



# “Maritime Transport: Opportunities & Threats in the Post-crisis world”

Under the auspices of the International Association of Maritime Economists (IAME)

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### Conference Theme

The year 2008 has been a milestone for global economy all. The credit crunch and the subsequent economics crisis ended a period of unprecedented growth of trade and transport demand. The effects on maritime and transport industries have been severe. All those involved in shipping, ports and intermodal transport, have to revisit earlier assumptions and reshape business models of development to prepare for the future. The observed difficulties are accompanied with considerable opportunities to develop corrective actions that address pre-existing misallocations. At the same time the quest of shipping and ports to integrate in intermodal transport systems has to address the post-crisis challenges to emerge. It is time to review established practices and streamline prevailing theories

**ECONSHIP 2011** invites researchers with an interest in shipping, transport, and trade from around the world to submit papers and participate in the Conference’s stimulating discussions of the lessons that shipping, maritime and intermodal transport systems can be drawn from the past, and the emerging prospects for the future.

The timing of **ECONSHIP 2011**, 22-24 June 2011, provides a unique opportunity

- **For maritime economists** who want to stimulate discussions on shipping, ports, and maritime industries, while developing their research in progress - in time before heading to [IAME2011](#) in Santiago, Chile
- **For transport researchers** to participate and exchange views in a major multidisciplinary event, that will bring together academics and practitioners from many different countries and experiences.
- **For young scholars and researchers**, who want to put forward and test their on-going research.

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# A REVIEW OF THE STUDIES ON EMPTY CONTAINER REPOSITIONING PROBLEM

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## ABSTRACT

As a result of numerous favorable effects of containerization, there has been considerable increase in the tendency of using containers in international movements of both finished as well as semi-finished goods. Such an intensive use of containers has eventually resulted in the intensive exits of all containers from the major export countries. There have been various difficulties, however, encountered in succeeding the smooth return of the empty containers back to the country of origin. Therefore, an efficient empty container management and repositioning problem has become an important issue in the liner shipping industry. The problems caused by empty containers are not limited to certain economic effects on shipping companies.

The import and export volume is not equal with each other in the foreign trade of the world countries, so empty container repositioning problem is caused by trade imbalanced exactly. There is an empty container supplying problem in exporter countries and there is an aggregation problem of empty containers in importer countries. The purpose of this study is to analyze the problems resulted from empty container repositioning. To manage this, the relevant literature published in the last twenty years will be thoroughly reviewed and the methods used by such studies will be evaluated.

**Keywords:** Empty Container, Repositioning, Containerization, Seaports, Liner Shipping, Trade Imbalance.

## INTRODUCTION

The shipping is one of the world's regularly grown industries regularly and transportation of containers is an important part of the global shipping industry. Container transport has been playing an important role in world trade since 1950s and since the 1970s, the containerization of cargo transportation has been the norm in worldwide maritime services.

World trades have been getting more imbalanced in recent years. Trade imbalances imply container transport imbalances and consequently a need to reposition empty containers. In consideration of this imbalances and the one-way container flow in the world trade, while in some region an aggregation problem of empty containers, there is a supplying problem of empty containers in right time and place. Because of these reasons, "empty container management" has become an important topic in world trade.

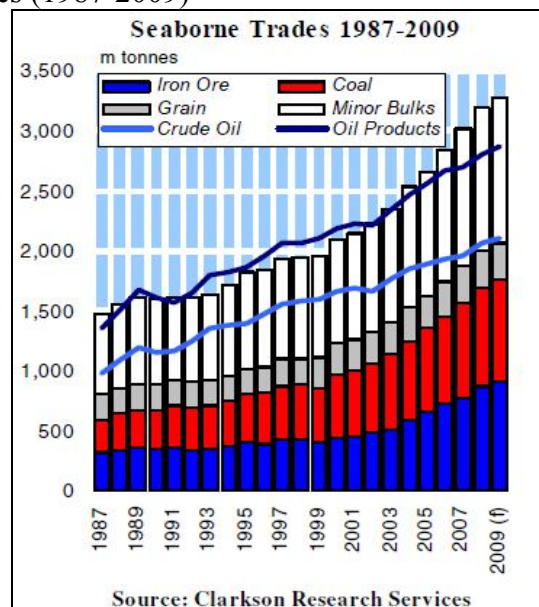
As a consequence of researches, many articles and papers, PhD theses and final reports are found about empty container repositioning problem. The purpose of this study is to analyze the problems resulted from empty container repositioning. To manage this, the relevant literature published in the last twenty years will be thoroughly reviewed and the methods used by such studies will be evaluated.

