EXPLORING FACTORS INFLUENCING MULTI-STAKEHOLDERS' CONTAINER ROUND-USE PLATFORM ADOPTION IN VIETNAM

CÁC NHÂN TỐ TÁC ĐỘNG ĐẾN VIỆC ÁP DỤNG NỀN TẢNG HOÁN ĐỔI VỎ CONTAINER CỦA CÁC BÊN LIÊN QUAN TẠI VIỆT NAM

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Abstract

Voyages of empty containers incur high expenses for the entire supply chain. Several container round-use platforms have been introduced as innovative solutions to better pool these empty boxes. This quantitative study aims to identify factors influencing the adoption of container round-use platforms in Vietnam. Employing the Technology-Organization-Environment (TOE) framework, the research explores contextual factors at the firm level that influence technological innovation adoption. 349 valid responses were collected through an online survey from 1st to 25th July 2023. The data are analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings indicated factors significantly influencing the adoption of container round-use platforms including cost, ease of use, usefulness, relative advantage, firm size, top management support, and workforce. By exploring these factors comprehensively, this research not only validates established adoption drivers but also unveils novel insights into enhancing platform adoption strategies in Vietnam. This study contributes uniquely to the literature by bridging theoretical gaps and offering practical implications for stakeholders seeking to enhance logistical efficiency and sustainability through advanced technological solutions in container logistics.

Keywords: *Container box pooling, container round-use platforms, empty voyage, transportation optimization.*

Tóm tắt

Việc vận chuyển các container rỗng gây tăng chi phí trong chuỗi cung ứng. Một số giải pháp nền tảng hoán đổi vỏ container rỗng đã được giới thiệu nhằm tối ưu việc luân chuyển vỏ container. Nghiên cứu định lượng này nhằm xác định các yếu tố tác động đến việc áp dụng nền tảng sử dụng container rỗng tại Việt Nam. Nghiên cứu sử dụng mô hình TOE nhằm khám phá các yếu tố theo ngữ cảnh ở cấp độ công ty tác động đến việc áp dụng đổi mới công nghệ. Dữ liệu được thu thập thông qua khảo sát trực tuyến với sự tham gia của 349 người trả lời hợp lệ từ ngày 1 tới ngày 25 tháng 7 năm 2023. Dữ liệu khảo sát được phân tích bằng phần mềm PLS-SEM. Các phát hiện cho thấy các yếu tố, bao gồm chi phí, tính dễ sử dụng, tính hữu ích, lợi thế tương đối, quy mô công ty, sự hỗ trợ của ban quản lý cấp cao và lực lượng lao động, ảnh hưởng đáng kể đến việc áp dụng nền tảng sử dụng container rỗng. Nghiên cứu này không chỉ xác nhận các yếu tố tác động mà còn chỉ ra các chiến lược áp dụng nền tảng hoán đổi vỏ container tại Việt Nam. Nghiên cứu này đóng góp vào việc thu hẹp khoảng cách lý thuyết và đưa ra những khuyến nghị ứng dụng thực tiễn cho các bên liên quan đang tìm cách nâng cao hiệu quả và tính bền vững của logisitics thông qua các giải pháp công nghệ tiên tiến.

Từ khóa: *Kết hợp vỏ container, nền tảng hoán đổi vỏ container, vận chuyển rỗng, tối ưu vận chuyển.*

1. Introduction

The repositioning of empty containers is a significant challenge in the global container shipping industry, leading to inefficiencies and high logistics costs. Empty container status causes a shortage of containers and increases logistics costs, further causing inefficiencies in the supply chain. On average, companies transport at least 60 million empty containers yearly, making every third container empty [1]. The transportation of a substantial number of empty containers results in

high costs for moving them to locations where they are needed. The Vietnam Transport Development and Strategy Institute indicates that around 70% of trucks travel empty in one direction, causing trucking expenses to be about 30% higher than their actual value [2]. The cost incurred of empty container voyages represents approximately 20% of the total expenses for a shipping company [3]. Therefore, increasing the utilization rate of empty container boxes is among the critical decisions to be considered by businesses. Addressing this problem through the adoption of a container round-use platform (CRUP) presents an opportunity to enhance supply chain efficiency, reduce costs, and minimize environmental impact.

This study aims to explore the factors influencing the adoption of CRUPs in Vietnam's logistics industry. By leveraging the TOE framework, this research provides a comprehensive analysis of the technological, organizational, and environmental factors that drive CRUPS adoption. This study attempts to answer the following research questions:

RQ1: What critical factors affect the adoption of CRUPs?

