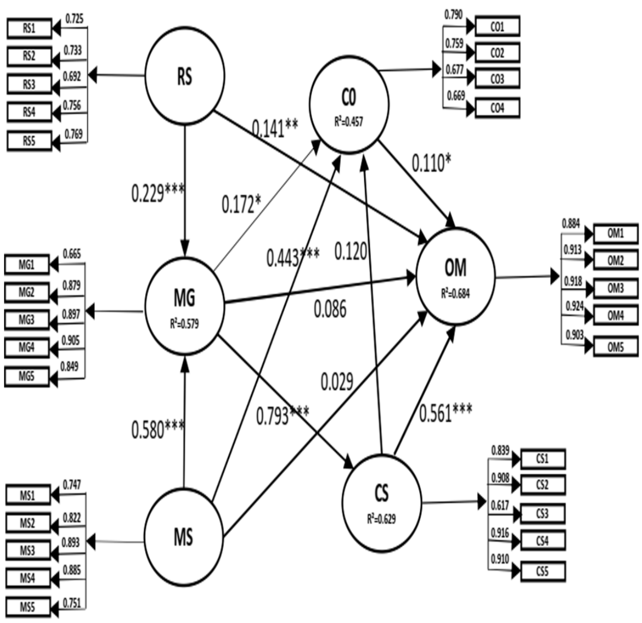


7. Structural Equation Model

SEM is the multivariant scientific method for testing of multivariate casual relationships for both direct and indirect relationships. This is a combination of two statistical methods: Confirmatory factor analysis and path analysis. This SEM utilizing circuit coefficients is seen throughout Overall, there were five direct relationships and six indirect relationships with the independent variables and dependent variables are depicted in Figure 5. The overall adoption of IoT in Australian manufacturing (OM), serving as the dependent variable in this study, demonstrates an *R*2 score of approximately 0.684. This suggests that the key antecedents within the contributory variables of this model collectively explain approximately 68.4% of the variation observed in this implicit variable. Employing partial least squares multiple linear regressions, this value is deemed statistically significant (Hsu & Yeh, 2017). The main study utilized ADANCO 2.0.1 software for variation-based SEM, focusing on partial least squares (PLS) path modeling, a favored method for success factor studies. Various variance-based structural models, including PLS path modeling, were employed to test hypotheses, demonstrating the effectiveness of the proposed solution in enhancing system performance and reducing complexity.

Reliability and validity were assessed using indicators such as Cronbach's alpha, inter-item correlation, and split-half reliability for reliability, and correlation coefficients, factor analysis, and convergent validity for validity. These measures ensured the accuracy and consistency of the data, critical for scientific studies. The software's analytics confirmed multicollinearity among independent variables, and bootstrapping validated sample distributions. Hypothesis testing models evaluated path coefficients, beta values, *t*-values, and *p*-values, affirming hypotheses during analysis.

Figure 5
Structural equation model



8. Justification of Using SEM Model

The existing approaches to studying and evaluating scientific information outputs are complicated and ambiguous. They are sometimes rigid and presume that measurements are error-free. SEM, by contrast, is a strong, versatile, and all-encompassing multivariate tool for studying the links between observed factors and underlying components (Mueller & Hancock, 2018). SEM requires a conceptually rooted paradigm and suitable investigative tools to guide scientists in constructing study strategies accurately. Through continuous analysis, SEM predicted interconnected assumptions, forming a key rationale for this investigation. Two types of factors, extrinsic and intrinsic components, were utilized in the study.

There were significant links involving the main variables, as well as secondary correlations among predictor factors.

8.1. Convergent validity

Convergent validity, a form of criterion validity, is employed to evaluate the extent to which different measures designed to assess the same construct or phenomenon demonstrate a relationship. Its application ensures the validity and reliability of a measure. In this framework, the overall average variance extracted (AVE) statistics were scrutinized to ascertain validity. AVE gauges the degree of variation explained by an unobservable concept relative to the variance attributed to random sampling error. The accepted threshold for assessment is 0.5, indicating that any construct with an AVE score surpassing 0.5 substantially contributes to the total variation within the framework.

