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Employees Technology Usage Adaptation Impact on Companies' Logistics Service Performance(*)

Çalışanların Teknoloji Kullanım Adaptasyonunun Firmaların Lojistik Servis Performansına Etkisi

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ABSTRACT: The information technology (IT) capability of companies is one of the determinants of their competitive power. However, IT outputs depend on employees intentions to use them. As a technological investment Port automation systems are widely used in container terminals. Therefore behavioral intention in the usage of various IT applications is one of the important factors that may affect logistics service performance. This study aims to explore the employees' technology usage adaptation impact on the logistics service performance of ports. In this context, the behavioral intentions of employees who use port automation systems are investigated using the Technological Acceptance Model.

Keywords: Competitive Power, Logistics Service Performance, Port Automation Systems, Technology Acceptance Model

ÖZ: *Şirketlerin rekabet gücünü belirleyen faktörlerden biri de bilgi teknolojisi yetenekleridir. Ancak, bu yetenek çalışanların bunları kullanma niyetiyle ilişkilidir. Liman otomasyon sistemlerini teknolojik yatırım olarak incelediğimizde konteyner terminallerinde yaygın olarak kullanılmaktadır. Bu sebepten bu teknolojilerin kullanımında davranışsal niyet lojistik servis performansını etkileyebilecek önemli faktörlerden biridir. Bu çalışma, çalışanların teknoloji kullanımındaki davranışsal niyetinin limanların lojistik servis performansı üzerindeki etkisini ortaya çıkartmayı amaçlamaktadır. Bu bağlamda, liman otomasyon sistemlerini kullanan çalışanların davranışsal niyeti, Teknolojik Adaptasyon Modeli ile incelenmiştir.*

Anahtar Sözcükler: *Rekabet Gücü, Lojistik Servis Performansı, Liman Otomasyon Sistemleri, Teknolojik Adaptasyon Modeli*

JEL Kodları: L25, M10, M15

1. Introduction

In today's global business environment logistics services become a vital tool in gaining a competitive advantage. Transportation is one of the major functions of these logistics services. Today over 66% of world trade (value based) is transferred through maritime transportation (United Nations Conference on Trade and Development [UNCTAD], 2016: 6). According to the literature ports are an important complement

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to international trade and the global supply chain (Mangan and Lalwani, 2008: 30) and they are an integral part of maritime transportation due to the services they provide.

Today, like many other industries, competition in container port industry is more intense than before (Cullinane and Song, 2006: 86). So ports need to improve their

performance and efficiency (Lee, Kuo, and Chou, 2005: 544) to gain a competitive advantage. Information technology (IT), as a competitive weapon, may contribute to a firm's competitive advantage by providing cost leadership and product differentiation (Porter, 1985). In the global business environment the IT capabilities of companies are one of the determinants of their competitive power. While technological infrastructures need costly investments they also provide companies with the capabilities to exploit strategic opportunities.

As a critical IT capability port automation systems are a widely used technological investments in container terminals. On the other hand, generally, the efficient and effective outputs of these technologies depend on employees intention to use them.

This study aims to explore employees technology usage adaptation impact on ports logistics service performance. In this context the behavioral intentions of employees to use port automation systems is investigated according to Technological Acceptance Model (TAM). In this research process a questionnaire was designed and all constructs were measured using existing scales from previous studies. The relationships between all variables were tested using factor, reliability, correlation and regression analyses by the SPSS 23 statistical package program.

In this context this study is organized as follows. A part literature review of the main concepts of the study is given after which the methodology of the study, including questionnaire design and sampling, is presented and data analyses and findings are given. Finally, the results are discussed in the conclusion.

2. Literature Review

Due to the logistics services shift from low-value basic to high value-added services, IT has had the greatest impact on the minimizing of risks, standardizing processes and reducing uncertainty (Lai, Li, Wang, and Zhao, 2008: 25), but it depends on employees intention to use IT.

