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FACTORS INFLUENCING BUSINESS ACCEPTANCE OF INDUSTRY 4.0 TECHNOLOGY APPLICATIONS IN DONG NAI PROVINCE

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Abstract

In today's era, the remarkable development of Industry 4.0 has triggered a revolution across numerous sectors, including the business realm. Implementing Industry 4.0 applications into business operations is not merely a trend but also an essential step to enhance competitiveness and adapt to market transformations. In this context, evaluating factors influencing the acceptance and application of Industry 4.0 technology in businesses within Dong Nai Province, one of the vigorously developing regions in Vietnam, has become a crucial and challenging topic. With the participation of 937 enterprises surveyed using a model and questionnaire, coupled with the results of regression analysis processed through SPSS 20.0 software, the study has identified six positively impactful factors on the acceptance of Industry 4.0 technology application in Dong Nai's business landscape: Expectation of the effectiveness of Industry 4.0 application within the unit, Expectation of the effort in deploying Industry 4.0 application within the unit, External Socio-Economic Factors, Deployment Influencing Factors, Costs of 4.0 Technologies, and Deployment Risk Factors.

Keywords: *Acceptance of 4.0 technology application; business; Dong Nai province*

1. Introduction

Numerous domestic and international research papers have delved into the factors influencing technology adoption. However, these studies tend to focus on specific business categories, such as large, medium, and small enterprises, as well as distinct geographical regions. Furthermore, these investigations have taken place within diverse contexts and serve varying objectives. One notable study, conducted by X. Nguyen and Quang Khai Luu, explored Factors Affecting the Adoption of Industry 4.0 by Small- and Medium-Sized Enterprises: A Case Study in Ho Chi Minh City, Vietnam. The findings indicate that perceived human resource development, timeliness, cost-saving perception, product quality perception, improved time-saving perception, ease-of-use perception, business resources, business environment conditions, usefulness perception, enhanced customer relationship perception, and adoption intention all exhibit a significantly positive impact on the actual adoption of Industry 4.0. The outcomes imply that managerial success in enhancing these factors' perceptions regarding Industry 4.0 adoption, along with personal relevance to the technology, contributes to the effective utilization of Industry 4.0. (Xuan Truong Nguyen, 2020)

Another study by Hilmi Yüksel delves into the transformation brought about by Industry 4.0: factors influencing its influence and impact on companies. The research identified key factors influencing Industry 4.0 applications, including company size, technological product levels, budget allocation for the R&D department, the extent of lean applications, agility/flexibility levels, and automation levels. Similarly,

anticipated impacts of Industry 4.0 applications encompass traceability of production processes, supply chain traceability, enhanced supply chain flexibility, improved partner communication within supply chains, heightened productivity, real-time data analysis, inter-company integration, and internal integration, as established through literature review. (Yüksel, 2022)

Furthermore, Koppiahraj Karuppiah et al conducted a study that focused on Evaluating Key Factors for the Adoption of Industry 4.0 Technologies in Small and Medium Enterprises (SMEs) within an emerging economy context. Their results unveiled three pivotal factors crucial to Industry 4.0 implementation: the organization's ability to expand IT infrastructure, alterations in organizational structure, and the capability to analyze key performance indicators. Remarkably, the study identified the concept of a smart factory as particularly fitting for Industry 4.0 adoption within Indian SMEs. (Koppiahraj Karuppiah, 2023)

Given its remarkable industrial growth, Dong Nai province is emerging as a shining example within Vietnam's economic landscape. With substantial resources and potential, the local emphasis on and advancement of 4.0 technology implementation not only bolsters economic progress but also fosters innovation and elevates industry performance. Recognizing the pivotal role of integrating 4.0 technology into businesses within Dong Nai province, the author embarked on a valuable study dedicated to this subject matter. This study aims to assess the influence of various factors on the adoption of 4.0 technology applications within business operations in Dong Nai province.

By delving into the factors that impact the adoption of Industry 4.0, this study seeks to illuminate the challenges and opportunities that enterprises in this region may encounter. Grasping and harnessing the potential of 4.0 technology will prove indispensable for the sustainable development of Dong Nai province, especially within an ever-evolving business environment. The primary objective of this study is to equip businesses and local authorities with the insights and knowledge required to effectively embrace digital transformation and integrate 4.0 technology into their operational framework.