In Table 1, the estimated AVE statistics for each study construct within the framework/model are presented below. Conclusive evidence of convergent validity is established through scores ranging from 0.5268 to 0.8252, underscoring the model's ability to consistently measure the intended constructs.

Table 1
Convergent validity table

Construct	Average variance extracted (AVE)
CO	0.5268
RS	0.5409
MS	0.6757
MG	0.7120
CS	0.7152
OM	0.8252

8.2. Direct effect interference

The examination of the direct impact of independent variables on a dependent variable stands as a pivotal aspect of research endeavors. The significance of such an analysis lies in the identification of independent variables that are most likely to exert influence on the dependent variable. This process serves to unravel the intricate relationships between various variables and their impact on the study's outcome. It also aids in pinpointing potential areas for improvement or avenues that warrant further exploration.

Moreover, this approach contributes to the research study's ability to draw conclusions grounded in evidence rather than assumptions. In Table 2, the *t*-values and the decision of their significance are mentioned. From the findings presented in Table 3, it is evident that there are at least six highly significant correlations. Specifically, the table illustrates that regulatory support (RS), management support (MS), manufacturing growth (MG), and cost savings exert considerable and statistically significant influence on the adoption of IoT within the Australian manufacturing sector.

Table 2
Direct effect interference

t-values	Decision
t <1.65	Not significant
1.65 < t < 1.96	Moderate
1.96 < t < 2.59	Significant
t > 2.59	Very significant

Effect	*t*-value	Decision
CO -> OM	2.21**	Significant
RS -> MG	4.02**	Very significant
RS -> OM	2.97**	Very significant
MS -> CO	6.05**	Very significant
MS -> MG	9.68**	Very significant
MS -> OM	0.61**	Not significant
MG -> CO	2.11**	Significant
MG -> CS	17.51**	Very significant
MG -> OM	1.32**	Moderate
CS -> CO	1.75**	Moderate
CS -> OM	9.23**	Very significant

The analysis of direct effects in Table 3 reveals a minimum of six highly significant correlations. Specifically, the tabulated data underscores that regulatory support (RS), management support (MS), manufacturing growth (MG), and cost savings exert a notably substantial influence on the adoption of IoT within the Australian manufacturing sector.

8.3. Moderating variable

In order to gain deeper understanding through the SEM, the use of moderating variables was introduced. Moderating variables are also known as moderators and they influence the strength or direction of the relationship between two other variables. They help to understand when and for whom a particular relationship is stronger or weaker.

The role which the moderating variables are to explore whether the relationship between an independent variable (IV) and dependent variable (DV) varies under different conditions or different subgroups of the population.

Moderating variables in SEM are typically included as interaction terms or product terms in the structural model. These terms multiply the IV(s) by the moderating variable(s), representing the interaction effect.

8.4. Effect of moderating variable

In order to understand the effect of moderating variables on independent variables in more detail, the below few points give us a better understanding along with the results shown in Tables 3 and 4.

8.4.1. Influence on the strength of the relationship

Moderating variables can influence the strength of the relationship between an IV and a DV. They help you determine whether the effect of the IV on the DV becomes stronger, weaker, or remains the same under different levels or conditions of the moderator.

In order to explain in a simple manner, let us take an example for studying the effect of a marketing campaign (IV) on product sales

(DV), the region of the country (moderator) might influence the strength of this relationship. The campaign's impact on sales could be stronger in one region and weaker in another.

8.4.2. Influence on the direction of the relationship

Moderating variables can also affect the direction of the relationship between an IV and a DV. In some cases, the presence of a moderator may reverse the direction of the relationship.

The same example of marketing campaign can be used, and aforesaid that if the moderator is the customer's age group, the campaign might have a positive effect on sales for older customers but a negative effect for younger customers.

8.4.3. Identification of subgroup differences

Moderating variables help researchers identify subgroup differences within the population. This is important for understanding whether the IV-DV relationship is consistent across different demographic or contextual groups.

In the marketing campaign example, if gender is the moderator, it might be possible to find that the campaign has a significant impact on sales for women but not for men, indicating a gender-based subgroup difference.

8.4.4. Enhanced model complexity

In SEM, the moderating variables can be used to increase the complexity. It is needed to account for the interaction between the IV and the moderator in the analysis, typically by adding interaction terms or product terms to the statistical model.