## DEVELOPMENTS OF WORLD ECONOMY AND SEABORNE TRADE

“Globalization” is one of the most important changes in our age. The fact that economical globalization has brought about certain advancement in production, trade, capital movements and competition in technological progress has resulted in integration within the product and factor markets through liberalization (Aktan ve Şen, 1999). In the world economy, when globalization increases, trade increases too, so it effect the movements of the goods pozitively.

Economic pressures along with competitive production models have forced many companies beyond borders for the sake of low cost production, which in turn has caused certain changes in micro as well as macro economies and hence a rapid movement of goods throughout the world (Yazıcı, 2008: 221). Such dramatic changes in economies and rapid movements of goods have affected shipping industry, which has long been keeping the leading post and which has risen up the peak point with the prevalent developments of containerization bringing about further developments in various containerization-related advances in such field as producing bigger containership, diversification of services in ports, multimodal transportation systems, logistic processes, supply chain management, appearing and developing forwarder system, etc.

**Figure 1.** Seaborne Trades (1987-2009)



**Source:** Clarkson Research Services, <http://www.crsi.com/>

While the world seaborne trade is 2.5 millions of tons in 1970s, it is 5.9 millions of tons in the beginning of 2000s. The world seaborne trade which is increasing day by day, is 8.2 millions of tons in 2008 and 7.9 millions of tons in the first quarter of 2009.

In 2008, the total world containerized trade was estimated at 1.3 billion tons, an increase of 4.6 per cent over the previous year (UNCTAD, 2009: 98). The containership market is currently trending upwards. In 2009, total world containerized trade was estimated at 1.19 billion tons, a decrease of around 9 per cent over the previous year (UNCTAD, 2010: 84).

Sun (2010) maintains that with the increasing development of economic globalization, the worldwide unbalanced economy development and foreign trade result in a large flow of empty containers.

## **METHODOLOGY**

In this research, literature survey was done. Although there is a lot of study at this topic, a national study concerning empty container repositioning was not found in Turkey. The research is an exploratory study by virtue of its aim. Secondary data method was used as the data collecting method in the study and analyzing the literature.

## **OVERVIEW OF RESEARCH AREAS: CAUSED BY TRADE IMBALANCE**

Conclusion of all the researches constructed about "empty container repositioning problem" tied upon to the problem of trade imbalance in world trade.

In addition to imbalanced trade activities, which raise the prices in the most frequently called regions but lower the prices in the reverse routes, another factor leading to accumulation of containers in certain regions seems to be the price tariffs.

## **PREVIOUS LITERATURE SURVEY**

Container shipping is one of the fastest growing sectors in shipping industry. The phenomenon of import-export imbalance is unavoidable in world trade and this results in empty container problem in liner shipping industry (Feng and Chang, 2008: 486).

As the world trades are getting more imbalanced in recent years, particularly in Trans-Pacific and Asia-Europe routes, empty container operations have incurred a huge amount of costs (Song and Dong, 2009: 2). The demand of container transportation is increasing nowadays and the demand for empty containers is also increasing regularly. So, the repositioning of empty containers represents a crucial activity for shipping companies.

Container management is one of the most important issues in the shipping industry (Song et.al., 2005). At this point, karşımıza iki durum çıkmaktadır. One of them is supplying empty container, and the other one is empty container management. Empty container management is one of the most complex problems facing the global logistics industry.

