Received: 18.10.2017
Accepted: 02.05.2018
Published Online: 24.06.2018
DOI: 10.18613/deudfd.428196
Review Article

Dokuz Eylül University
Maritime Faculty Journal
Vol:10 Issue:1 Year:2018 pp:127-153
ISSN:1309-4246
E-ISSN: 2458-9942

AUGMENTED REALITY AS BLUE OCEAN STRATEGY IN PORT INDUSTRY

Gül DENKTAŞ ŞAKAR[1]
Ebru SÜRÜCÜ[2]

ABSTRACT

Augmented Reality as one of the components of Industry 4.0 is defined as a technology which layers digital improvements, geared to develop an existing real life setting by appealing to the senses. Augmented Reality applications will have possible uses in logistics industry in the near future and ports as the critical components of supply chain mechanisms will have no choice but to integrate such technologies to their services. Moreover, the seaports integrating their systems and strategies to such developments are expected to open up a new competitive field for rival ports. "Blue ocean marketing strategy" (BOMS) asserts that businesses should formulate new value for products and services to customers from different segments and place themselves in an uncontested market environment. The main aim of this paper is to provide an insight regarding the Augmented Reality concept in port business and discuss how such applications can serve in building blue ocean marketing strategies. Following a literature review of the port industry from Industry 4.0 perspective, possible applications of Augmented Reality will be considered by focusing on the marketing strategies of the port businesses.

Keywords: *Augmented reality, blue ocean strategy, marketing strategy, seaports.*

[1]Assoc. Prof. Dr., Dokuz Eylül University, Maritime Faculty, Izmir, Turkey, gul.denktas@deu.edu.tr
[2] Res. Asst., Manisa Celal Bayar University, Faculty of Business, Manisa, Turkey, ebru.surucu@cbu.edu.tr *(corresponding author)*

LİMANCILIK SEKTÖRÜNDE MAVİ OKYANUS STRATEJİSİ OLARAK ARTTIRILMIŞ GERÇEKLİK

ÖZET

Endüstri 4.0 bileşenlerinden biri olan Artırılmış Gerçeklik, duyuları cazip hale getirerek var olan bir gerçek ortam ayarını geliştirmek üzere geliştirilmiş dijital iyileştirmeler sağlayan bir teknoloji olarak tanımlanmaktadır. Artırılmış gerçeklik uygulamalarının yakın gelecekte lojistik sektöründe olası kullanımlara sahip olacağı ve tedarik zinciri mekanizmalarının kritik bileşenleri olarak bu teknolojileri hizmetlere entegre etmekten başka bir alternatifin bulunmayacağı tahmin edilmektedir. Sistemlerini ve stratejilerini bu gibi gelişmelere entegre eden limanların rakip limanlar içinde yeni bir rekabet alanı açması beklenmektedir. ¨Mavi okyanus pazarlama stratejisi¨ adı verilen strateji, işletmelerin farklı bölümlerden müşterilere ürün ve hizmetler için yeni bir değer yaratması ve kendisini tartışmasız Pazar ortamına yerleştirmesi gerektiğini savunmaktadır. Bu çalışmanın amacı, limanlarda Artırılmış Gerçeklik kavramının nasıl kullanılabileceğine dair fikir vermek ve bu uygulamaların mavi okyanus pazarlama stratejileri oluşturmada ne gibi yardımları olabileceği tartışılmaktadır. Endüstri 4.0 bakış açısıyla yapılan liman literatür taramasından sonra, olası Artırılmış Gerçeklik uygulamalarının limanların pazarlama stratejilerine etkileri incelenmiştir.

Anahtar Kelimeler: *Arttırılmış gerçeklik, liman, mavi okyanus stratejisi, pazarlama stratejisi.*

1. INTRODUCTION

In today's global world, firms notice the importance of designing and coordinating supply chains and distribution networks; while competing and surviving in harsh market conditions (Sengupta et al. 2006: 4). This competition increased the importance of maritime transportation while ports are considered as an important ingredient in linking the global trade with maritime transport while they are taking part in both of end point within maritime transport and the link with other modes of transport in the supply chain (Heaver, 1995; Notteboom and Winkelmans, 2001; Jacobs and Hall, 2007; Cahoon et al. 2013). This situation caused to intense competition between ports.