2.1. Information Technology Capabilities (ITC)

Capability is an ability to accomplish organizational goals in a competitive environment (Teece, Pisano, and Shuen, 1997: 513). In a research-based view, IT is considered as a distinct capability for companies which provides a competitive advantage (Mata, Fuerst, and Barney, 1995: 487; Bharadwaj, 2000: 171; Acar and Zehir, 2009) and if a company combines IT related resources to a unique IT capability, it can create competitive power (Santhanam and Hartono, 2003: 126). IT investment adds value to companies by improving organizational efficiency and effectiveness (Bhatt and Grover, 2005: 255). According to the literature ITC has three dimensions; IT Infrastructure (ITCI), IT Qualifications (ITQ), and IT Operations (ITO) (Turulja and Bajgorić, 2016: 150; Karagoz and Akgun, 2015:25; Kmieciak, Michna, and

Meczynska, 2012: 710; Lai et al., 2008; DeSarbo, Anthony Di Benedetto, and Sinha, 2005; Tippins and Sohi, 2003: 748).

2.2. Technology Acceptance Model

IT plays a critical role in a company's performance, but, without users, it will be valueless in regard to competitiveness. Therefore individual's behavioral intention to use a system has been measured by many researchers and models have been developed (Ajzen and Fishbein, 1980; Venkatesh, 1999: Davis, 1989; Davis, Bagozzi, and Warshaw, 1989; Venkatesh, and Davis, 2000). One of these models is TAM, which was created by Davis in 1989. According to this model "Perceived Usefulness (PU)" and "Perceived Ease of Use (PEOU)" are two dimensions of individual behavioral intention to use a technology (Davis, 1989: 320).

PU is a person's degree of belief that using a technological system will increase his/her job performance, and PEOU is a person's degree of belief that using a technological system requires no additional effort (Davis, 1989: 320).

3. Methodology

3.1. Conceptual Framework

The main focus of current empirical study is to evaluate the effects of port automation systems capabilities on logistics service performance. In this context, behavioral intentions of employees to use port automation systems are exposed by Technological Acceptance Model (TAM). In this connection, the hypotheses which we use in our study are improved according to scientific paradigms and we construct a model that explains the relationship between TAM, ITC, and LSP (Figure 1), with support from the contemporary literature, these hypotheses are expanded in Table 1:

Table 1. Hypotheses

H1	There is a positive, significant and direct relationship between TAM and ITC
H1aa	There is a positive, significant and direct relationship between PU and ITCI
H1ab	There is a positive, significant and direct relationship between PU and ITQ
H1ac	There is a positive, significant and direct relationship between PU and ITO
H1ba	There is a positive, significant and direct relationship between PEOU and ITCI
H1bb	There is a positive, significant and direct relationship between PEOU and ITQ
H1bc	There is a positive, significant and direct relationship between PEOU and ITO
H2	There is a positive, significant and direct relationship between ITI and ITC
H2a	There is a positive, significant and direct relationship between ITI and ITCI
H2b	There is a positive, significant and direct relationship between ITI and ITQ
H2c	There is a positive, significant and direct relationship between ITI and ITO
H3	There is a positive, significant and direct relationship between TAM and ITI
H3a	There is a positive, significant and direct relationship between PU and ITI
H3b	There is a positive, significant and direct relationship between PEOU and ITI
H4	There is a positive, significant and direct relationship between ITC and LSP
H4a	There is a positive, significant and direct relationship between ITCI and LSP

H4b	There is a positive, significant and direct relationship between ITQ and LSP
H4c	There is a positive, significant and direct relationship between ITO and LSP
H5	There is a positive, significant and direct relationship between TAM and LSP
H5a	There is a positive, significant and direct relationship between PU and LSP
H5b	There is a positive, significant and direct relationship between PEOU and LSP

According to the generated hypotheses the preliminary research model is depicted in Figure 1.