Cheung and Chen (1998), indicated that most liner international trades are typically imbalanced in terms of the numbers of import and export containers, because of the different economic needs in different regions. Thus, liner shipping companies often need to reposition their empty containers or to lease empty containers from vendors to meet exporters' demands (Chou et.al., 2010; 1). Shipping companies reposition empty containers between hub areas, ports and depots. Because it usually takes a long time to reposition empty containers between

hub areas and an efficient management of the empty containers is an important factor that can contribute to raising the productivity of shipping companies (Yun et.al., 2010). In this way, because a solution is generated whenever a customer wants, both the time problem is abated and customer satisfaction is provided,

Mathematical programming are used to minimize the expected total costs consisting of inventory-holding costs, lifting-on/off costs, transportation costs, repositioning costs, and lost demand penalty costs (Dong and Song, 2009; 875; Chou et.al., 2010:8 and Francesco et.al., 2009: 769) and produce a optimistic estimation of empty container movements (Song and Charter, 2010: 305). A heuristic method is presented to solve the coordinated balancing problem which aims to minimize the total empty container repositioning costs (Song and Dong, 2009: 14).

Li and Han (2009) set a stochastic programming model, and had a simulation, got different results by changing the routes and changing the expectations of decision-maker, in order to solve the reposition of empty containers under uncertain demand and supply. According to Wang and Wang (2007), in the integer model, the cost of empty container transportation is minimized on the condition that the need and supply of empty containers are satisfied because of the application of the model.

Jula et.al. (2006) maintain that empty container reuse consists of two methodologies: street-turn and depot-direct. With a careful selection of the reuse cost function, weights can be adjusted to put more emphasis on either the street-turn or depot-direct. On the other hand, when the traveling cost and traffic congestion are the important factors, street-turn methodology provides the best match between supply and demand of empties. As a consequence of reducing the number of truck trips to and from the container terminals, empty container reuse will have significant environmental effects. It will reduce the traffic and congestion around the ports, which in turn reduce noise and emissions. It will save time, energy and cost for both truckers and port operators (Jula, et.al., 2006: 58).

According to Choong et.al. (2002) and Choong et.al. (2003), discussed the planning horizon effects on empty container management for multimodal transportation networks. For a network with a barge transportation mode, the planning horizon should be long enough for the model to have a chance to consider using the slower cheaper barge mode. In the test cases, there are two barge transit times that are equally used most frequently: 12 and 19 days. So, the lengths of planning horizon considered (15 and 30 days) are most likely appropriate for the test cases.

Olivo et.al. (2005) consider that in a perfect world, empty movements would not exist because there would always be cargo to fill every container when and where it was emptied. However, commercial traffic never seems to be in balance, either in volume or value, and carriers must relocate empty containers on a local, national and global scale in the hope that containers will be adequately positioned to take advantage of future transportation opportunities. Thereby, balance is provided in the world seaborne trade.

**Table 2.** Review of Journals and Conference Books (1972 - 2011)

Type of Source	BOOK / JOURNAL / CONFERENCE PROCEEDINGS	YEARS		TOTAL	
		1972-2005	2006-2011		
BOOK	Container and Port Administration		1	1	
	Managing Closed-Loop Supply Chains	1		1	
JOURNALS	Transportation Related	Maritime Policy and Management		2	2
		Transportation Research Part E	1	6	7
		Transportation Research Part C		1	1
		Maritime Economics & Logistics	1	1	2
		Transport Policy		1	1
		Journal of Transportation Systems Engineering and Information Technology		1	1
		European Journal of Transport and Infrastructure Research (EJTIR)	1		1
		International Journal of Shipping and Transport Logistics		1	1
		Networks, an International Journal	1		1
		International Journal of Physical Distribution & Logistics Management	1		1
	Transportation Non-Related	Decision Support System (DSS)	1	1	2
		European Journal of Operational Research		1	1
		Mathematical and Computer Modelling	1		1
		International Journal of Computer Applications in Technology	1		1
		GeoJournal		1	1
		International Journal of Production Economics		1	1
		Journal of the Operational Research Society		1	1
		Operations Research	1		1
		Applied Soft Computing xxx		1	1
		SIAM Journal on Control and Optimization		1	1
South African Journal of Industrial Engineering		1	1		
Engineering Applications of Artificial Intelligence		1	1		
CONFERENCE PROCEEDINGS	Transportation Related	ICLEM 2010: Logistics for Sustained Economic Development © 2010 ASCE		3	3
		IAME- International Association of Maritime Economists 2009		1	1
		ICTE- International Conference on Transportation Engineering 2009		1	1
		The 8th International Conference "Reliability and Statistics in Transportation and Communicatin" 2008		1	1
		IAME 2008		1	1
		IAME 2007		1	1
		Sixth Triennial Symposium on Transportation Analysis 2007		1	1
		ICTE- International Conference on Transportation Engineering 2007		1	1
	Transportation Non-Related	Proceedings of the 8th World Congress on Intelligent Control and Antomation Jnly 6-9 2010, Jinan, China		1	1
		Proceedings of the 29th Chinese Control Conference Beijing, China 2010		1	1
	Proceeding of the 45th Annual Conference of		1	1	