2. Literature Review

Digital transformation is the application of digital technology or the use of digital technology based on digital or digitized data to alter research, production, and business models in order to create more opportunities and value. Create new value, increase the operational efficiency and competitiveness of the organization/agency/business. Cloud computing, big data, the internet of things, and artificial intelligence are the four primary digital industries of digital transformation. (Siebel, 2019)

Technology 4.0, also known as "The Fourth Industrial Revolution" (Industry 4.0), refers to a prevalent innovation trend in the industrial and manufacturing sectors. Technology 4.0 is centered on integrating and optimizing the interaction between digitization and information technologies to produce intelligent, flexible, and interactive automation systems. (Smith, 2019)

Integral technologies within Industry 4.0 encompass:

Internet of Things (IoT): Establishing connections and facilitating communication among devices and objects via the internet to exchange data and information, thereby forging a comprehensive interconnected environment.

Artificial Intelligence (AI): Employing algorithms and computer systems to simulate human thought processes and learning, ranging from automatic data classification to intricate decision-making.

Robotics and Automation: Converging robotics and automated production and operations to construct an efficient and adaptable working ecosystem.

Big Data: Collecting, analyzing, and harnessing vast volumes of data to gain deeper insights into trends, patterns, and future projections.

Augmented and Virtual Reality: Harnessing augmented and virtual reality simulations to engender novel interactive encounters for users and enhance product training, design, and testing.

Industry 4.0 technology empowers the optimization of production, services, and management procedures, thereby fostering fresh value creation for both enterprises and society.

The Technology Acceptance Model (TAM) stands as a theoretical construct in the domains of psychology and technology management, introduced by Fred Davis in 1989, to elucidate and anticipate human behavior concerning the adoption and utilization of novel technology. This model centers on the psychology and attitudes of users toward technology, diverging from an emphasis on technical aspects. (Davis, 1989)

According to TAM, two primary factors influence technology adoption behavior:

Perceived Usefulness: Signifying users' perception of the extent to which technology enhances their job performance or fulfills their needs. If users deem the technology valuable, their inclination to accept and use it increases.

Perceived Ease of Use: Denoting the users' perception of technology's ease of operation. If users perceive technology as user-friendly and intuitive, their inclination to embrace and use it heightens.

The TAM framework also encompasses the impact of external influences, such as personal attributes, social dynamics, and cultural factors. TAM has evolved into a pivotal tool for prognosticating technology adoption and utilization across various domains, including information systems, mobile applications, and diverse industrial sectors.

3. Research model

Anticipations regarding the efficacy of implementing Industry 4.0 applications within the entity encompass the entity's prospects for augmenting productivity and service quality, reducing input costs for products or services, fostering opportunities for domestic and international market expansion, and enhancing the unit's ability to monitor factors influencing its operations, thereby ameliorating the efficiency of product and service marketing.

Hypothesis H1: The expectations surrounding the effectiveness of implementing Industry 4.0 applications exhibit a positive correlation with the decision to adopt Industry 4.0 applications.

Anticipations of implementation efforts for Industry 4.0 applications encompass the unit's prospects for ease of use within the unit, seamless transition to the unit's operations, ready acceptance by managers and experts, as well as workers embracing the implementation of Industry 4.0 (Digital Industry). Moreover, these expectations include the ease of application and deployment of current technical technology to facilitate Industry 4.0 (Digital Industry) implementation, and the utilization of Industry 4.0 deployment to ensure uninterrupted operations during challenging circumstances (such as epidemics or shortages of experts).

Hypothesis H2: The expected effort to deploy Industry 4.0 applications exhibits a positive correlation with the decision to adopt Industry 4.0 applications.

External socio-economic factors exert an influence on the implementation of Industry 4.0. These factors originate beyond enterprises and can yield both favorable and limited impacts on the adoption of 4.0 technology applications. Noteworthy examples comprise the guidelines and policies set forth by the Central Government, which significantly shape the inclination to deploy Industry 4.0 technology. Furthermore, the intentions of the Dong Nai People's Committee and the various departments within Dong Nai province wield an effect on the integration of Industry 4.0 applications within business units.