To survive this intense competition, firms can choose blue ocean strategy. Blue ocean strategy mainly refers to creation of a new, uncontested market space -with the help of innovation- that makes competitors irrelevant and creates new customer value while generally decreasing costs (Kim and Mauborgne, 2005a: 6). Ports must have a

route that will differentiate themselves in order to adopt blue ocean strategy. Moreover, ports should use this tool in operations to differentiate themselves. One of the concepts that Industry 4.0 adds to our lives is Augmented Reality (AR) and it can act as a differentiating tool for port businesses in terms of services, processes, marketing communications, service delivery systems and pricing as well. Although there are various studies focusing on the use of information technologies in the port industry as well as the increasing interest on components of Industry 4.0, the studies discussing the applicability of Augmented Reality in port businesses are in their infancy. Thus, the main aim of this paper is to provide an insight regarding the Augmented Reality concept in port business and discuss how such applications can serve in building blue ocean marketing strategies.

The paper proceeds as follows. In the first part, a literature review was conducted in two sections. In the first part the relationship between Industry 4.0 and innovation on ports was investigated and then blue ocean marketing strategy was discussed. After the literature review, the expected effects of AR on ports were examined in terms of service, price, place, promotion and internal marketing reflections. Later, the study continues with a framework for determining which factors should be eliminated, raised, reduced and created to form the blue ocean marketing strategy with AR. Study ends with the future research ideas and limitations.

2. INDUSTRY 4.0 AND INNOVATION AT PORTS

The emergence of Information and Communication Technologies (ICT) has brought fundamental changes in businesses. Computers are getting smaller while things can communicate across world-thanks to Internet. These improvements also affected manufacturing systems. In Germany, this trend is called the 4th Industrial Revolution or Industry 4.0 (Kagermann et al. 2013: 5). Driven by ICT, Industry 4.0 is a network approach that components and machines are becoming smart and part of a standardized network depending on the well proven internet standards (Kolberg and Zühlke, 2015: 1870). Industry 4.0 aims to optimize the value chains with implementing an autonomously controlled and dynamic production (Kolberg and Zühlke, 2015: 1871). During this process, new technological advancements are the biggest auxiliaries.

The discovery of new technologies has accompanied industry development from early adoption of mechanical systems to support production process, to today's highly automated assembly lines, in order

to be responsive and adaptive current dynamic market requirements and demands (Lee et al. 2014: 4). The incredible growth in the development and adoption of information technology and social media networks has increasingly affected consumer perceptions of product innovation, quality, variety and delivery speed. This requires creating the factory with self-awareness, self-guessing, self-comparison, self-restructuring and self-care facilities. Two innovative developments that bring this new technology together are highlighted by academia and industry: service innovation and industrial big data (Lee et al. 2014: 4).

Ports as one of the main actors of service industry within the scope of maritime transport and logistics, need to meet the requirements of such changing environment by focusing on both the technological and service innovation. International competitive dynamics, economies of scale and globalization have emphasized the key role of technological innovation, supply chain integration and knowledge for ports in order to achieve competitive advantage (Priemus, 2001; Yang et al. 2009). Since port activities are known as complex in the supply chain activities, implementing new digital industrial technology will be useful which eventually lead to increased productivity in port activity and lead in change the profile of port workers (Popa et al. 2017: 50). Main advance of new technologies will force the ports to be more technology-oriented and to be able to stay competitive and attract employees, even in the context of employee shortage. In the ports, innovations in equipment and information technologies are adapted to the port system to operate unmanned terminals based on automation, optimize operational processes to implement process innovations, and provide service innovations by providing integrated value-added logistics services as well as basic port services (Karataş Çetin and Sait, 2014: 82). Moreover, literature review showed that studies related to port innovation has increased dramatically over the years (Blanco et al. 2010, Van den Bosch et al. 2011; Keçeli, 2011; Arduino et al. 2013; Cahoon et al. 2013; De Martino et al. 2013; Hall et al. 2013; Acciaro et al. 2014; Karataş Çetin and Sait, 2014; Vanelslander et al. 2016; Quintana et al. 2016).