	the ORSNZ, November 2010			
	2009 Second International Conference on Intelligent Computation Technology and Automation		1	1
	Joint 48th IEEE Conference on Decision and Control and 28th Chinese Control Conference 2009		4	4
	Proceedings of the 2008 IEEE IEEM		1	1
	Proceedings of the Fifth International Conference on Machine Learning and Cybernetics, Dalian 2006		1	1
	International Technology and Innovation Conference 2006		1	1
	Proceeding of the Fifth Asia Pacific Industrial Engineering and Management Systems Conference, 2004		1	1
	N/A	4	3	7
	<b>TOTAL</b>	<b>14</b>	<b>48</b>	<b>62</b>

As seen in Table 2, although the issue of empty container repositioning first attracted attention in the mid 90's, interest in this problem seems to have grown even further in the last five years. Considering the last five years as the pre- and post-global crisis period, the repositioning issue has gained even greater importance as various problem have been encountered in supplying empty containers. The literature review has revealed that 62 of the studies since 1972 have dealt with repositioning empty containers. 31 of such studies have appeared in journals, 22 of them seem to have published in conference proceedings, but the sources of 7 of them have not been reached. 28 of those studies the source of which have been determined are related with transport, 18 of which have been published in journals and 10 have been presented in transport-related conferences and congresses. Another 25 studies, not related with transport, 13 have been published in journals and 12 have been presented in conferences and congresses. Still another two seem to have appeared in the relevant chapters of the transport-related books.

At the time of literature survey, 3 PhD thesis which are confirmed in 1986, 2007 and 2008, and 1 undergraduate thesis which is confirmed in 2010 in Turkey are found. 3 final reports which are published by different public and private foundations in 2002, 2003, and 2006, are found (see Table 4).