RQ2: What are the relationships among the critical factors affecting the adoption of CRUPs?

2. Literature Review

2.1. Adoption of container round- use platforms in logistics industry

The literature on Container round-use platforms and their adoption highlights the potential benefits of these platforms in optimizing the use of empty containers and reducing logistical costs. Existing studies emphasize the importance of technological innovation, organizational readiness, and environmental factors in influencing technology adoption [4]. This section develops the hypotheses based on the TOE framework, linking them to relevant literature and the research questions guiding this study.

A Container round-use platform allows demand-side matching with supply-side related to empty container volume and freight demand through an algorithm to determine geographic distance, availability, scale, and other predefined constraints. Exporters can search for available containers and trucking services at reasonable spot prices. Importers do not need to return unloaded containers to pre-designated warehouses; empty containers are shipped directly from importer to exporter. Trucking companies can win bids to increase

trip-filled rates with the least sales effort. XChange Platform, for example, was created by the Boston Consulting Group to aid industry players in collaborating more effectively on a scale. This project working with several of the top 20 carriers globally, has introduced critical new perspectives on the magnitude of container imbalances worldwide and the opportunity for the container shipping sector to employ interchanges to address its repositioning difficulties [5]. In Vietnam, several pioneers like Vinatake, Matchbox, and Smartlog have introduced their solutions related to container box optimization platforms to connect the supply and demand of empty containers in import and export sector.

2.2. Research hypotheses and model

The technological context is relevant to the technologies pertinent to the firm, whether adopted or not, internally and externally (Baker, 2012). The organizational context involves the qualities and resources of the firm, such as its size and the degree of support the top management provides, as suggested by Wang et al. (2010). Besides, the environmental context considers the regulatory environment and industry structure in which the organization operates (Ilin et al., 2017). Therefore, this study adopts and implements TOE because it has received much empirical support.

The TOE theory highlights that technology adoption is influenced by three key factors: Technology, organization, and environment [4]. This theory has been largely applied in research on technology adoption and uses across various industries, including healthcare, manufacturing, and service sectors [7]. The author synthesized predictors from literature review and adapted them into the current paper.

This paper employs the TOE theory as a main framework to explain the adoption of technology in organizations. The researchers proposed eleven hypotheses. These hypotheses aim to provide a comprehensive understanding of the factors that influence the phenomenon under investigation. By leveraging the existing theoretical framework and knowledge, this study seeks to contribute to the body of literature in this field and offer valuable insights into the relationships between the variables examined. Below are 11 hypotheses (H) to test the relationship between 11 predictors and the adoption of the container round-use platforms (CRUPs), and the proposed research model:

Table 1. List of Predictors

Adoption factors	Key references
Technological context	
Perceived ease of use	Bienstock et al. (2008); Cheng & Yeh (2011)
Perceived usefulness	Bienstock et al. (2008); Cheng & Yeh (2011)
Relative advantage	Ilin et al. (2017); Oliveira et al. (2014); Tsai et al. (2010); Wang et al. (2010)
Cost	Harris et al. (2015); Kurnia et al. (2015); Lin (2014); Power & Simon (2004); Tu (2018)
Security concern	Ilin et al. (2017); Tu (2018)
Organizational context	
Top management support	Harris et al. (2015); Ilin et al. (2017); Lin (2014); Oliveira et al. (2014)
Firm size	Harris et al. (2015); Kurnia et al. (2015); Oliveira et al. (2014); Wang et al. (2010)
Workforce	Abdinnour-Helm et al. (2003); Craighead & Laforge (2003); Lal (1999)
IT Infrastructure	Wei et al. (2015)
Environmental context	
Policy/Regulation	Harris et al. (2015); Ilin et al. (2017); Kurnia et al. (2015)
Stakeholder pressure. (trade partner, competitor, government)	Cheng & Yeh (2011); Lin (2014); Tu (2018)

Source: Authors' Synthesis, 2023

H1: Perceived ease of use has a significant impact on the adoption of the CRUPs.

H2: Perceived usefulness has a significant impact on the adoption of the CRUPS.

H3: Relative advantage has a significant impact on the adoption of the CRUPs.

H4: Cost has a significant impact on the adoption of the CRUPS.

H5: Security concern has a significant impact on the adoption of the CRUPs.

H6: Top management support has a significant impact on the adoption of the CRUPs.

H7: Firm size has a significant impact on the adoption of the CRUPs.

