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SUPPLY CHAIN INTEGRATION OF CONTAINER TERMINALS LOCATED IN AEGEAN REGION OF TURKEY*

Ercan KURTULUŞ[1]
Çimen KARATAŞ ÇETİN[2]
Durmuş Ali DEVECİ[3]

ABSTRACT

In the new competitive environment of maritime business, a need for evaluating supply chain integration of ports has emerged. The aim of this paper is to evaluate the supply chain integration of three container terminals located in the Aegean Region of Turkey. We have developed a model consisting of four constructs: "relationship with users", "information and communication systems", "value added services" and "multimodal connections and systems". We have also conducted a questionnaire through the shipping companies which use the container terminals and tested the validity by means of performing Confirmatory Factor Analysis. The results indicate the two privately owned container terminals are more closely integrated with the supply chain than the publicly owned container terminal. On the other hand, multimodal connections and systems of the two privately owned container terminals are less supply chain integrated than the publicly owned container terminals since the former lack adequate rail and road connections.

Keywords: *Container terminal, supply chain integration, port competition, confirmatory factor analysis, Aegean Region.*

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[1] PhD Candidate, Dokuz Eylül University, Maritime Faculty, kurtulusercan@yahoo.com, Karadeniz Technical University, Sürmene Faculty of Marine Sciences, Trabzon.
[2] Asst. Prof. Dr., Dokuz Eylül University, Maritime Faculty, Izmir, cimen.karatas@deu.edu.tr
[3] Prof.Dr., Dokuz Eylül University, Maritime Faculty, Izmir, adeveci@deu.edu.tr.

TÜRKİYE'NİN EGE BÖLGESİNDEKİ KONTEYNER TERMİNALLERİNİN TEDARİK ZİNCİRLERİNE ENTEGRASYONU

ÖZET

Denizcilik işletmelerinin yeni rekabetçi çevresi limanların tedarik zinciri entegrasyonlarını değerlendirme ihtiyaçlarını doğurmuştur. Bu çalışmanın amacı Türkiye'nin Ege Bölgesinde bulunan üç konteyner terminalinin tedarik zincirlerine entegrasyonlarını değerlendirmektir. Bunun için dört yapıdan oluşan bir model geliştirdik: "kullanıcılar ile ilişkiler"; "bilgi ve iletişim sistemleri"; "katma değerli hizmetler" ve "çoklu ulaşım bağlantıları ve sistemleri". Buna ek olarak konteyner terminallerini kullanan denizcilik isletmelerine anket uyguladık ve bu uygulamanın geçerliliğini Doğrulayıcı Faktör Analizi ile test ettik. Çalışmanın sonuçları göstermektedir ki iki özel konteyner terminali tedarik zincirlerine devlet tarafından işletilen konteyner terminalinden daha fazla entegredir. Öte yandan, devlet tarafından işletilen konteyner terminalinin "çoklu ulaşım bağlantıları ve sistemleri" iki özel konteyner terminalinden, yeterli demiryolu ve kara yolu bağlantılarına sahip olmadıkları için, daha fazla tedarik zincirine entegredir.

Anahtar Kelimeler: *Konteyner terminali, tedarik zinciri entegrasyonu, liman rekabeti, doğrulayıcı faktör analizi, Ege Bölgesi.*

1. INTRODUCTION

In the era of global supply chains, companies do not compete with each other but the supply chains they are embedded in (Christopher, 2010). As a result for that, the role of ports has been changing - they are not just traditional providers of ship loading and unloading facilities but they are integrated members of supply chains. Ports that are adapted in supply chains improve their performance and thus competitive position (Hoshino, 2010; Zondag et al. 2010; Lam and Yap, 2011; Yeo et al. 2011; Ng et al. 2013). Thus, vertical and horizontal integrations to control greater parts of supply chain leads the maritime industry (Heaver et al. 2000). Transport chain members such as forwarders, transport operators, terminal operators, and shipping lines integrate vertically -providing international logistics packages to shippers- and horizontally -increasing the range of those logistics packages with mergers, alliances, and acquisitions (Notteboom and Winkelmans, 2001). Shipping companies complement economies of scale approach with economies of scope approach in order to build core competencies and gain competitive advantages (Notteboom and Winkelmans, 2001). Ports can accomplish it with the development of value added logistics services, information systems and intermodal connections (Notteboom and Winkelmans, 2001).