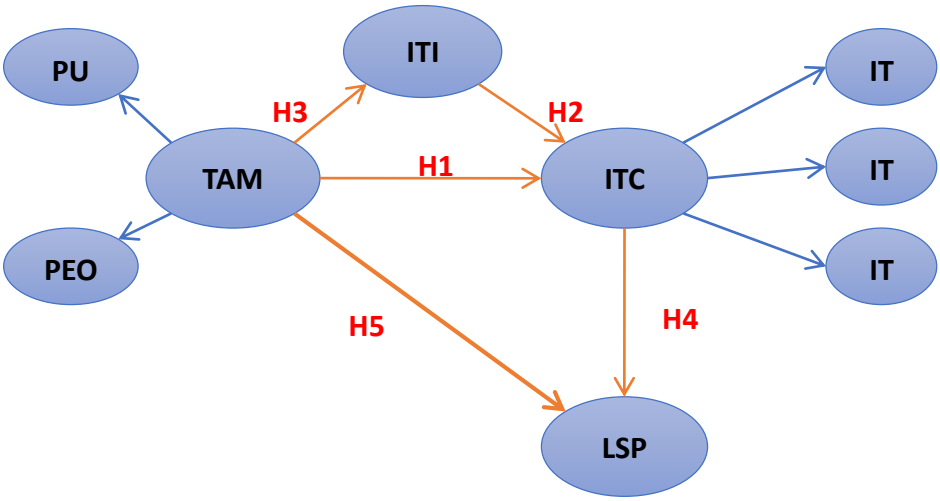

Figure 1. Research Model

3.2. Questionnaire Design

All constructs are measured using existing scales from previous literature, and adapted for the port industry. The first of these scales is the Technology Acceptance Model (TAM), and the questionnaire is taken from recent studies (Hamid, Razak, Bakar, and Abdullah, 2016; Abdullah, and Ward, 2016; Fathema, Shannon, and Ross, 2015; Wallace, and Sheetz, 2014; Joo, and Sang, 2013) which were generated according to Davis's study (1989). The second is Information Technology Investments (ITI), and the questionnaire was adapted from recent studies (González-Benito, 2007; Sriram, Stump, and Banerjee, 1997). The other scale is Information Technology Capability (ITC) and the questionnaire was adapted from recent studies (Turulja and Bajgorić, 2016; Karagoz and Akgun, 2015; Kmieciak, Michna, and Meczynska, 2012; Lai, Li, Wang, and Zhao, 2008; DeSarbo, Anthony Di Benedetto, and Sinha, 2005; Tippins and Sohi, 2003). Finally, the Logistics Service Performance measurement tool is taken from recent studies (Acar and Zehir, 2010; Richey, Daugherty, and Roath, 2007; Lu, and Yang, 2006; Lynch, Keller, and Ozment, 2000; Morash, 2001).

3.3. Sampling and Data Collecting

To perform the analyses valid data was collected from employees of Turkish Container Terminals. A total of 62 questionnaires were returned from more than 11 ports. The descriptive statistics of the respondents are shown in Table 2. All items are measured on the 5 points Likert type scale (1= strongly disagree and 5= strongly agree).The relationships between all variables are tested using factor, reliability, correlation and regression analyses via the SPSS 23 statistical package program.

Table 2. Descriptive Statistics of the Sample

Hierarchical Status	Frequency	Percent
Owner/ Shareholder	1	1.61%
Top Level Man.	2	3.23%
Middle-Level Man.	15	24.19%
Entry Level Man.	9	14.52%
Office Employee	12	19.35%
Fieldworker	23	37.10%
TOTAL	62	100%

Education	Frequency	Percent
Primary School	3	4.84%
High School	13	20.97%
Vocational School	10	16.13%
Graduate	23	37.10%
Masters/ PhD	13	20.97%
TOTAL	62	100%

Tenure	Current Company		Total	
	Frequency	Percent	Frequency	Percent
1-4	28	45.16%	10	16.13%
5-10	18	29.03%	18	29.03%
11-19	13	20.97%	26	41.94%
20 >	3	4.84%	8	12.90%
TOTAL	62	100%	62	100%

Department	Frequency	Percent
Operations	29	46.77%
IT	3	4.84%
Sales and Marketing	7	11.29%
Administrative Services	7	11.29%
OTHER	16	25.81%
TOTAL	62	100%

3.4. Data Analyses and Findings

In this study all items and components are tested using comprehensive reliability analyses. The overall scale reliability test coefficient was determined as $\alpha = 0.790$; this value is above the recommended 0,70 threshold (Nunnally, 1978: 245), in the correlation matrix PEOU showed no strong mutual relationship with each other, so this item was removed, and after that, the reliability test was done again and the coefficient was determined as $\alpha = 0.840$; this value is significantly over the recommended 0.70 threshold. After removing PEOU the results of the correlation analysis reveal that all constructs which differed from each other as a factor also correlated each other positively and significantly.