The expansion of online public services across all levels of management serves to propel the uptake of Industry 4.0 applications within business units. Widespread dissemination of information concerning Industry 4.0 within the sector bolsters its adoption. The robust implementation of Industry 4.0 at the unit hinges on societal responsiveness, political collaboration, and equitable rights. The state of network infrastructure also emerges as a pivotal factor impacting the integration of Industry 4.0 applications within the unit.

Hypothesis H3: The external socio-economic factor influencing the adoption of Industry 4.0 applications exhibits a positive correlation with the decision to adopt Industry 4.0 applications.

Cluster of Factors Influencing the Implementation of Industry 4.0 applications in Dong Nai. This grouping comprises factors that exert direct influence over the unit during the deployment of Industry 4.0 applications. For instance, the Dong Nai Government's facilitation of conducive conditions for the integration of Industry 4.0 within the unit, the unit's possession of sufficient financial means to support the implementation of Industry 4.0, a proficient human resource team equipped with the requisite knowledge and skills for Industry 4.0 application implementation, the formulation of a strategic approach by the unit for Industry 4.0 deployment, and the unit's fulfillment of prerequisites for successful 4.0 application implementation.

Hypothesis H4: The cluster of factors impacting the implementation of Industry 4.0 applications exhibits a positive correlation with the decision to adopt Industry 4.0 applications.

Pricing Factors of 4.0 Technologies. These encompass cost-related considerations that impact the unit during the deployment of Industry 4.0 applications. These factors encompass aspects such as the initial and intermediate procurement costs of Industry 4.0, which the unit can feasibly manage, the reasonably attainable cost of acquiring Industry 4.0 at lower levels, the affordability and cost-effectiveness of operating Industry 4.0, the variety of Industry 4.0 types available to the unit with numerous suppliers and competitive pricing, as well as the comprehensive pricing of Industry 4.0 that includes transfer, training, salaries, and the substantial remuneration of experts proficient in Industry 4.0.

Hypothesis H5: The pricing of Industry 4.0 applications exhibits a positive correlation with the decision to adopt Industry 4.0 applications.

Risk Factors in Deploying Industry 4.0 applications within the Unit. This category encompasses risk-related considerations that are relevant to the unit during the execution of Industry 4.0 applications. These factors encompass the risk of Industry 4.0 applications not meeting expected levels of effectiveness, the risk of incomplete integration of Industry 4.0 practices, susceptibility to information disclosure and hacking associated with technology 4.0 (Digital technology), and vulnerability to rapid changes inherent in Industry 4.0, characterized by a perpetual state of innovation.

Hypothesis H6: The risk factors encountered during the implementation of Industry 4.0 applications exhibit a positive correlation with the decision to adopt Industry 4.0 applications.