Robinson (2002) argues new paradigm for ports has emerged: ports are not only the places that provide cargo loading and discharging facilities for shipping companies rather they are "*elements in value-driven chain systems*". *"Ports deliver value to shippers and other third party service providers in the value-driven chain; they will segment their customers in terms of a value proposition; and will capture value for themselves and for the chain in which they are embedded in"* (Robinson, 2002: 252). Paixão and Marlow (2003) discuss the changing competitive environment of ports and propose a new methodology, which includes two stages; internal and external integration. Carbone and Martino (2003), with a supply chain management approach, analyze port operators' role of involvement in the supply chain. Notteboom and Rodrigue (2005) introduce "*port regionalization phase*", where inland transportation has critical importance and favors transport corridors, and concluded that port authorities should extent their strategic coverage beyond a traditional facilitator and play a role by participating in the development of *"inland freight distribution, information systems and inter-modality"* (Notteboom and Rodrigue, 2005). Mangan et al. (2008) develop a concept called "port-centric logistics" in which ports have evolved to satisfy the needs of their embedded supply chains.

Panayides (2006) demonstrate the need for research on port supply chain integration and argue the most of the researches until then was anecdotal or company-specific. Panayides and Song (2008) develop a measurement model to evaluate the extent of integration of seaport container terminals in supply chains. In the later study, Panayides and Song (2009) validate container terminals are integrated into the supply chains to various degrees and the level of the integration is determined by a set of parameters. Song and Panayides (2008) conclude supply chain integration positively affects competitiveness. Tongzon et al. (2009) state the container terminals are not as supply chain integrated as expected by researchers and practitioners and there is a considerable gap between perspectives of container terminal users and operators. Lam and van de Voorde (2011) found scenarios representing a higher level of supply chain integration favored by the supply chain members. Woo et al. (2013) revealed supply chain orientation of container terminals positively affects supply chain integration of container terminals and supply chain integration of container terminals positively affects container terminal performance.

Adaptation and usage of new information and communication technologies such as e-customs, e-freight and e-navigation can increase the supply chain integration of ports. With the usage of e-customs, the time of customs procedures can be significantly reduced and the misinterpretations can be eliminated (Raus et al. 2009). Ease of usage and savings of costs are the other drivers of the adaptation of e-customs procedures (Urciuoli et al. 2013). On the seaborne side, the adaptation of e-navigation technologies leads to increase reliability for more informed decisions so that the ports can provide safe and efficient sea connection for the vessels (Amato et al. 2011; Weintrit, 2011). Through usage and access of e-freight portal small and medium enterprises in logistics sector are able to achieve a higher level of productivity and efficiency (Hassall et al. 2011). This kind of e-freight application already has been developed by some port authorities, such as Singapore port authority, providing significant productivity for their users (Hassall et al. 2011).

Current literature on supply chain integration of ports focuses on the developed countries, research on emerging countries are rare. Denktaş Şakar and Deveci (2012) conducted a focus group study on intermodal transport orientation of port in Turkey and concluded that characteristics of intermodal port concept from the perspectives of the actors in intermodal transportation are connectivity both from the hinterland and foreland, favorable location, efficient infrastructure and superstructure, advanced handling and ICT, ability to provide customer oriented and value added services, collaborative managerial and administrative port structure, and lean, flexible and harmonized port operations.

The aim of this paper is to evaluate supply chain integration of container terminals which are located in the Izmir region of Turkey. Models developed by previous studies modified and adapted and a questionnaire applied to the shipping companies which use the container terminals in the region.