This complexity can provide a more accurate representation of real-world relationships but may also require larger sample sizes and careful interpretation of results.

8.4.5. Improved model explanation

Moderators can easily explain when and for whom certain effects are more pronounced or relevant. This can lead to a deeper understanding of the underlying mechanisms and provide more precise insights for decision-making in the outcome of the dependent variables.

8.4.6. Positive and negative effects of moderating variables

Moderating variables have positive effects in research by enhancing the researcher's understanding of complex relationships between independent and dependent variables, allowing for context-specific findings, improving predictive accuracy, enabling targeted interventions, refining theories, identifying boundary conditions, increasing precision, validating results, facilitating personalization, and advancing scientific knowledge. They provide a more nuanced and applicable perspective, making research more robust and relevant across diverse contexts and subgroups.

While moderating variables offer valuable insights, their inclusion in research can also have negative effects. These effects include increased model complexity, requiring larger sample sizes for sufficient statistical power, potential difficulties in interpreting interactions, and a risk of overcomplicating analyses. Moreover, accounting for moderating variables may introduce measurement challenges and complicate the presentation of research findings, potentially making them less accessible to a broader audience. Researchers must carefully consider the trade-offs between increased complexity and the benefits of understanding nuanced relationships when deciding to incorporate moderating variables in their studies.

From the moderating variables derived for the SEM:

$$\text{Manufacturing Growth(MG) x Regulatory Support(RS)}$$
$$-\text{Adoption of IoT(Outcome Measures)}$$
$$\text{Manufacturing Growth(MG) x Cost Savings(CS)}$$
$$-\text{Adoption of IoT(Outcome Measures)}$$
$$\text{Management Support(MS) x Competitiveness(CO)}$$
$$-\text{Adoption of IoT(Outcome Measures)}$$
$$\text{Cost Savings(CS) x Competitiveness(CO)}$$
$$-\text{Adoption of IoT(Outcome Measures)}$$

Table 3
Confidence interval table

	Original sample (O)	Sample mean (M)	2.5%	97.5%
CS × MS -> OM	0.120	0.117	0.013	0.221
CO × CS - >OM	0.123	0.117	−0.056	0.304
RS × MG - >OM	−0.080	−0.077	−0.197	0.037
CO × MG ->OM	−0.191	−0183	−03.69	−0.015

Table 4
Indirect relationship table

Code	Indirect relationships	*β*-value	*t*-value	Supported?
H2A	Regulatory Support–» Adoption (through Manufacturing Growth)	0.0196	1.2575	No
H3A	Management Support–» Adoption (through Competitiveness)	0.0486	2.0794	Yes
H3B	Management Support–» Adoption (through Manufacturing Growth)	0.0498	1.31113	No
H4A	Manufacturing Growth–» Adoption (through Competitiveness)	0.0188	1.5304	No
H4B	Manufacturing Growth–» Adoption (through Cost Savings)	0.4448	7.49	Yes
H5A	Cost Savings-» Adoption (through Competitiveness)	0.01319	1.3738	No

8.5. Summary of hypotheses and results

From the SEM above where 11 cause and effect relationships generated, and analyzed. Of the 11 relationships, five were found to be direct, and six were tested between the independent variables and the dependent variable through the mediation of other variables.

Out of the five direct independent variables, only three (regulatory support, competitiveness, and cost savings) were found to have a significant effect on the adoption of IoT by the manufacturing industries of Australia. Although management support and manufacturing growth did not have a significant direct impact on the adoption of IoT, through the mediation of other independent variables, it had a significant impact.

9. Scope of Future Research

There exists potential for future research in Australia to delve into the environmental and social impacts associated with the utilization of IoT. Additionally, a crucial and significant avenue for exploration lies in examining the development and adoption of IoT concerning job creation and its broader economic impact. Future research should investigate the environmental and social impacts of IoT implementation in Australia's manufacturing sector, exploring its effects on resource utilization, energy consumption, waste generation, and workplace dynamics. Additionally, there is a need to examine the role of IoT in job creation and its economic impact, analyzing employment trends and economic growth within the industry. Furthermore, researchers should explore the integration of other Industry 4.0 technologies like Big Data and Cybersecurity with IoT, aiming for a comprehensive digital transformation. Understanding how these technologies complement each other and enhance operational efficiency, data analytics, and decision-making processes is crucial. By delving into these areas, future studies can provide valuable insights into the holistic impact and potential of IoT and related technologies, facilitating the advancement of the manufacturing sector towards a smarter and more sustainable future.