H8: Workforce has a significant impact on the adoption of the CRUPs.

H9: IT infrastructure has a significant impact on the adoption of the CRUPs.

H10: Policy/regulation has a significant impact on the adoption of the CRUPs.

H11: Stakeholder pressure has a significant impact on the adoption of the CRUPs.

3. Research Methodology

In this study, the researcher uses the convenience sampling method. The survey was sent via email to the authors' network and professional group in Facebook, and to the multi-stakeholder company's senior managers, middle managers, and employees involved in logistics activities using containers in Vietnam. To ascertain the suitable sample size for the study, the researcher employs G*Power, a widely used standalone power analysis program in social sciences, behavioral sciences, and biomedical sciences [8]. Accordingly, this study needed a minimum sample size of 128 responses.

The survey questionnaire including the informed consent form and 53 mostly closed-ended questions were distributed to participants via email and social networking from 1st to 25th July 2023. Hair et al. (2019) outlined a seven-step process for designing questionnaires. These steps include: confirming research objectives, choosing an appropriate data collection method, creating questions and scales, determining the questionnaire layout, obtaining initial approval from the client, pretesting, revising, finalizing the questionnaire, and implementing the
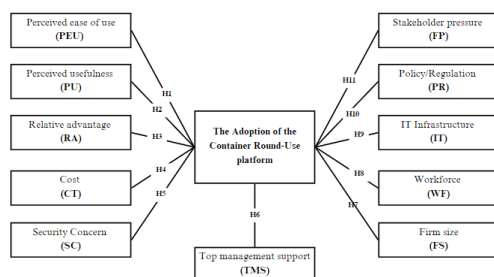

Figure 1. Proposed research model

Source: Authors, 2023

survey. This questionnaire is divided into three main parts related to the factors of technological context, organizational context and environmental context. This measurement is based on 5-point Likert scale: 5 = Fully agree, 4 = Agree, 3 = Neither agree nor disagree, 2 = Disagree, 1 = Fully disagree. The survey collected a total of 349 valid respondents, thereby yielding a substantial dataset for analysis and interpretation.

The collected data was analyzed using PLS-SEM, a widely employed method in exploratory research for theory development. PLS-SEM explains the variance of dependent variables within the model [9]. By employing the PLS-SEM approach, this research successfully identifies and analyzes crucial factors influencing the intention to use digital technologies, ultimately contributing to developing and validating a theoretical model.

4. Results

4.1. Demographic Analysis

Survey participants varied in age from under 25 to over 55. The age group from 25 to 34 (35%) and from 35 to 44 (36%) accounted for a large proportion of the sample.

There is a great mix of participants' working levels, senior manager 12%, middle manager 43%, and employee 45%. Respondents are all people with experience working in the logistics industry, 35% less

Table 2. General information of participants

Information	N	%
Gender		
Female	161	46%
Male	188	54%
Age		
Under 25	37	11%
From 25 to 34	122	35%
From 35 to 44	125	36%
From 45 to 54	60	17%
Over 55	5	1%
Working level		
Senior manager	43	12%
Middle manager	149	43%
Employee	157	45%
Experience		
Under 5 years	122	35%
5 - 10 years (excluding 10 years)	91	26%
10 - 20 years (excluding 20 years)	113	32%
20 years and above	23	7%

Table 3. Business Information and Understanding of the Container Round-Use Platform

Information	N	%
Type of Business		
Export	9	3%
Import	18	5%
Third-party logistics company	262	75%
Freight forwarder	34	10%
Other	26	7%
Business Location		
Ho Chi Minh	50	14%
Ha Noi	146	42%
Binh Duong	46	13%
Dong Nai	8	2%
Hai Phong	13	4%
Bac Ninh	46	13%
Other	42	12%
Knowing about Container Round-Use Platforms		
Do not know	83	24%
Not sure	40	11%
General understanding	181	52%
Comprehension	37	11%
Know very well	8	2%
Using Container Round-Use Platforms		
Yes	77	22%
No	207	59%
Do not know	65	19%

than 5 years of experience, 26% from 5 to 10 years of experience, 32% from 10-20 years of experience, and 7% from 20 years or more experience.

Participants came from variable types of businesses: export, import, third-party logistics company, freight forwarder, and others. These companies are widely distributed throughout Vietnam, with the largest portion in Hanoi (42%).