2. THEORETICAL FRAMEWORK

The model used in this paper is based on the models developed by previous researchers (Panayides and Song, 2008; Song and Panayides, 2008; Panayides and Song, 2009; Tongzon et al. 2009; Woo et al. 2013). We adopted Panayides and Song (2008: 563)'s definition for supply chain integration of container terminals: *"the extent to which the container terminals establishes systems and processes and undertakes functions relevant to becoming an integral part of the supply chain".* Carbone and Martino (2003) demonstrated four components of port supply chain integration in their research based on interviews with French Port operating companies: "mutual relationships"; "supplied services"; "information and communication technologies" and "performance measurement". Panayides and Song (2008) conceptualized the port supply chain integration by developing TESCI model, consists of five components, for measuring integration level of ports: "information and communication systems"; "relationship with users"; "value-added service"; "multimodal systems and operations" and "supply chain integration practices". In their later research, they validated these components with confirmatory factor analysis (Panayides and Song 2009). Tongzon et al. (2009) further developed and validated the four model components: "relationship with users", "value-added service", "intermodal infrastructure" and "channel integration practices". To further develop previous models, Woo et al. (2013) added new components called "port supply chain orientation": "relationship orientation"; "human resources"; "financial resources" and "top management support". They investigated the relationship among "port supply chain orientation", "port supply chain integration" and "port performance" in ports of Korea. On the foundation of above discussion, we used four components to constitute the measurement: "information and communication systems"; "relationship with users"; "value added services" and "multimodal systems and operations".

Table 1: Constructs and Measures of Container Terminal Supply Chain Integration Evaluation Model

Components	**Measures**
Relationship with Terminal Users	Working together with the port users to ensure higher quality of service (Song and Panayides, 2008; Tongzon et al. 2009)
	Working together with the users to reduce costs (Song and Panayides, 2008; Tongzon et al. 2009)
	Frequently measuring and evaluating port user satisfaction (Tongzon et al. 2009)

Table 1: Constructs and Measures of Container Terminal Supply Chain Integration Evaluation Model (Continued)

Components	Measures
Relationship with Terminal Users	Considering to terminal users' opinion before developing/upgrading port facilities (Song and Panayides, 2008) Meeting with users to discuss issues of mutual interest (Song and Panayides, 2008)
Information and Communication Systems	Providing information concerning shipment and cargo tracking (Woo et al. 2013) Using integrated EDI to communicate with terminal users (Song and Panayides, 2008; Panayides and Song, 2008; Panayides and Song, 2009; Woo et al. 2013) Adopting computerized service systems for their operations (Song and Panayides, 2008; Panayides and Song, 2008; Panayides and Song, 2009; Woo et al. 2013) Using the latest IT technology to support their operations (Panayides and Song, 2008; Panayides and Song, 2009; Woo et al. 2013)
Value Added Services	Having adequate facilities for adding value to cargoes (Song and Panayides, 2008; Panayides and Song, 2008; Tongzon et al. 2009) (Panayides and Song, 2009; Woo et al. 2013) Capable of adapting a service to meet the customers' specifications (Panayides and Song, 2008; Panayides and Song, 2009; Woo et al. 2013) Capable of launching new tailored services should the need arise (Song and Panayides, 2008; Panayides and Song, 2008; Tongzon et al. 2009; Panayides and Song, 2009; Woo et al., 2013) Capable of delivering services tailored to different markets (e.g. Electronic, Textile, etc.) (Song and Panayides, 2008; Panayides and Song, 2008; Tongzon et al. 2009; Panayides and Song, 2009; Woo et al. 2013)
Multimodal Connections and Systems	Providing adequate railway connections Providing adequate road connections Providing reliable service operations for the multimodal interface (Panayides and Song, 2008; Panayides and Song, 2009; Woo et al. 2013) Providing cost-effective multimodal operations (Panayides and Song, 2008; Panayides and Song, 2009; Woo et al. 2013) Providing services to widest possible hinterland with rail connections Providing services to widest possible hinterland with road connections

3. CONTAINER TERMINALS IN AEGEAN REGION

In the context of Turkish port industry, ownership status of ports and terminals divided into three categories: public, private and municipality ports and terminals (Oral et al. 2006; Denktaş Şakar and Deveci, 2012). 23 container terminals located in Turkey, 4 of them are publicly owned and 19 of them are privately owned.

During 2013, Totally 7,9 million TEU handled in Turkey's container terminals. 89% of this throughput handled in private container terminals and public ports handled 10,5%. Four container terminals located in Aegean region -one of them is publicly owned and three of them are privately owned. Containers handled in Aegean region ports had risen 3,5% and became 1,17 million TEU in 2013. Nemport, Ege Gubre, and Petkim located in Aliaga region and TSR Izmir port located in the city center of Izmir. Petkim container terminal is currently not operational. The throughput of TSR Alsancak port decreased 1,1%, Newport's throughput decreased 7,7% and Ege Gubre's throughput increased 46% in 2013. TSR Izmir has the highest throughput in the region.