10. Contribution to Practice

The research objectives were successfully addressed by affirming that the incorporation of IoT technology results in elevated productivity within manufacturing firms, consequently yielding cost reductions. This heightened operational efficacy significantly bolsters these firms' competitiveness within the market.

Moreover, noteworthy strides have been taken by the Australian Federal Government to oversee IoT deployment, thereby fortifying data protection protocols. This proactive regulatory stance establishes a secure ecosystem for IoT utilization.

Furthermore, the investigation unveiled that robust managerial backing within these firms acts as a catalyst for manufacturing sector expansion. This, in turn, imparts an indirect yet positive influence on the broader economic progression of the country.

A practical recommendation to Australian manufacturing industries is to list the critical assets in the processes and adopt IoT real-time monitoring through sensors. The critical parameters which can be monitored are current, temperature, oil, and insulation to prevent premature breakdown of the assets. This will lead to faster decision-making and prevent from unexpected downtime of the manufacturing units. In both technology and social environments, the global context of IoT adoption contributes to practice by fostering innovation, connectivity, and efficiency. This study was validated and presented in a conference presentation at IEEE, Spain Tenerife Island Conference (Mitra & Seetharaman, 2023).

Innovation: Across technology and social environments, the adoption of IoT fosters innovation. In technology, IoT enables the development of new products, services, and solutions by integrating physical devices with digital technologies. Similarly, in the social environment, the adoption of IoT encourages innovative approaches to addressing societal challenges, such as healthcare, transportation, and sustainability. For example, IoT-enabled healthcare devices allow for remote patient monitoring and personalized treatment plans, leading to improved healthcare outcomes.

Connectivity: IoT adoption enhances connectivity in both technology and social settings. In technology, IoT devices enable seamless communication and data exchange between interconnected devices, systems, and platforms, facilitating automation and data-driven decision-making. Similarly, in the social environment, IoT adoption promotes connectivity among individuals, communities, and organizations. For instance, IoT-enabled smart cities leverage interconnected sensors and data analytics to optimize urban infrastructure and services, enhancing the quality of life for residents.

Efficiency: The global adoption of IoT contributes to practice by improving efficiency in both technology and social contexts. In technology, IoT streamlines processes, reduces downtime, and enhances resource utilization through real-time monitoring and automation. Similarly, in the social environment, IoT solutions optimize resource allocation, improve service delivery, and enhance productivity across various sectors, including agriculture, education, and manufacturing. For example, IoT-enabled precision agriculture systems optimize water usage, fertilizer application, and crop yields, leading to increased agricultural productivity and sustainability.

Overall, the adoption of IoT in both technology and social environments drives innovation, connectivity, and efficiency, thereby contributing to practice by addressing challenges, improving processes, and enhancing outcomes on a global scale.

11. Conclusion

This section outlines the study's progression from problem statement to findings, focusing on five key factors: competitiveness, regulatory support, management support, manufacturing growth, and cost savings. Primary data were gathered globally, and reliability analysis was conducted using SEM software ADANCO 2.1.

This was evident based upon the direct interference and indirect interference results where competitiveness emerged as a primary success indicator, with IoT adoption enhancing market competitiveness. Regulatory support significantly impacted IoT adoption, while management support facilitated transparency and efficiency. Intrinsic benefits of IoT adoption boosted industrial growth, and cost savings drove adoption.

Overall, the study confirms significant relationships among variables, providing insights into IoT adoption's impact on Australian manufacturing.

Over the past decade, the IoT has become an integral part of both individuals' daily lives and the industrial sector (Rosas et al., 2017). Its integration has bestowed organizations worldwide with a substantial competitive edge, enabled by the collection and utilization of consumer device data (Singh et al., 2020). However, it is imperative for organizations to also acknowledge potential drawbacks, particularly concerning security concerns.

