The way Australian manufacturers are adopting Internet of Things

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Abstract

This research study was conducted to understand the adoption of the Internet of Things as a technology in the Australian manufacturing industries. As a part of the study, the adoption of the Internet of Things in the manufacturing domain was identified as a dependent variable through various online literature reviews. The following five independent variables were then identified as follows: competitiveness, regulatory support, cost savings, management support, and manufacturing growth. The objective of the research and the research questions were defined to assess the independent variables on the adoption of the technology Internet of Things. It was identified that all five independent variables positively impacted the adoption of the Internet of Things in the manufacturing industries in Australia. This will lead to unplanned downtime reduction and clearer data transparency to take the faster decision.

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Abstract — This research study was conducted to understand the adoption of the Internet of Things as a technology in the Australian manufacturing industries. As a part of the study, the adoption of the Internet of Things in the manufacturing domain was identified as a dependent variable through various online literature reviews. The following five independent variables were then identified as follows: competitiveness, regulatory support, cost savings, management support, and manufacturing growth. The objective of the research and the research questions were defined to assess the independent variables on the adoption of the technology Internet of Things. It was identified that all five independent variables positively impacted the adoption of the Internet of Things in the manufacturing industries in Australia. This will lead to unplanned downtime reduction and clearer data transparency to take the faster decision.

Keywords—Internet of Things (IoT), Industry 4.0 Competitiveness, Cost savings, management support, manufacturing growth, regulatory support, big data, information security.

Introduction

The evolving world today has embraced a faster pace than ever before with the advent of technological advancement. The global manufacturing industry is seeing a change in working conditions. The adoption of the Internet of Things (IoT) in Australia is increasing rapidly. According to the Australian Bureau of Statistics, the number of IoT devices in use in Australia has grown from 7.3 million in 2018 to 9.2 million in 2020. This indicates an increase of 25.3%. This is mainly due to the rise of connected home devices, such

as smart thermostats, voice-activated digital assistants, and connected security systems. Additionally, IoT is being adopted in the enterprise sector, with companies increasingly turning to IoT to improve efficiencies, enhance customer experiences, and reduce operational costs. Industries such as agriculture, transport, healthcare, and manufacturing are all seeing an increase in their use of IoT. The government is also taking steps to promote the adoption of IoT in Australia, setting out an ambitious National IoT Strategy that aims to increase the adoption of IoT technologies and create new industry opportunities. Overall, IoT adoption rates in Australia are expected to continue to rise in the

coming years, as more companies, industries, and individuals recognize the potential of IoT in improving their operations and driving innovation. The Australian industry is already under a massive transformation where the complete supply chain of the industry is equipped with data and undermining the fact of the right utilization of data is one of the biggest challenges. The availability of data at the manufacturing levels of operations, production, quality, and cost always existed, however, the industry stalwarts did not know what to do with those massive data. In this paper, a quantitive analysis of the factors influencing the adoption of the Internet of Things in the manufacturing domain of Australian industries is mentioned. It analyses 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 and focusing mainly on the risks of cyber security associated with enhanced uptake of IoT.

Research Problems and Questions

The research gaps identified beforehand are the basis of the research gaps identified beforehand are the basis for the research questions. These questions determine how adoption of IoT will be beneficial for Australia in the long run. They are as follows:

a) How does competitiveness influence the adoption of IoT in Australia?

b) How do security concerns manage to influence the adoption of IoT in the Australian industry?

c) Does cost savings essentially drive an industries decision to adopt IoT?

d) What role does regulatory support by the government play in the adoption of IoT in the industrial sector of Australia?

e) How does management support influence the decision of an industrial sector to adopt IoT?

Research objectives

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

1. To understand how security concerns, manage to influence the adoption of IoT in the Australian industry.
2. To understand the degree of cost savings that might essentially drive an industry to adopt IoT.
3. To evaluate how competitiveness influence and affect the adoption of IoT in Australia.
4. To investigate the role of regulatory support offered by the government in the adoption of IoT in the industrial sector of Australia.
5. To measure the influence of management support in the decision of an industrial sector to adopt IoT.