Table 2: Throughputs of Container Terminals Located in Aegean Region

	2011	2012	2013
TSR Izmir	690.539	705.097	697.026
Nemport	256.598	279.853	258.275
Ege Gübre	127.961	149.429	219.469
Petkim	111	257	61

Source: TURKLIM, 2014

4. METHODOLOGY

Table 1 shows the studies that we derived the model. They include the papers by Panayides and Song (2008), Song and Panayides (2008), Panayides and Song (2009), Tongzon et al. (2009) and Woo et al. (2013). Our model has four constructs which are Relationship with Terminal User (RTU), Information and Communication Systems (ICS), Value Added Services (VAS), Multimodal Connections and Systems (MCS).

The four measures; "Providing adequate railway connections", "Providing adequate road connections", "Providing services to widest possible hinterland with rail connections" and "Providing services to widest possible hinterland with road connections" were developed through modifying measures of above studies; "Adequate connectivity for the ship/road interface" (Tongzon et al. 2009), "Adequate connectivity for the ship/rail interface" (Tongzon et al. 2009) and "Capacity to provide the widest possible road/rail access to hinterland and foreland" (Song and Panayides, 2008; Tongzon et al. 2009). Modification process was conducted by separate interviews with four academicians who are expert in seaport-related subjects. First, measures of previous studies were presented them and asked if the wording was clear, there was a better wording to express the variables and there was any additional variables need be included.

4.1. Sampling and Data Collection

Shipping companies using container terminals in Aegean region of Turkey were included in the study. Respondents were required to state the business field of their companies. Four different business fields could be selected by the respondents: "Shipping Line", "Liner Agency", "Freight Forwarder" and "Logistics Service Provider". Additionally, "Other" option is provided for the companies do not fit in those categories. Respondent companies were chosen from the member databases of Izmir Branch of Turkish Chamber of Shipping and Freight Forwarders Association.

The questionnaires were sent to the operations departments of the companies and the employees who are responsible for port and/or terminal operations were asked to respond. The responses which include same answers to all of the measures (e.g. all the answers to the questionnaire are 1 or 5) were excluded from the analysis in order to eliminate possible biased responses.

Totally 168 questionnaires have been sent and 47 respondents have been answered to the questionnaire. 38% percent of the respondents were working in "Liner Agencies", 6% of them were working in "Shipping Lines", 36% percent of them were working in "Freight Forwarders", 6% of them were working in "Logistics Service Providers" and 12% percent were working in "Other" container terminal user companies.

Because of the privacy issues, the three container terminals located in Izmir Region were called Container Terminal-1, Container Terminal-2, and Container Terminal-3. Respondents were asked to answer the survey questionnaire for all three container terminals. 44 responses gathered for Container Terminal-3, 31 responses gathered for Container Terminal-1 and 32 responses gathered for Container Terminal-2.

Table 3: Respondents' Profile

	Liner Agencies	**Shipping Lines**	**Freight Forwarders**	**Logistics Service Providers**	**Other**
Container Terminal 1	14(45%)	2(6%)	11(35%)	1(3%)	3(9%)
Container Terminal 2	14(43%)	2(6%)	11(34%)	1(3%)	4(12%)
Container Terminal 3	17(38%)	3(6%)	17(38%)	3(6%)	4(9%)
Total	45	7	39	5	11

4.2. Validity and Reliability

The validity of the study was evaluated under three headings; content validity, convergent validity, and discriminant validity. "*Convergent validity means the extent to which indicators of a specific construct share a high proportion of variance in common and discriminant validity means the extent to which a construct is distinct from other constructs"* (Hair et al. 2010: 689). The content validity was obtained by including relative literature. The model used in this study is modified and combined version of the models developed by Panayides and Song (2008), Song and Panayides (2008), Panayides and Song (2009), Tongzon et al. (2009) and Woo et al. (2013). In their research, they validated their models with confirmatory factor analysis. Confirmatory factor analysis is a method used for testing the validity of a model which represents the measurement theory showing how variables come together to represent constructs (Hair et al. 2010). With the confirmatory analysis, we can be able to see how different measured items represent psychological, sociological, or business constructs (Hair et al. 2010). Despite the fact that the model used in this study was based on the previously validated models, further validation is needed because the model is modified slightly to capture the perceptions of Turkish shipping companies.