The adoption of IoT is shaped by five carefully selected variables. This research endeavors to delve into both the advantages and disadvantages stemming from the influence of these variables on IoT adoption. The study culminates by pinpointing the highly significant variables—namely, manufacturing growth, management support, and regulatory support—which exhibit a positive impact on the adoption of IoT within the manufacturing industries of Australia.

The study's constraints include geographical limitations, potential bias in the literature review, and the common method bias in data analysis. Generalizability and replicability were hindered by the focus group population and the inclusion of respondents from various global regions. The IPMA identified areas for deeper analysis, but future scope remains unexplored due to time constraints. Additionally, works in languages other than English may have been overlooked, possibly omitting crucial factors.

The study employed a positivist, cross-sectional design aiming to understand predetermined factors' connections through a diverse participant poll. While offering clear outcomes, alternative approaches such as a subjective layout might have allowed for the inclusion of more factors. Despite evidence of industrial aspirations, contradictory findings regarding IoT adoption in Australian manufacturing suggest a need for further investigation. Future studies could explore the social and environmental impacts of adopting emerging technologies and fill existing gaps, accelerating a comprehensive digital transition. Scholars may also examine instructional technology's impact on academic standards globally to enhance student understanding, recognizing the dynamic nature of technology integration and the varying degrees of cooperation.

Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

The data that support the findings of this study are openly available in Final Data.xlsx at https://spjainorg-my.sharepoint.com/personal/abhishek_db1804001_spjain_org/_layouts/15/onedrive.aspx?id=%2Fpersonal%2Fabhishek%5Fdb1804001%5Fspjain%5Forg%2FDocuments%2FConference%20submissions%2FIot%20Journal%20submission%20docs%2FJCBAR&view=0

References

Ahlmeyer, M., & Chircu, A. M. (2016). Securing the Internet of Things: A review. *Issues in Information Systems*, *17*(4), 21–28. https://doi.org/10.48009/4_iis_2016_21-28

Australian Computer Society. (2018). *Australia's IoT opportunity: Driving future growth.* Retrieved from: https://www.pwc.com.au/consulting/assets/publications/acs-pwc-iot-report-web.pdf

Caputo, A., Marzi, G., & Pellegrini, M. M. (2016) The Internet of Things in manufacturing innovation processes: Development and application of a conceptual framework. *Business Process Management Journal*, *22*(2), 383–402. https://doi.org/10.1108/BPMJ-05-2015-0072

Carcary, M., Maccani, G., Doherty, E., & Conway, G. (2018). Exploring the determinants of IoT adoption: Findings from a systematic literature review. In *Perspectives in Business Informatics Research: Proceedings of the 17th International Conference on Business Informatics Research,* 113–125. https://doi.org/10.1007/978-3-319-99951-7_8

Ferretti, M., & Schiavone, F. (2016). Internet of Things and business processes redesign in seaports: The case of Hamburg. *Business Process Management Journal*, *22*(2), 271–284. https://doi.org/10.1108/BPMJ-05-2015-0079

Gekara, V., Snell, D., Molla, A., Karanasios, S., & Thomas, A. (2019). *Skilling the Australian workforce for the digital economy.* Retrieved from: https://eric.ed.gov/?id=ED594704

Harkin, D., Mann, M., & Warren, I. (2022). Consumer IoT and its under-regulation: Findings from an Australian study. *Policy & Internet*, *14*(1), 96–113. https://doi.org/10.1002/poi3.285

Hsu, C. W., & Yeh, C. C. (2017). Understanding the factors affecting the adoption of the Internet of Things. *Technology Analysis & Strategic Management*, *29*(9), 1089–1102. https://doi.org/10.1080/09537325.2016.1269160

Huerta, M., Leiva, V., Liu, S., Rodríguez, M., & Villegas, D. (2019). On a partial least squares regression model for asymmetric data with a chemical application in mining. *Chemometrics and Intelligent Laboratory Systems*, *190*, 55–68. https://doi.org/10.1016/j.chemolab.2019.04.013

Kamble, S. S., Gunasekaran, A., Parekh, H., & Joshi, S. (2019). Modelling the internet of things adoption barriers in food retail supply chains. *Journal of Retailing and Consumer Services*, *48*, 154–168. https://doi.org/10.1016/j.jretconser.2019.02.020