**Table 3.** A Review of Studies, According to Methods

	<b>PAPER</b>	<b>AUTHORS (YEAR)</b>	<b>METHODS</b>
<b>MATHEMATICAL MODELS</b>	Effectiveness of an Empty Container Repositioning Policy With Flexible Destination Ports	Song, D. P. and Dong, J.X. (2011)	Mathematical Model, Numerical Experiments
	Application of a Mixed Fuzzy Decision Making and Optimization Programming Model to the Empty Container Allocation	Chou, C.C. et.al. (2010)	Mathematical Programming Network Model
	Modelling and Optimization of Empty Container Reuse: A Real Case Study	Belmecheri, F. et.al. (2009)	A Mathematical Model and Solving By Excell
	A DSS for Integrated Distribution of Empty and Full Containers	Bandeira, D. L. et.al. (2009)	Mathematical Model
	Optimal Management Of Heterogeneous Fleets Of Empty Containers	Francesco, M.D. (N/A)	Mathematical Model
	Empty Container Repositioning in Shipping Industry: The Scale and The Strategies	Song, D.P. and Carter, J. (2008)	Mathematical Programming
	Empty Container Repositioning in Liner Shipping	Song, D.P. and Carter, J. (2009)	Mathematical Programming
	Dynamic and Stochastic Models for the Allocation of Empty Containers, Operations Research	Crainic, T.G. et.al. (1993)	A Mathematical Formulation
	An Operational Model For Empty Container Management	Olivo, A. and Zuddas, P. (2005)	Mathematical Programming
	Study on Marine Shipping Capacity Option Contract Optimization Problem Under Empty Container Reposition	Bu, X. et.al. (2010)	Optimal Decision Model
	Forecast of Monthly Empty Container Throughput Based on Semi-Parametric Linear Regression	Sun, H. (2010)	A Semi-Parametric Linear Regression Model
	Robust Optimization For Empty Container Allocation Problems Under Uncertainties	Lin, W. et.al. (2010)	Robust Optimization
	Returnable Containers: and Example of Reverse Logistics	Kron, L. and Vrijens, G. (1995)	Quantitative Model, Optimization Model, Case Study
	A DSS for Empty Container Distribution Planning	Shen, W.S. and Khoong, C.M. (1995)	Network Optimization Models
	An Optimization Model for Empty Container Reposition under Uncertainty	Crainic, T.G. et.al. (2007)	Optimization Model: Representative scenarios
	Planning Empty Container Relocations Under Uncertainty	Bean, W.L. and Joubert, J.W. (2010)	Optimisation Model
	Optimal Inventory Control of Empty Containers in Inland Transportation System	Yun, Y. W. et.al. (2010)	Optimization tool, Optquests
	Immunity-Based Hybrid Evolutionary Algorithm for Multi-objective Optimization in Global Container Repositioning	Wong, E.Y.C. et.al. (2009)	Optimization Algorithms
Study on Empty Container Repositioning Problem Under Sea-Rail Through Transport	Sun, M. et.al. (2009)	Optimization of Algorithm	
Container Fleet Sizing and Empty Repositioning in Liner Shipping Systems	Dong, J.X. and Song, D. P. (2009)	Genetic Algorithms	
Impact of Dynamic Information on Empty Container Repositioning in a Seaport	Song, D.P. and Zhang, Q. (2009)	The Value Iteration Algorithm	

	With Uncertainties		
MATHEMATICAL MODELS	Optimizing Empty Container Allocation Based on Hybrid 0 Genetic Algorithm	Li, Y. et.al. (2009)	Hybrid Genetic Algorithm
	The Container Shipping Network Design Problem with Empty Container Repositioning	Shintani, K. et.al. (2007)	Genetic Algorithm-Based Heuristic
	Dynamic transshipment networks: An algorithm and its application to the distribution of empty containers	White, W. W. (1972)	Out-of-kilter Type of Algorithm
	The Effect of Multi-Scenario Policies on Empty Container Repositioning	Francesco, M. D. et.al. (2009)	Deterministic and Stochastic Models
	The Marine Reposition of Empty Containers Under Uncertain Demand and Supply	Li,F. and Han, S. H. (2009)	Stochastic Programming
	Empty Container Reposition Planning For intra-Asia Liner Shipping	Feng, C. M and Chang, C.H. (2008)	Liner Programming
	The Study on Empty Containers Allocation in The Container Transportation	Wang, R. et.al. (2008)	Liner Programming Model
	Empty Containers Distribution Among Railway Network Container Freight Stations	YAN, H. et.al. (2007)	Non-Linear Integer Static Optimization Model
	Characterizing Optimal Empty Container Reposition Policy in Periodic-Review Shuttle Service Systems	Song, D. P. (2007)	Dynamic Programming
	A Fluid Flow Model for Empty Container Repositioning Policy with a Single Port and Stochastic Demand	Song, D.P. and Zhang, Q. (2010)	Dynamic Programming
	An Approximate Dynamic Programming Approach for the Empty Container Allocation Problem	Lam, S. W. et.al. (2007)	Dynamic Stochastic Model: TPTV, MPMV
	Managing Empty Container Flows Through Short Sea Shipping and Regional Port Systems	Le-Griffin, H.D. and Griffin, M.T. (2010)	Integral Aspect
	Empty Container Management in a Port with Long-Run Average Criterion	Li, J. et.al. (2004)	A Simulation Model, Infinite-Horizon Case.
	First Automatic Empty Container Yard with no Operator in China	XIE, Y. et.al. (2006)	Simulation Model
	Port Dynamic Empty Container Reuse	Jula, H. et.al. (2006)	Simulation and Case Study
	Empty Container Reuse in the Los Angeles/Long Beach Port Area	Chang, H. et.al. (N/A)	Approximation solution methods: Realistic Simulation Scenarios
	Analysis on The Synthetical Application of Empty Container Distributing and Leasing Strategy	Sun, J. and Yang, Z. (2006)	Operating Model; Synthetical Application
	Research on the Optimization of Intermodal Empty Container Reposition of Land-Carriage	Wang, B. and Wang, Z. (2007)	Integer Programming
	Empty Container Management for Intermodal Transportation Networks	Choong, S. T. et.al. (2002)	Integer Program
	Empty Container Management for Container- On-Barge (COB) Transportation:Planning Horizon Effects on Empty Container Management in a Multi-Modal Transportation Network	Choong, S.T. et.al. (2003)	Integer Programming Model
The Impact of Foldable Containers on Container Fleet Management Costs in	Shintani, K. et.al. (2010)	Integer programming	