Literature review

The review of various literatures was done and carried out in order to have a sync of the upcoming change and adoption of IoT in the whole world and understood and analysed the shaping of the technology culture in Australia These literatures were obtained from secondary sources online. It identified the key research gaps and allowed to position the research study.

The whole idea of mechanism for developing a conceptual model and a conforming set of hypotheses for empirical testing. The literature review provided a comprehensive and also a bird's eye view of the various factors that directly or indirectly impact the adoption of IoT in the manufacturing domain of the Australian demography.

This paper highlights the three most important independent variables out of total of five variables.

Competitiveness

[9] Factors affecting IoT adoption explains that the IoT adoption is a strategic move taken by companies to gain competitive advantage over others. Failure to have a competitive edge leads to the failure of the company to grow or succeed [12]. Thus, any company needs to devise a model that is both easily absorbable as well as deft to maintain that edge in the current competitive market [4]. Since the need for innovation is developed due to this intense competition, the adoption of IoT will occur because of such pressure.

This thesis studies the relationship between competitive pressure and the adoption of IoT in depth and whether the result is in consistency with previous results.

Regulatory Support

The adoption of IoT can be influenced by the laws and regulations set by the government as well [1]. Adoption of IoT will provide the country with a momentary edge to boost its failing economy. The Australian Industry is already under a massive transformation where the complete supply chain of the industry is equipped with data and undermining the fact of right utilization of data is one of the biggest challenges. The application of IoT in the industry of supply chain will assist Australia with an opportunity to upscale its economic growth. This thesis studies the relationship between adoption of IoT and regulatory support and concludes whether it will boost Australian economy.

Cost Savings

An organization can achieve higher efficiency in productivity, quality as well as lower investments, only when they choose to adopt automation technologies like that of IoT [11]. This adoption of automation will not only reduce the cost of the production but will also indirectly influence the price of products for the users [2]. IoT can generate revenues and boost cost savings hence [7] stated that the Australian economies need to adopt latest technologies. This thesis explores the relationship between cost savings and IoT adoption to estimate the degree of positive effect on Australian economy.

Manufacturing Growth

The productivity and the size of an organization have a direct link to adoption of any technological innovation[3]. IoT is used by an organization to predict the possibility of an equipment failure thereby preventing it and as a result down-time would be automatically reduced thereby improving manufacturing growth and reliability. IoT helps cut down the cost while at the same time due to the acceleration and automation, it will eventually boost productivity too[8]. This will give an organization an upper hand in the global market. To gain that advantage and boost Australia's economy companies are inclining towards IoT adoption.

Management Support

The procedure of steering the maintenance and development of an organization is carried out by the management[13]. The support of the management plays a humongous role in the decisions taken by an organization. It is continuously evolving and caters to the requirements of the organization both in terms of internal and external affairs. Australian manufacturing market is driven by HR because of low cost of labour alongside automation.

Major decisions like allotting resources, operation reengineering and service integration cannot proceed without the support of the top management[5]. Without their support, the adoption of IoT is unlikely.

Proposed methodology

The research methodology embraced association of five independent variables through an exhaustive literature survey. articles ranging from 2018 to 2022 were specifically reviewed to arrive at the findings. Findings, methods, problems, and solutions were then mapped and research gaps and areas for future research were identified.

The primary source of data was sourced from focused group participants through online survey using google form. A total of 501 participants from Australia, all from IoT & automation related field of work experiences participated in the survey. The secondary source was from already published articles which were carefully sorted by relevance and broken down into important components, to assess the importance of the variables; their frequency of occurrence was noted down. The pilot study was followed by the main study and the data analysis model used was structural equation model. Following the below research framework, the findings were analyzed to highlight further necessary research for understanding the adoption of Internet of Things in Australian manufacturing industries.

research framework

Under the literature review, a conceptual framework model is proposed for the Adoption of IoT in Australian manufacturing industries as a dependent variable. This is measured by the research outcomes in service differentiation as competitiveness, effective regulatory support, transparent management support, enhanced manufacturing growth, cost saving performances. The independent variables identified during the literature surveys were, competitiveness, regulatory support, management support, manufacturing growth and cost savings. The research framework is developed based on the relationship between the independent variables identified and the main dependent variable. The framework shown in the below figure 1 is an assumed base model and is not a confirmed existence, or modified, intended effect of a variable yet.