Main port innovations can be grouped under eight groups as; port service innovations, process innovations, ecological innovations, information technologies innovations, social innovations, infrastructure innovations, organizational innovations and marketing innovations (Karataş Çetin and Sait, 2014: 84-85). Port service innovations are new or developed port services such as waste management, value added logistics services, electric supply to ships (De Martino et al. 2013; Blanco et al. 2010). Process innovations can be changing equipment assignments

during terminal operation processes, sharing railway services, licensing land transportation vehicles at port entrances (Hall et al. 2013). Ecological innovations can be cold ironing, electric handling equipment and land vehicles used to reduce carbon dioxide emissions, tariff reductions to vessels using low-sulfur fuels, green harbor and green technology programs and use of renewable energy sources such as wind, wave and solar energy (Arduino et al. 2013; Hall et al. 2013; Acciaro et al. 2013; Cahoon et al. 2013). Information technology innovations can be identified as terminal operation and port management systems (Arduino et al. 2013; Keçeli, 2011). Social innovations in ports can be occurred in training and development of port staff and development of external relations with the business and academic environment (Arduino et al. 2013; Blanco et al. 2010). Infrastructure innovations can be identified as indented berths, unmanned terminals based on automation, advanced crane and load elevator designs, as well as many other examples such as propelled cranes and self-propelled unmanned vehicles (Arduino et al. 2013; Acciaro et al. 2013; Vanelslander et al. 2016). Organizational innovations include changes in port organization structure, putting new business procedures into action and facilitating intra-organizational information sharing (Blanco et al. 2010; Quintana et al. 2016). Marketing innovation includes port promotions and development of marketing strategies (Blanco et al. 2010; Quintana et al. 2016).

In the era of Industry 4.0, ports are expected to face some challenges in order to meet the needs of such various innovations in their mechanisms. For instance, while information technology innovations will necessitate the application of complex systems to the various levels of operations and port services, marketing innovations will require more innovative ways to contact with the customers and stakeholders in order to remain competitive. In this sense, emerging areas that the ports have not entered before with regards to various innovation types (ecological, information technology, etc.) can be considered as an important opportunity for port industries. Hence, blue ocean strategy for port industries can be considered as a valuable strategy where ports can achieve success not by competing with their competitors but rather from creating blue oceans of untapped new market spaces ripe for growth. Rather than involving in head-to-head competition for achieving sustainable competitive advantage, which is a typical characteristic of red ocean of rivals fighting over a shrinking profit pool, ports may look for new ways of developing new areas for blue ocean strategy. Next section provides an overview of blue ocean marketing strategy by focusing on the main components and the assumptions.

3. STATE ART OF THE BLUE OCEAN MARKETING STRATEGY

Metaphor of ¨red oceans¨ and ¨blue oceans¨ represents the market universe. Red oceans are industries that exist today, in other words, the known market space. In red oceans, industry boundaries are designated and accepted, and the competitive rules of the game are well understood (Kim and Mauborgne, 2004: 72) while firms try to perform better than their competitors to get greater share of existing demand. As the market gets more crowded, profits and growths are declined (Kim and Mauborgne, 2005a: 4). The Blue Ocean Strategy is *¨a consistent pattern of strategic thinking behind the creation of new markets and industries where demand is created rather than fought for and the rule of competition is irrelevant¨* (Kim and Mauborgne, 2005b: 106). Blue oceans symbolize industries don't exist today (Kim and Mauborgne, 2005a: 4). In blue oceans, demand is created instead of fighting for existing demand and blue oceans are areas free of competitors. They offer the possibility of profits and success and great customer satisfaction and thus create new demands by changing the basis of competition. To do so, they must be innovative and the heart of the Blue Ocean approach as in marketing and product development is customer knowledge. Thus, the key to avoiding disastrous competition is to leapfrog over the competition to serve customers in new ways (Chakrabarti, 2014: 69).

One of the most important features of blue ocean strategy is that it refuses the principal presumptions about conventional strategy which is a trade-off exists between value and cost. Considering this presumption, a firm can either create value with higher costs or create reasonable value with lower cost. To put in other way, in red oceans, the strategy has to be determined either by low cost or by differentiation. However, both the differentiation and the low cost can be offered together in blue ocean strategy (Kim and Mauborgne, 2004:76). Red ocean strategy assumes that industry conditions are set and firms have to compete within these boundaries. This assumption is called as structuralist view or environmental determinism by the academics (Kim and Mauborgne, 2004: 77). On the contrary, blue ocean strategy is based on a view that market boundaries and industries can be reconstructed by the actions and beliefs of industry players, which is called as reconstructionist view (Kim and Mauborgne, 2005b: 108). Reconstructionist view of strategy is built on the theory of endogenous growth. Endogenous growth theory traces back to Joseph A. Schumpeter's observations that pressures that change economic structure and industry landscapes can be caused by the system.

However, Schumpeter focuses on the essential characteristics of actors behind innovations that convince structural change. Schumpeter sees entrepreneurs as the main source of innovation and disputes that big firms, which have resources and capital to invest in research and development, are the main drivers for innovation (Sledzik, 2013: 93).