	Hinterland Transport		
MATHEMATICAL MODELS	A Heuristic Solution for the Empty Container Substitution Problem	Chang, H. et.al. (2008)	Analytical Model and A Heuristic Solutions
	Allocation of Empty Containers Between Multi-Ports	Li, J. A. et.al. (2007)	Heuristic Algorithms
	Examining the Efficiency of Container Movements	Yeh, H.Y. et.al. (2007)	Statistical
	Integrating Empty Container Allocation With Vehicle Routing In Intermodal Transport	Braekers, K. Et.al. (2010)	Separate models, Numerical experiments
	Empty Container Repositioning - A Review	Liu, C. et.al., (2010)	Review, Game Theory
	A Multi-Commodity Model and Algorithm For The Railway Empty Container Allocation	Chen, Z. and Li, Y. (2010)	A Heuristic Method, A Numerical Example
	Empty Container Management in Cyclic Shipping Routes	Song, D. P. and & Dong, J. X. (2008)	NRP and The Heuristic Policies (REND, RECD, RELD)
A HEURISTIC MODEL	Reducing Empty Container Flow by Promoting Baltic and Russian's Wastepaper Export to China Through Port of Tallinn	Tolli, A. and Griffin, H. D.L. (2008)	Comparative Analysis
	Flow Balancing-Based Empty Container Repositioning in Typical Shipping Service Routes	Song, D. P. and Dong, J.X. (2009)	A Heuristic Solution
	A network flow based method for the distribution of empty containers	Cheang, B. and Li, A. (2005)	Decision Support System
	Empty Container Logistics: Fundamental International Maritime Transport Management Tool	Robles, L.T., et.al. (2007)	Case Analysis
	Empty Marine Container Logistics: Facts, Issues and Management Strategies	Theofanis, S. and Boile, M. (2009)	Review
	Empty Container-truck Movement Problem: At Ports of Auckland	Islam, S. et.al. (2010)	Review
	Foldable Containers:A New Perspective on Reducing Container-Repositioning Costs	Konings, R. and Thijs, R. (2001)	Review
	Off-Dock Storage of Empty Containers in the Lower Mainland of British Columbia: Industry Impacts and Institutional Issues	Davies, P. (2005)	Review
	Empty Container Management	Yazıcı, S. (2008)	Review
	Empty Container Reposition: the Port of Rotterdam Case	Veenstra, A. W. (2005)	Review
	The Present State of "Korean Security Deposit System on Empty Container" and Its Reform Measure	Koh, M. H. (2007)	Normative Approach and Legal Sociology Approach
	Container Management Strategies to Deal with the East-West Flows Imbalance	Brito, M.P. and Konings, R. (N/A)	Reverse Logistic Theory