Table 3. Correlation Matrix

	PU	ITCI	ITQ	ITO	ITI	LSP
PU	1					
ITCI	,409**	1				
ITQ	,529**	,431**	1			
ITO	.208	,413**	,540**	1		
ITI	,443**	,605**	,672**	,658**	1	
LSP	,280*	,299*	,574**	,528**	,416**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

After correlation analysis the linear relationships are tested through regression analysis. According to the results given in Table 4 PU has statistically significant direct positive effects on the ITC dimensions of ITCI, and ITQ. Conversely, there is no significant proof of the effects of PU on ITO.

Table 4. The Effect of TAM on ITC

D. V.: ITCI	Beta	T	Sig.	Hypotheses	Results
PU	0.409***	3.468	.001	H1aa	Supported

R^2=0,166 ; F=12,023 ; p<0,001

D.V.: ITQ	Beta	T	Sig.	Hypotheses	Results
PU	0.529***	4.832	.000	H1ab	Supported

R^2=0,280 ; F=23,344 ; p<0,001

D. V.: ITO	Beta	T	Sig.	Hypotheses	Results
PU	.208	1.647	.105	H1ac	Not Supported

R^2=0,043 ; F=2,711 ; p>0,05

According to the results that are given in Table 5 ITI has statistically significant direct positive effects on all ITC dimensions.

Table 5. The Effect of ITI on ITC

D.V.: ITCI	Beta	T	Sig.	Hypotheses	Results
ITI	0.605***	5.886	.000	H2a	Supported

R^2=0,366 ; F=34,643 ; p<0,001

D.V.: ITQ	Beta	T	Sig.	Hypotheses	Results
ITI	0.672***	7.027	.000	H2b	Supported

R^2=0,451 ; F=49,375 ; p<0,001

D.V.: ITO	Beta	T	Sig.	Hypotheses	Results

ITI	0.658***	6.776	.000	H2c	Supported

R^2=0,433 ; F=45,915 ; p<0,001

According to the results that are given in Table 6 TAM has statistically significant direct positive effects on ITI.

Table 6. The Effect of TAM on ITI

D.V.: ITI	Beta	T	Sig.	Hypotheses	Results
PU	0.443***	3.824	.000	H3a	Supported

R^2=0,195 ; F=14,624 ; p<0,001

According to the results that are given in Table 7 the ITC dimensions of ITQ and ITO have statistically significant direct positive effects on LSP. Conversely, there is no significant proof of the effects of ITCI on LSP.

Table 7. The Effect of ITC on LSP

D.V.: LSP	Beta	T	Sig.	Hypotheses	Results
ITCI	-.005	-.046	0.963	H4a	Not Supported
ITQ	0.410**	3.256	0.002	H4b	Supported
ITO	0.309*	2.478	0.016	H4c	Supported

R^2=0,397 ; F=12,734 ; p<0,001

According to the results that are given in Table 8 TAM has statistically significant direct positive effects on LSP.

Table 8. The Effect of TAM on LSP

D.V.: LSP	Beta	t	Sig.	Hypotheses	Results
PU	0.280*	2.263	.027	H5a	Supported

R^2=0,0786 ; F=5,121 ; p<0,05

The results not only reveal the positive effect of ITIs and technologic acceptance on the ITCs but also exposed the mediating role of ITIs on this relationship.

According to the regression analysis ITI has a mediating effect between TAM and ITC.

Table 9. Mediating Role of ITI

D.V.: ITCI	Beta	t	Sig.
PU	,175	1,545	,128
ITI	,528***	4,654	,000

R^2=,391 ; F=18,914 ; p<0,001

D.V.: ITQ	Beta	t	Sig.
PU	,288**	2,861	,006
ITI	,544***	5,401	,000

R^2=,518 ; F=31,737 ; p<0,001

According to the regression analysis ITC has a mediating effect between TAM and LSP.