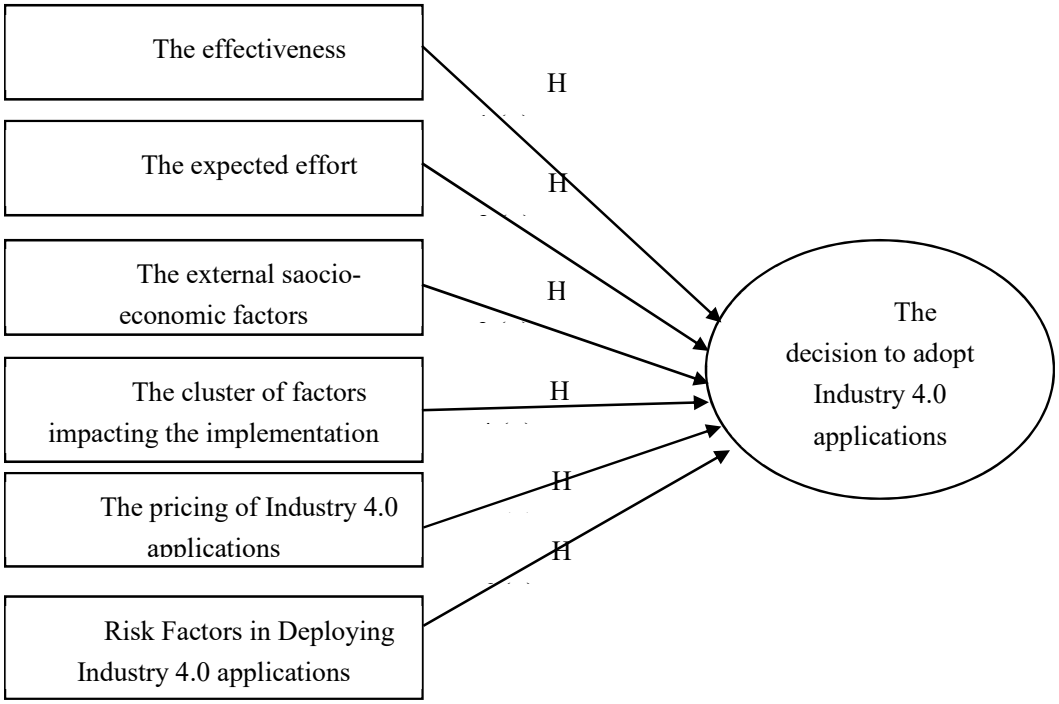

Figure 1. Research Conceptual Framework

4. Research Methodology

This study employed a dual-pronged research approach, encompassing two distinct methodologies:

Qualitative Research: The qualitative component employed the focus group discussion approach, involving the NC group, consulting experts, and key leaders responsible for various aspects of enterprises. The aim was to uncover the primary factors influencing the decision to deploy 4.0 technology applications within the unit. The insights garnered from the group discussions informed the formulation and refinement of variables within the scale. These variables were tailored to align with the applicability of 4.0 technology in enterprises within Dong Nai province. Subsequently, this input contributed to the construction of a questionnaire that adhered to the research model's framework. The questionnaire's objective was to collect information for analysis and hypothesis testing.

Quantitative Research: The subsequent phase of the research entailed a formal quantitative methodology to scrutinize the research model and hypotheses. Specifically, a comprehensive survey involving 937 participants was conducted to assess the reliability and validity of the scale. This evaluation was achieved through indicators such as the Cronbach's Alpha coefficient and variable-total correlation. The sample pool consisted of enterprises from diverse industries situated in different regions, including Bien Hoa city, Nhon Trach industrial zones, Bien Hoa industrial zones, Ho Nai industrial zones, and districts within Dong Nai province. Furthermore, the study employed Exploratory Factor Analysis (EFA) to assess the factor load level, ensuring the convergent and discriminant validity of each scale. Ultimately, a linear regression model was employed to test the hypotheses.

5. Main Findings

In this study, the research model has 6 scales that are respectively evaluated for reliability. All scales were evaluated for reliability by Cronbach's Alpha coefficient ≥ 0.7 and variable-total correlation coefficient ≥ 0.3, respectively.

The results of the Barlett test show that there is a correlation between the variables in the population (sig = 0.00 < 0.05). At the same time, the coefficient KMO = 0.937 > 0.5, proves that factor analysis to group variables together is appropriate and the data is suitable for factor analysis.

F-test for the fit of the overall linear regression model. This indicates whether the dependent variable is linearly correlated with the entire independent variable.

With the regression equation: $y = \beta 0 + \beta 1xX1 + \beta 2xX2+...+ \beta nxXn$

The hypothesis is that: H0 is: $\beta 1 = \beta 2 = ...= \beta n = 0$.

With the Coefficients results, it is expected that The effectiveness of implementing Industry 4.0 applications (β = 0.108), The expected effort to deploy Industry 4.0 applications (β = 0.152), The external socio-economic factors (β = 0.022), The cluster of factors impacting the implementation (β= 0.430), The pricing of Industry 4.0 applications (β= 0.192), Risk Factors in Deploying Industry 4.0 applications (β= -0.054). Thus, the linear regression equation is built as follows:

Y = 0.108*X1 + 0.152*X2 +0.022*X3 + 0.430*X4 + 0.192*X5-0.054*X6

The decision to adopt Industry 4.0 applications = 0.108* The expected effort to deploy Industry 4.0 applications + 0.152* The expected effort to deploy Industry 4.0 application +0.022* The external socio-economic factors + 0.430* The cluster of factors impacting the implementation + 0.192* The pricing of Industry 4.0 applications -0.054* Risk Factors in Deploying Industry 4.0 applications

Therefore, the research identifies six crucial factors: The effectiveness of implementing Industry 4.0 applications, The expected effort to deploy Industry 4.0 applications, The external socio-economic factors, The cluster of factors impacting the implementation, The pricing of Industry 4.0 applications, Risk Factors in Deploying Industry 4.0 applications. Higher β values of these factors, namely X1, X2, X3, X4, X5, and X6, correspond to a greater inclination to deploy 4.0 technology applications within enterprises in Dong Nai. Consequently, hypotheses H1, H2, H3, H4, H5, and H6 for the theoretical research model are formally validated.