Confirmatory factor analysis was applied in order to assess the convergent validity and the discriminant validity of our model. Indicators of these validity measures are fit indices, factor loading and factor correlation. The two-headed arrows in Figure 1 shows the inter-correlation between constructs and two error covariance are applied between MCS1 and MCS5 and between MCS2 and MCS6 in order to increase the model fit. Because of the close interrelationship of those indicators, application of error covariance is not expected to cause problems. "Providing services to widest possible hinterland with railway connections (MCS5)" is highly related with "Availability of adequate railway connections (MCS1)" and "Providing services to widest possible hinterland with road connections (MCS2)" is also highly related to "Availability of adequate railway connections (MCS6)"

Convergent validity is evaluated by fit indices and factor loadings. Hair et al. (2010) stated loadings greater than .50 considered moderately significant and loadings exceeding .70 indicates well-defined structure. Figure 1 shows factor loading of VAS1 is .58 which is the only factor loading less than .70. Table 4 shows the accepted threshold for fit indices and actual model results of the confirmatory factor analysis applied in this paper. The only one of the p-values lacks the required outcome. The reason behind this might be the sensitivity of the p-value to sample size (Hair et al. 2010). Concerning discriminate validity, CFA results show that all of the factor correlations coefficients do not exceed the value of threshold which is .80 (Hair et al. 2010).

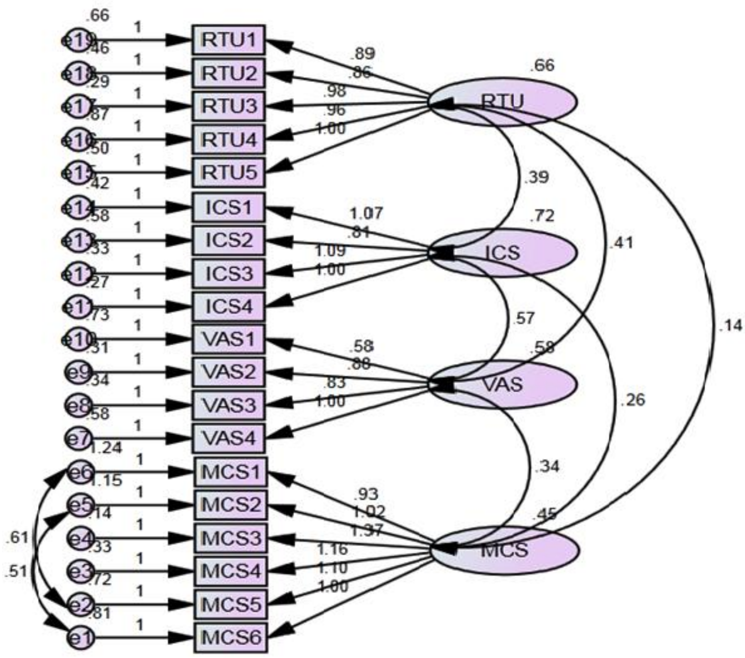

Figure 1: Outcomes of the Confirmatory Factor Analysis Derived by the Authors

Table 4: Model Fit Indices

	Threshold (Hair et al. 2010)	Outcomes of the CFA
Chi-square/df (cmin/df)	<3 good	1.2
P-value	>.05	.025
RMSEA	<.05 good, .05-.10 moderate	.075
CFI	>.90	.918
TLI	Better if it is close to 1.0 (it can be over 1.0)	.902

Reliability of the model was evaluated with Cronbach's alpha, construct reliability, and Average Variance Extracted. Only Cronbach's alpha value of VAS is less than .80. Construct reliability values of all factors exceed .70. Two of the factors’ (RTU and MCS) extracted average variances are slightly less than .50.