Table 10. Mediating Role of ITC

D.V.: LSP	Beta	t	Sig.
PU	,001	,005	,996
ITQ	,408*	2,903	,005
ITO	,308*	2,525	,014

R^2=,397 ; F=12.733 ; p<0,001

According to analysis the final research model is shown in Figure 2.

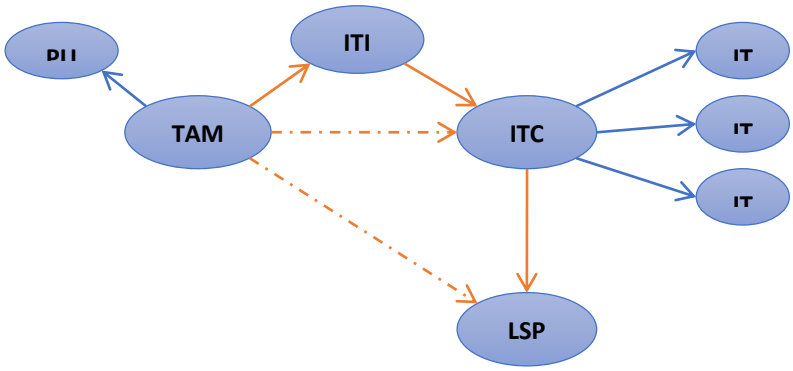

Figure 2. Final Model of the Research

4. Conclusion

This study explores the relationship between technologic acceptance, information technology capabilities and logistics service performance. Information technology capabilities and technology acceptance have a positive effect on logistics service performance. The results not only reveal the positive effect of information technology investments and technologic acceptance on information technology capabilities, but also exposed the mediating role of information technology investments in this relationship. Information technology capabilities and technology acceptance have a positive effect on logistics service performance and information technology capabilities have a mediating role in this relationship. 45% of emloyees in total worked less than 11 years and according to the literature the new generation has more ability in information technology usage. If information technology investments are supported by employee training, information technology capabilities and logistics service performances will be performed positively.

5. References

Abdullah, F., and Ward, R. (2016). Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors. *Computers in Human Behavior*, 56, 238-256.

Acar, A.Z., and Zehir, C. (2009). Development and validation of a multidimensional business capabilities measurement instrument. *Journal of Transnational Management*, 14(3), 215-240.

Acar, A.Z., and Zehir, C. (2010). The harmonize effects of generic strategies and business capabilities on business performance. *Journal of Business Economics and Management*, 11(4), 689-711.

Ajzen, I., and Fishbein, M. (1980). Understanding attitudes and predicting social behaviour.

Bharadwaj, A. S. (2000). A resource-based perspective on information technology capability and firm performance: an empirical investigation. *MIS Quarterly*, 169-196.

Bhatt, G. D., and Grover, V. (2005). Types of information technology capabilities and their role in competitive advantage: An empirical study. *Journal of management information systems*, 22(2), 253-277.

Cullinane, K., and Song, D. W. (2006). Estimating the relative efficiency of European container ports: a stochastic frontier analysis. *Research in Transportation Economics*, 16, 85-115.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319-340.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science*, 35(8), 982-1003.

DeSarbo, W. S., Anthony Di Benedetto, C., and Sinha, I. (2005). Revisiting the Miles and Snow strategic framework: uncovering interrelationships between strategic types, capabilities, environmental uncertainty, and firm performance. *Strategic Management Journal*, 26(1), 47-74.

Fathema, N., Shannon, D., and Ross, M. (2015). Expanding the technology acceptance model (tam) to examine faculty use of learning management systems (LMSS) in higher education institutions. *Journal of Online Learning and Teaching*, 11(2).

González-Benito, J. (2007). Information technology investment and operational performance in purchasing: The mediating role of supply chain management practices and strategic integration of purchasing. *Industrial Management and Data Systems*, 107(2), 201-228.