Proposed research framework

survey of population

The survey catered to the focused group who had similar knowledge in the domain of automation and IoT and have been working in the Australian industries for a long time. The population for the study included senior management, experienced professionals, C-level suites, graduate trainees, junior management, owners of IoT companies. All the above professionals have been somewhat related to the IoT field and have been working progressively in Australia to achieve the efficiency in their respective fields.

structural equation model

This structural equation model utilizing circuit coefficients is seen throughout Figure 2. Overall adoption of IoT in Australian manufacturing (OM), which serves as the dependent variable in this study, has around R^2 score of 0.684.This indicates that perhaps key antecedents throughout this model's contributory variables account for approximately 68.4% of said variation in this implicit variable. Using these partial least-squares multiple linear regressions, this value is viewed as being rather significant [6].

Structural Equation Model

convergent validity

Convergent validity is a type of criterion validity that is used to assess the degree to which different measures that are designed to measure the same construct or phenomenon are related. It is used to ensure that a measure is valid and reliable. Overall average variance extracted (AVE) statistics were examined to determine this framework's validity. The degree of variation described via an unseen concept in comparison with the variance attributable to randomized sampling error is measured using AVE. The appropriate threshold for the assessment is 0.5. Consequently, it is reasonable to conclude that any construct having an AVE score higher, exceeding 0.5. This accounts for a sizable percentage of total variation within the framework. shows estimated AVE statistics for every one of the study constructs throughout the framework/model. The existence of convergent validity within the model is shown by the scores ranging between: 0.5268 to 0.8252 in the below table.

Table. 1. Convergent Validity Table snapshot.

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

direct effect interference

The direct effect of independent variables on a dependent variable is one of the most important components of a research study. The significance of such study is to identify the independent variables that are most likely to influence the dependent variable. This helps to understand the relationships between different variables and how they impact the outcome of the study. It also helps to identify potential areas of improvement or areas that need to be further researched. Furthermore, it assists in the research study to draw conclusions that are based on evidence rather than assumptions.

From the below table 3, the direct effect on the study shows that there are at least six highly significant co-relations. The table below shows that regulatory support (RS), management support (MS) and manufacturing growth (MG) influences very significantly to the adoption of IoT.

Table. 2. Direct Effect Interference.

t-values	Decision
t <1.65	Less moderate
$1.65 < t < 1.96$	Moderate
$1.96 < t < 2.59$	Significant

t-values	Decision
t > 2.59	Very significant

Table. 3. Direct Effect Interference.

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^{**}	less moderate
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

Table. 3. Direct Effect Interference.

limitation and scope for future research

The focus of the research is limited to the manufacturing industries in Australia. This research is purely a quantitative analysis to understand the direct relationship between the dependent variable and the five significant independent variables. The focus of this research is on IoT only, not on Industry 4.0 other remaining technologies. The delimitations are motivated through the directives of the researcher and have further scope of research as Australia grows into the world of IoT. However, some of them are mentioned shortly in this research study as these nine technologies are interrelated with each other. In addition, the outcome of this research is not represented in financial terms, as a qualitative form of the study with highly focused calculations and analysis that is to be derived for Australia's challenges towards IoT.

CONCLUSION

In the last decade, IoT has been imbibed in individual's daily lives and an essential part of the industrial sector [10] It has given organizations all over the world a tremendous competitive advantage by gathering and implementing the data from the devices used by consumers [12]. But the organizations also must reflect upon the negative aspects of IoT such as security issues. Adoption of IoT is influenced by these five selected variables. The research work aims to explore both the merits and demerits of the influence of these variables on the adoption of IoT. The study also concludes by identifying the highly significant variables of manufacturing growth, management support and regulatory support which has positive impact on the adoption of the Internet of Things in the manufacturing industries in Australia.

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