Table 5: Reliability of Factors

Factor	Cronbach's Alpha	Construct Reliability	Average Variance Extracted
Relationship with Terminal Users (RTU)	.836	.834	.469
Information and Communication Systems (ICS)	.875	.876	.639
Value Added Services (VAS)	.753	.846	.525
Multimodal Connections and Systems (MCS)	.853	.768	.461

5. RESULTS

5.1. Supply Chain Integration Level of Container Terminal-1

Table 6 and Figure 2 shows supply chain integration of Container Terminal-1. 38% of the respondents perceive the terminal is integrated with the supply chain while 26% see it is not integrated and 36% of the respondents are uncertain. The weakest construct is "multimodal connections and systems", where only 20% of the respondents think terminal's multimodal connections and systems is integrated whereas 38% of the respondents think otherwise and 36% of respondents are uncertain. Two parameters which are "cost-effective multimodal operations" and "railway connections" have scored lowest. 6% of the respondents agree the terminal provides cost effective multimodal operations while 52% does not agree. 6% of the respondents agree it is possible to provide services to widest possible hinterland with the terminals rail connections. On the other hand, 49% of them think the opposite.

Table 6: Supply Chain Integration Level of Container Terminal-1

	1(%)	2(%)	3(%)	4(%)	5(%)
RTU1	3	13	32	39	13
RTU2	10	23	35	26	6
RTU3	23	13	26	35	3
RTU4	16	19	26	32	6
RTU5	10	6	26	52	6
ICS1	3	10	26	39	23
ICS2	6	3	39	32	19
ICS3	3	10	29	35	23
ICS4	6	3	52	35	3
VAS1	0	13	35	42	10
VAS2	3	16	35	39	6
VAS3	16	16	23	42	3
VAS4	0	13	45	35	6
MCS1	29	19	35	10	6
MCS2	6	13	48	19	13
MCS3	13	16	45	26	0
MCS4	23	29	42	6	0
MCS5	23	26	45	6	0
MCS6	10	16	45	26	3
Overall	11	15	36	30	8

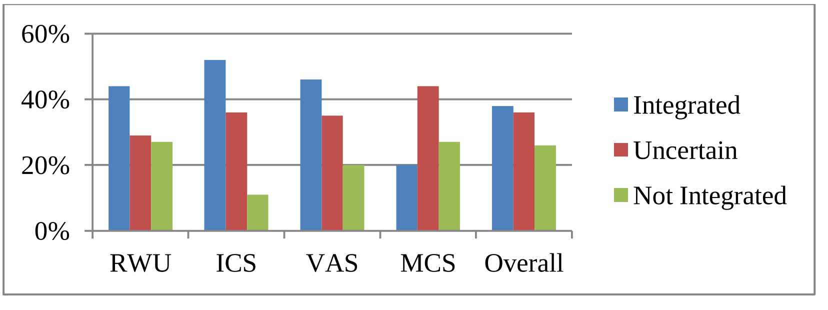

Figure 2: Supply Chain Integration Level of Container Terminal-1

5.2. Supply Chain Integration Level of Container Terminal-2

Table 7 and Figure 3 indicate the findings of Container Terminal-2. 38% of the respondents perceive that the terminal is integrated with the supply chain while 22% of the respondents perceive the opposite and 40% is uncertain. Similar to Container Terminal-1, the weakest construct is

Multimodal Connections and Systems. 22% of the respondents think the multimodal connections and systems of the terminal are integrated with the supply chain whereas 35% thinks the opposite and 44% is uncertain. Two lowest parameters under this construct are cost-effective multimodal operations and possibility to provide services to widest hinterland with rail connections. 6% of the respondents agree the terminal provides cost-effective multimodal operations while 41% of them think the terminal does not provide cost-effective multimodal operations. Respondents who think users are able to provide services to widest possible hinterland with the rail connections of the terminal is 9%. 50% think users are not able to provide services to widest possible hinterland with the railway connections.

Table 7: Supply Chain Integration Level of Container Terminal-2

	1(%)	2(%)	3(%)	4(%)	5(%)
RTU1	3	6	38	38	16
RTU2	9	13	44	31	3
RTU3	19	9	44	22	6
RTU4	16	9	38	31	6
RTU5	9	6	34	44	6
ICS1	3	9	22	50	16
ICS2	6	6	38	34	16
ICS3	3	9	34	31	22
ICS4	6	6	56	28	3
VAS1	0	9	38	41	13
VAS2	3	13	41	31	13
VAS3	13	9	34	38	6
VAS4	0	16	41	34	9
MCS1	22	19	38	16	6
MCS2	9	13	44	22	13
MCS3	13	16	44	25	3
MCS4	16	25	53	6	0
MCS5	22	28	41	6	3
MCS6	6	19	47	25	3
Overall	9	13	40	29	9