Hamid, A. A., Razak, F. Z. A., Bakar, A. A., and Abdullah, W. S. W. (2016). The effects of perceived usefulness and perceived ease of use on continuance intention to use e-government. *Procedia Economics and Finance*, 35, 644-649.

Joo, J., and Sang, Y. (2013). Exploring Koreans' smartphone usage: An integrated model of the technology acceptance model and uses and gratifications theory. *Computers in Human Behavior*, 29(6), 2512-2518.

Karagoz, I. B., and Akgun, A. E. (2015). The roles of it capability and organizational culture on logistics capability and firm performance. *Journal of Business Studies Quarterly*, 7(2), 23-45.

Kmieciak, R., Michna, A., and Meczynska, A. (2012). Innovativeness, empowerment and IT capability: evidence from SMEs. *Industrial Management and Data Systems*, 112(5), 707-728.

Lai, F., Li, D., Wang, Q., and Zhao, X. (2008). The information technology capability of third-party logistics providers: a resource-based view and empirical evidence from China. *Journal of Supply Chain Management*, 44(3), 22-38.

Lai, F., Li, D., Wang, Q., and Zhao, X. (2008). The information technology capability of third-party logistics providers: a resource-based view and empirical evidence from China. *Journal of Supply Chain Management*, 44(3), 22-38.

Lee, H. S., Chou, M. T., and Kuo, S. G. (2005). Evaluating port efficiency in Asia Pacific region with recursive data envelopment analysis. *Journal of the Eastern Asia Society for Transportation Studies*, 6, 544-559.

Lu, C. S., and Yang, C. C. (2006). Comparison of investment preferences for international logistics zones in Kaohsiung, Hong Kong, and Shanghai ports from a Taiwanese manufacturer's perspective. *Transportation Journal*, 30-51.

Lynch, D. F., Keller, S. B., and Ozment, J. (2000). The effects of logistics capabilities and strategy on firm performance. *Journal of Business Logistics*, 21(2), 47-68.

Mangan, J., Lalwani, C., and Fynes, B. (2008). Port-centric logistics. *The International Journal of Logistics Management*, 19(1), 29-41.

Mata, F. J., Fuerst, W. L., and Barney, J. B. (1995). Information technology and sustained competitive advantage: A resource-based analysis. *MIS Quarterly*, 487-505.

Morash, E. A. (2001). Supply chain strategies, capabilities, and performance. *Transportation Journal*, 37-54.

Nunnally, J. (1978). *Psychometric theory* (2nd ed.). New York: McGraw Hill.

Porter, M. E. (1985). Technology and competitive advantage. *Journal of Business Strategy*, 5(3), 60-78.

Richey, R. G., Daugherty, P. J., and Roath, A. S. (2007). Firm technological readiness and complementarity: capabilities impacting logistics service competency and performance. *Journal of Business Logistics*, 28(1), 195-228.

Santhanam, R., and Hartono, E. (2003). Issues in linking information technology capability to firm performance. *MIS Quarterly*, 125-153.

Sriram, V., Stump, R. L., and Banerjee, S. (1997). Information technology investments in purchasing: an empirical study of dimensions and antecedents. *Information and Management*, 33(2), 59-72.

Teece, D. J., Pisano, G., and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 509-533.

Tippins, M. J., and Sohi, R. S. (2003). IT competency and firm performance: is organizational learning a missing link?. *Strategic Management Journal*, 24(8), 745-761.

Turulja, L., and Bajgorić, N. (2016). Innovation and Information Technology Capability as Antecedents of Firms' Success. *Interdisciplinary Description of Complex Systems: INDECS*, 14(2), 148-156.

United Nations Conference on Trade and Development [UNCTAD]. (2016). *Review of Maritime Transport – 2016*. United Nations Publication.

Venkatesh, V. (1999). Creation of favorable user perceptions: exploring the role of intrinsic motivation. *MIS Quarterly*, 239-260.

Venkatesh, V., and Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186-204.

Wallace, L. G., and Sheetz, S. D. (2014). The adoption of software measures: A technology acceptance model (TAM) perspective. *Information and Management*, 51(2), 249-259.