The most impactful factor in the model is the " The cluster of factors impacting the implementation" boasting a notable weight of Beta = 0.430. However, its mean value is relatively modest (Mean = 3.1145), indicating that despite its significance, enterprises have slightly underestimated its importance (ranking only higher than the "The expected effort to deploy Industry 4.0 applications " factor). As such, the " The cluster of factors impacting the implementation" category is of prime concern for the Dong Nai provincial government to prioritize in supporting businesses' engagement with Industry 4.0 application in the region.

Following closely, the second most vital factor in the model is "The pricing of Industry 4.0 applications," with a weight of Beta = 0.192. This factor garners relatively higher business agreement levels compared to "The cluster of factors impacting the implementation," yet it ranks second among the six model factors (Mean = 3.62209). Consequently, it too warrants focused attention and support from the Dong Nai provincial government, following "The cluster of factors impacting the implementation."

The third most crucial factor in the model is "The expected effort to deploy Industry 4.0 applications," with a weight of Beta = 0.152. Nonetheless, it registers the lowest business agreement level (Mean = 3.0657). Hence, this factor assumes paramount importance for the Dong Nai government's consideration.

Moreover, the fourth most significant factor in the model is "The effectiveness of implementing Industry 4.0 applications," carrying a weight of Beta = 0.108. Remarkably, this factor garners the highest level of enterprise agreement within the group (Mean = 3.7725). Nevertheless, it remains a focal point requiring attention and support from the Dong Nai provincial government.

The fifth most pivotal factor in the model is "The external socio-economic factors," with a weight of Beta = 0.022. Remarkably, this factor achieves favorable enterprise agreement levels relative to other factors within the group (Mean = 3.5326). Thus, it similarly commands consideration and support from the Dong Nai provincial government, following the "he effectiveness of implementing Industry 4.0 applications" factor.

Lastly, the " Risk Factors in Deploying Industry 4.0 applications" holds the least significance within the group, denoted by its negative sign. Although it ranks second in enterprise agreement levels among the group (Mean = 3.6334), it emerges as the top priority for the Dong Nai provincial government's attention and support.

6. Conclusion

In the context of the global Industrial Revolution 4.0, the evaluation of factors influencing the acceptance of 4.0 technology application in businesses within Dong Nai Province has proven to be both crucial and imperative. By delving into the factors that shape adoption, the intricate and diverse nature of influences on local digital transformation becomes evident. Through the scrutiny of these factors impacting the integration of 4.0 technology applications into businesses in Dong Nai, the study has unearthed and delineated six primary factors that exert a positive influence on this progression. These factors not only construct a comprehensive panorama of 4.0 technology assimilation within the local business ecosystem but also propose strategies to optimize the digital transformation process. On the whole, comprehending and evaluating the factors that impact the acceptance of 4.0 technology application in Dong Nai businesses serves not only as the bedrock for charting a course but also contributes to the creation of a conducive environment to foster successful and sustainable digital transformation in the future.

References

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *13*(3), 319-340.

Koppiahraj Karuppiah, B. S. (2023). Evaluation of key factors for industry 4.0 technologies adoption in small and medium enterprises (SMEs): an emerging economy context. *Journal of Asia Business Studies, 17*(3).

Siebel, h. M. (2019). *Chuyển đổi số (Digital Transformation).* Nhà xuất bản Tổng hợp Tp. Hồ Chí Minh.

Smith, C. &. (2019). Industry 4.0 and its Implications for Business. *25*(4), 567-584.

Xuan Truong Nguyen, Q. K. (2020). Factors Affecting Adoption of Industry 4.0 by Small- and Medium-Sized Enterprises: A Case in Ho Chi Minh City, Vietnam. *Journal of Asian Finance, Economics and Business*, 255-264. doi:https://doi.org/10.13106/jafeb.2020.vol7.no6.255

Yüksel, H. (2022). Industry 4.0 transformation: factors affecting adoption and impacts on companies. *International Journal of Industrial Engineering and Operations Management, 4*(3).

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