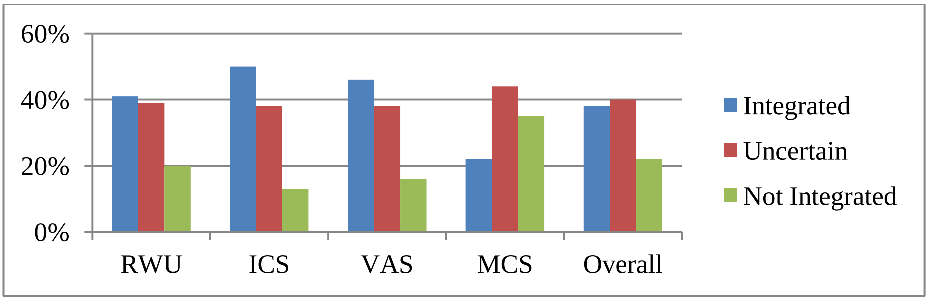

Figure 3: Supply Chain Integration Level of Container Terminal-2

5.3. Supply Chain Integration Level of Container Terminal-3

Table 8: Supply Chain Integration Level of Container Terminal 3

	1(%)	2(%)	3(%)	4(%)	5(%)
RTU1	27	27	34	7	5
RTU2	32	36	25	5	2
RTU3	66	16	14	2	2
RTU4	41	25	20	7	7
RTU5	20	36	27	11	5
ICS1	27	27	27	16	2
ICS2	30	27	34	7	2
ICS3	34	20	34	9	2
ICS4	55	20	20	2	2
VAS1	36	34	20	9	0
VAS2	48	27	23	2	0
VAS3	50	27	20	2	0
VAS4	20	30	30	18	2
MCS1	9	16	36	11	27
MCS2	11	16	27	25	20
MCS3	16	34	30	20	0
MCS4	18	30	36	16	0
MCS5	14	30	25	27	5
MCS6	7	20	32	27	14
Overall	30	26	27	12	5

As indicated in Table 8 and Figure 4, supply chain integration level of the Container Terminal-3 is lowest among the three terminals. 17% of the users agree that the terminal is integrated with the supply chain while 56% of them think the terminal is not integrated and 27% is uncertain. Only 10% of the users see the terminals relationship with users is integrated with supply chain whereas 65% thinks the opposite. 11% of the users think terminals information and communication systems are integrated with the supply chain. On the other hand, 60% of them agree the communication and information system of the terminal is not integrated with the supply chain while 29% is uncertain about it. 9% of the respondents agree the terminal is integrated with the supply chain under the construct of value added services whereas 69% thinks the opposite. The terminal is scored highest for its multimodal connections and systems. 32% of the users responded that the terminal's multimodal connection and systems are integrated with the supply chain. On the contrary, 37% of the users agree the opposite.

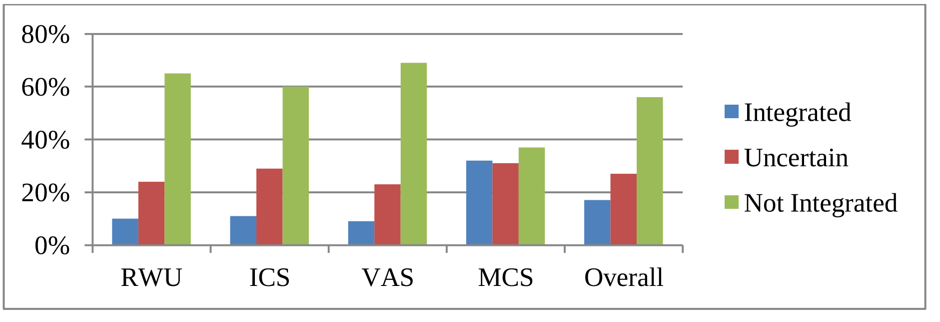

Figure 4: Supply Chain Integration Level of Container Terminal-3

5.4. Comparison of the Terminals

Among the three container terminals, Container Terminal-3 scored the lowest supply chain integration level. The score of the other two terminals' integration level is the same. Figure 5 indicates the comparison of the three terminals. 17% of the users agreed Container Terminal-3 is integrated with the supply chain whereas 38% of the respondents agree Container Terminal-1 and Container Terminal-2 are integrated with the supply chain. Container Terminal-3 scored the best on multimodal connections and systems: Container Terminal-3 scored 32% while Container Terminal-2 scored 22% and Container Terminal-1 scored 20%. Container Terminal-1 and Container Terminal-2 scored way higher than Container Terminal-3 on the other constructs.