Lee, I., & Lee, K. (2015). The Internet of Things (IoT): Applications, investments, and challenges for enterprises. *Business Horizons*, *58*(4), 431–440. https://doi.org/10.1016/j.bushor.2015.03.008

Mazhar, T., Talpur, D. B., Shloul, T. A., Ghadi, Y. Y., Haq, I., Ullah, I., . . . , & Hanam, H. (2023). Analysis of IoT security challenges and its solutions using artificial intelligence. *Brain Sciences*, *13*(4), 683. https://doi.org/10.3390/brainsci13040683

Mazhelis, O., Luoma, E., & Warma, H. (2012). Defining an Internet-of-Things ecosystem. In *Conference on Internet of Things and Smart Spaces and International Conference on Next Generation Wired/Wireless Networking,* 1–14. https://doi.org/10.1007/978-3-642-32686-8_1

Mitra, A., & Seetharaman, A. (2023). Quantitative analysis of factors influencing adoption of Internet of Things in Australian manufacturing industries. In *3rd International Conference on Electrical, Computer, Communications and Mechatronics Engineering,* 1–5. https://doi.org/10.1109/ICECCME57830.2023.10252640

Mueller, R. O., & Hancock, G. R. (2018). Structural equation modelling. In G. R. Hancock, L. M. Stapleton & R. O. Mueller (Eds.), *The reviewer's guide to quantitative methods in the social sciences* (pp. 445–456). Routledge.

Nguyen, T., Novak, R., Xiao, L., & Lee, J. (2021). Dataset distillation with infinitely wide convolutional networks. *arXiv Preprint: 2107.13034*.

Nižetić, S., Šolić, P., López-de-Ipiña González-de-Artaza, D., & Patrono, L. (2020). Internet of Things (IoT): Opportunities, issues and challenges towards a smart and sustainable future. *Journal of Cleaner Production*, *274*, 122877.

https://doi.org/10.1016/j.jclepro.2020.122877. Epub 2020 Jul 19. PMID: 32834567; PMCID: PMC7368922.

Papert, M., & Pflaum, A. (2017). Development of an ecosystem model for the realization of Internet of Things (IoT) services in supply chain management. *Electronic Markets*, *27*(2), 175–189. https://doi.org/10.1007/s12525-017-0251-8

PwC. (2015). *The smart manufacturing industry.* Retrieved from: http://www.pwc.se/sv/verkstad/the-smart-manufacturing-industry.html

Rogers, E. M. (1964). *Diffusion of innovations*. USA: Free Press of Glence.

Rosas, J., Brito, V., Palma, L. B., & Barata, J. (2017). Approach to adapt a legacy manufacturing system into the IoT paradigm. *International Journal of Interactive Mobile Technologies*, *11*(5), 91–104. https://doi.org/10.3991/ijim.v11i5.7073

Singh, S., Haneef, F., Kumar, S., & Ongsakul, V. (2020). A framework for successful IoT adoption in agriculture sector: A total interpretive structural modelling approach. *Journal for Global Business Advancement*, *13*(3), 382–403. https://doi.org/10.1504/JGBA.2020.111013

Sivathanu, B. (2019). Adoption of industrial IoT (IIoT) in auto-component manufacturing SMEs in India. *Information Resources Management Journal*, *32*(2), 52–75. https://doi.org/10.4018/IRMJ.2019040103

Sundmaeker, H., Guillemin, P., Friess, P., & Woelfflé, S. (2010). *Vision and challenges for realising the Internet of Things*. Belgium: Publications Office of the European Union. https://doi.org/10.2759/26127

Taneja, S., Pryor, M. G., & Hayek, M. (2016). Leaping innovation barriers to small business longevity. *Journal of Business Strategy*, *37*(3), 44–51. https://doi.org/10.1108/JBS-12-2014-0145

How to Cite: Mitra, A., Seetharaman, A., & Maddulety, K. (2024). A Structural Equation Model Study for Adoption of Internet of Things for the Growth of Manufacturing Industries in Australia. *Journal of Comprehensive Business Administration Research*. https://doi.org/10.47852/bonviewJCBAR42022482