**Table 4.** Unpublished MSc and PhD Thesis and Final Reports

THESIS / FINAL REPORT NAME	AUTHORS	UNIVERSITY / FOUNDATION	PLACE	YEAR
<b>PhD THESES</b>				
Regional Empty Marine Container Management	Neha MITTAL	The State University of New Jersey Graduate School-New Brunswick Rutgers	New Brunswick, New Jersey	2008
New Optimization Models For Empty Container Management	Massimo Di FRANCESCO	Università Degli Studi Di Cagliari Facolta Di Ingegneria Dipartimento Di Ingegneria Del Territorio	Gennaio	2007
Empty Container Repositioning and Leasing: An Optimization Model	Florez HUMBERTO	University Microfilms International Polytechnic Institute of New York	Ann Harbor, Michigan	1986
<b>UNDERGRADUATE THESIS</b>				
Transportation of Empty Container, Port Operations and Coast Calculation	Nasihu GÜNAY	Karadeniz Teknik Üniversitesi Sürmene Deniz Bilimleri Fakültesi	Trabzon	2010
<b>FINAL REPORT</b>				
Empty Intermodal Container Management	Dr. Maria P. Boile Assistant Professor Rutgers, The State University of New Jersey	New Jersey Department of Transportation Bureau of Research and U.S. Department of Transportation Federal Highway Administration	New Jersey	2006
The Logistics of Empty Cargo Containers in the Southern California Region: Are Current International Logistics Practices A Barrier to Rationalizing the Regional Movement of Empty Containers	P.I. Le Dam Hanh University Of Southern California	METRANS Research Project		2003
Empty Ocean Container Logistics Study	The Tioga Group	Gateway Cities Council of Governments, Port Of Long Beach, Southern California Association of Governments		2002

## **FINDINGS**

In the modelling oriented analyses of the 62 studies published in various journals and conference and/or congress proceedings, two distinct methods approaches have been adopted. The studies analyzed have been categorized either as mathematical modelling or heuristic products. 50 of those studies analyzing the problem through mathematical modelling seem to have used such modelling techniques as numerical experiments, mathematical programming, genetic algorithms, regression analysis, simulation, integer programming, dynamic programming, statistics, linear programming, optimization programming, game theory and deterministic modelling. In the 12 heuristic studies, the methods used have been case study and literature review, and 1 of such studies seems to have preferred to use reverse logistics theory. This overall picture can be said to reveal that in solving the problem the most commonly used method seems to have been mathematical modelling.

The aims of the studies which are used mathematical programming to solve empty container repositioning problem, minimize the total empty container repositioning costs and produce a optimistic estimation of empty container movements. But, because of dynamic and uncertain environment, it cannot eliminate the empty repositioning problem exactly and reveal a more imbalanced world trade and container shipping will have to face the challenges of empty repositioning.

On the other hand, some authors prefer foldable containers solution to solve an empty container repositioning problem. According to these authors the foldable containers can contribute to substantial cost savings in empty container repositioning between the seaport and its hinterland (Konings and Thijs, 2001: 347) and transshipment and storage costs (Shintani et.al., 2010: 762).

## **CONCLUSION**

Container transportation has been giving an importance the last 30 years. But because of the trade imbalances in world trade, management problem which grow out of empty container supplying, accrues. World economy has a lot of fluctuation in recent year in which empty container repositioning problem is caused by trade imbalanced exactly.

As a result of literature survey, so many international study concerning empty container repositioning (articles, papers, PhD thesis and final reports) were found. Türkiye’de konunun akademik kesimin dikkatini çekmesinde piyasada sıkıntılar yaşandığı belirlenmiştir. Sonraki yapılacak çalışmalara yardımcı olabilmesi açısından literature taraması yapılmış, günümüze kadar yapılan tüm çalışmalar incelenmiştir. So, the research is an exploratory study by virtue of its aim. Secondary data method was used as the data collecting method in the study

Throughout this research, 69 sources have been reached particularly related with the main concern of the research. The specific sources for lot of these studies along with the full papers have been well reached. Three of these studies are PhD theses, one undergraduate thesis, four theses and three final reports.

The studies which were done between 1972-2011, classify the mathematical models and heuristic models and the most of studies were used mathematical model to solve a problem.

About empty container repositioning problem, interview method with lines which are giving services in Turkey, can be thought as a further research.

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