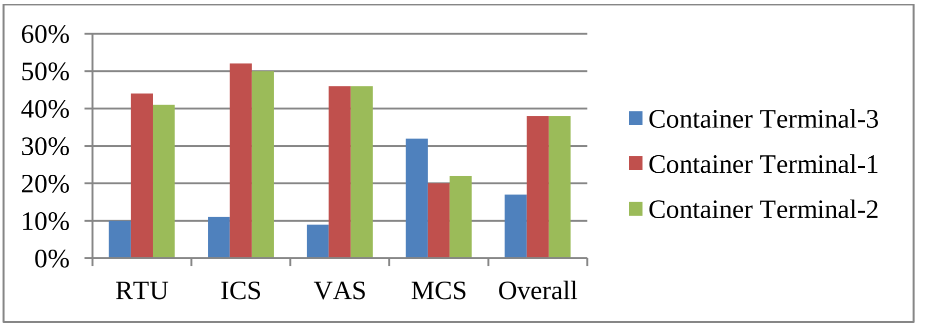

Figure 5: Comparison of the Terminals

6. DISCUSSION

Overall evaluation of the three terminals' supply chain integration levels indicates 38% of the users agree that Container Terminal-1 and Container Terminal-2 is integrated with the supply chain whereas 17% of them agreed Container Terminal-3 is integrated with the supply chain. Findings present a very low supply chain integration level for the three terminals. Many researchers point out the positive relation between supply chain integration and port performance thus higher competitiveness. The terminals need to place a strategic importance to improve their level of supply chain integration since it is perceived low.

Container Terminal-3 operators should focus on to increase its relationship with users; information and communication systems and value added services. Almost all of the measures under these constructs need improvement. The reason behind the low supply chain integration level of the terminal might be it is publicly owned. Only multimodal connections and systems of the terminal scored higher than the other two terminals since it is the only terminal which has rail connections.

Supply chain integration level of Container Terminal-1 and Container Terminal-2 is almost the same. Lowest scored construct for both terminals is multimodal connections and systems. These two terminals need to improve their multimodal connections. The lowest scored measures indicate that the need to achieve cost-effective multimodal connections and the need to provide railways connections for users to service the widest hinterland possible.

7. CONCLUSION

In the new competitive environment of maritime business, a need for evaluating supply chain integration of ports has emerged. This research paper aims to evaluate supply chain integration level of the container terminals located in Aegean Region of Turkey. The evaluation model is gathered together from existing literature and the measures were adapted to reflect characteristics of the container terminals located in Turkey. Additionally, the model is validated by performing confirmatory factor analysis.

Findings indicate the container terminals lack close integration in supply chains. The terminals performed low on "multimodal connections and systems". Container Terminal-1 and Container Terminal-2 scored the same and higher than Container Terminal-3. "Multimodal connections and systems" component of Container Terminal-1 and Container Terminal-2 lack integration in supply chains since both terminals have inadequate multimodal connections and operations. Container Terminal-3 performed higher than Container Terminal-1 and Container Terminal-2 on the component of "multimodal connections and systems" because it the only terminal which has a direct rail connection. On the other hand, Container Terminal-3 performed lower than other terminals on the other constructs. Container Terminal-3 is a public port which is operated by the government authorities. Therefore, without having pressures to become profitable, managers of Container Terminal-3 might lack attention to the supply chain integration.

This paper only focuses on perceptions of container terminal users; it is mainly because the managers of the three terminals do not constitute enough number to perform a questionnaire. It can be useful to reveal the perceptions of terminal operators in order to see the difference between terminal users' and terminal operators' perceptions. The results of this study indicates the supply chain integration level difference between state owned terminals and privately owned terminals. Future studies can focus on this difference to reveal the reasons behind it. Additionally, the model can be expanded and adapted further and applied to the other container terminals in Turkey or in other countries. The study is cross-sectional which indicates the supply chain integration level of the container terminals at a specific time. In future, the study can be repeated to see the improvements of the terminals' supply chain integration levels.

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