4.2. Measurement model analysis

In convergent validity, for the first time, outer loadings for all items, except FS1, exceed the cut-off value of 0.7, supporting convergent validity [9]. The authors eliminated FS1 and rerun the model the second time. All things were, therefore, appropriate for additional statistical analysis [9]. All indicators exceed the recommended threshold, 0.5 for AVE and 0.7 for reliability statistics [10]. These results suggest that all construct measures exhibit sufficient internal consistency reliability.

Table 4. Structural Estimates: Path Coefficients

Hypotheses	Path Coefficient (Beta - β)	Standard Deviation	T-Statistics	p-value	Study Results
CT → ADT	0.256	0.040	6.470	0.000	Supported
PEU → ADT	0.208	0.027	3.894	0.000	Supported
PU → ADT	0.172	0.029	3.884	0.000	Supported
RA → ADT	0.169	0.055	3.801	0.000	Supported
TMS → ADT	0.156	0.026	3.070	0.000	Supported
WF → ADT	0.115	0.037	4.669	0.000	Supported
IT → ADT	0.114	0.043	1.330	0.000	Supported
FS → ADT	0.083	0.027	0.678	0.002	Supported
SC → ADT	-0.018	0.029	3.825	0.498	Not Supported
PR → ADT	-0.350	0.031	4.998	0.183	Not Supported
SP → ADT	-0.050	0.030	1.763	0.078	Not Supported

Additionally, discriminant validity was assessed by the Fornell-Lacker criterion. Values positioned above the principal diagonal denote the extent of correlation with themselves (derived from the square root of AVE). In contrast, values situated outside the principal diagonal indicate the degree of correlation between pairs of variables. The analysis findings indicate that the square root of AVE for each latent variable surpasses all correlations between latent variables, affirming that discriminant between variables is guaranteed [11]. This evidence substantiates the high reliability of the factors, and the data employed in the research process.

4.3. Structural model analysis

The R-square adjusted value for the variable ADT is 0.801. It suggests a strong relationship between the independent and dependent variables, highlighting their significant explanatory power in understanding the variation in the outcome variable.

All variables have Variance Inflation Factor (VIF) values smaller than 3, suggesting that there may be no significant multicollinearity issues among the independent variables [12].

4.4. Testing hypothesizes result

Based on the findings presented in Table 2, Security concern (SC), Policy/regulation (PR), and Stakeholder pressure (SP) do not exhibit a significant impact on the adoption (ADT) of SCUPs as evidenced by their p-values exceeding 0.050 [10]. As a result, hypotheses H5, H10 and H11 are rejected. Conversely, the remaining direct effects demonstrate statistical significance, implying meaningful relationships. Notably, Cost (CT), Perceived ease of use (PEU), and Perceived usefulness (PU) emerge as the primary drivers with the most significant influence on ADT, highlighting their substantial impact in shaping the dependent variable.

Out of 11 predictors, Security concern (SC), Policy/regulation (PR), and Stakeholder pressure (SP) have no impact on adoption of CRUPs. This finding implies that platform users are proactive in selecting what is considered best to their operations without fearing any pressures, concern or binding. Vietnam businesses are now at the middle stage of digital transformation. They have understood the importance of platform as a service and are willing to decide to adopt appropriate technologies.

Platform providers need to take the cost factor into consideration as users require a return on investment. Suggested user fee packages can be built based on monthly subscription and/or transaction value. In every container box transaction completion, users can contrast their earning and spending. Besides, perceived ease of use and perceived usefulness are the top 3 predictors proved for the adoption of CRUPs. Platform developers need to introduce the user-friendly porter through user icon (UI) and user experience (UX). These two factors also contribute to levering business to a new stage of digitization.

Users have not only demanded for exchange of empty container boxes, but also trailers. Containers have been an international means of transport since its introduction in the 1950s. Trailers, however, remain local ones. In waiting for trailers to be internationally legalized through cross-border transportation, software and platform businesses can consider developing trailer round-use in on country territory.

5. Conclusion

The findings contribute to the existing literature by offering insights into the adoption process of innovative technologies in emerging markets, specifically within the Vietnam context. The Container Round-Use Platforms represent one such solution in this context. Matching between supply side of empty container box and demand side counterpart are technically feasible. Matching between platform providers and business users needs to consider top proved predictors.

Despite its contribution to highlight adoption factors and recommendations to CRUPs platform providers, this research is limited to its quantitative method, convenience sampling, and geographical coverage of Vietnam. Future research can consider adding qualitative methods, purposive sampling, and expanding surveys to neighboring countries to compare users' behavior.

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