Competition was not used as a benchmark in blue ocean strategy instead value innovation was the main force (Kim and Mauborgne, 2005c: 22). The cornerstone of blue ocean strategy is value innovation (Kim and Mauborgne, 2005a: 12). According to Blue Ocean Strategy value and innovation are inseparable (Leavy, 2005: 13). Value innovation happens only when firms coordinate innovation with utility, price and cost positions (Kim and Mauborgne, 2005a: 13). Value innovation is created in the region where a company's actions favorably affect both its cost structure and its value proposition to buyers. Cost savings are made by eliminating and reducing the factors an industry competes on. Buyer value is lifted by raising and creating elements the industry has never offered. Over time, costs are reduced further as scale economies kick in due to the high sales volumes that superior value generates (Kim and Mauborgne, 2005a: 17).

The creation of blue oceans is concerned with driving costs down while simultaneously driving value up for buyers. This is how an increase in value for both the company and its buyers is achieved. Since the buyer value comes from the utility and price that the company offers to buyers and the value to the company is generated from price and its cost structure, value innovation is achieved only when the whole system of the company's utility, price, and cost activities is arranged properly. It is this whole-system approach that makes the creation of blue oceans a sustainable strategy. Value innovation requires companies to orient the whole system toward achieving a leap in value for both buyers and themselves (Kim and Mauborgne, 2005a: 17; Chang, 2010; Chakrabarti, 2014). In terms of achieving value innovation, blue ocean strategy calls for new areas and/or markets for companies and in the case of ports, recent developments in information and communication technologies in accordance with Industry 4.0 provide new areas for differentiation as well as for creating blue oceans such as augmented reality, virtual reality (VR) applications etc. Next section firstly provides an overview of augmented reality concept and then discusses this concept within the view of ports and blue ocean marketing strategy.

4. AUGMENTED REALITY IN THE PORT INDUSTRY

Digital Transformation describes *"the use of technology to radically improve performance of enterprises"* (Westerman, 2011). The meaning of "digital" as an economic term stands for *"based on digital technologies or digital techniques"* compared to different meanings in other fields (Hartel, 2016). The so-called SMACT-technologies – Social, Mobile, Analytics, Cloud and Internet-of-Things (Van Manen et al. 2014: 6) shape the future of the businesses by mirroring the new fields of gaining competitive advantage.

Industries and companies are motivated to digitally transform their businesses leading to changes in strategies, processes, structures, products and cultures in order to deal with more stringent requirements of the business environment (Westerman, 2011). Ports worldwide have to face a various number of challenges and meet them by taking measures of digitalization. Various technologies have been adopted in various industries and finally to complex industries, namely ports and commercial aviation that entail a high degree of risk and safety (Rushmore, 2016).

Augmented reality (AR) refers to the perception of the real world and an extension of this perception by the integration of virtual aspects. Images of the real world are displayed on smartphones or data glasses and texts or other images will be inserted (Augment, 2016). Main AR items currently available can be listed as: handheld devices, stationary AR systems, spatial AR systems, head-mounted displays, smart glasses, smart lenses (DHL, 2014). Some of the well-known examples of AR technologies are Hololens, Meta2 and DAQRI Smart Helmet. Microsoft HoloLens is the most advanced AR device available on the market. As a standalone computer that can display images that look like they are in the real world, HoloLens is the first example of a model. With a collection of sensors and cameras, HoloLens continually scans the area around the user and updates the 3D mesh of that area to a so-called spatial map (Odom, 2017). Another example is Meta 2 which is a connected device. This means that a conventional PC needs a connection to work and is designed to be used in a fixed place without the ability to navigate in your real-world environment. Meta 2, built around the idea that will replace your 2D screen, is plugged into the video port of your computer, sensor input and image processing are performed by the processors of connected PCs (Odom, 2017). The DAQRI Smart Helmet is an AR instrument with a stereoscopic (binoculars) and wireless headset placed in a helmet. The device is focused on industrial uses and contains a large number of

sensors inside and around the industrial machines to assist the operator in freehand interaction (Gaydhani, 2017).

AR can be considered a variation of the Virtual Environment (VE) concept (Azuma, 1997). VE technologies put a user in a completely synthetic environment. When using this technology, the user cannot see the real world around him. Conversely, the AR allows the user to see the real world, with virtual objects superimposed or brought together in the real world. For this reason, the AR completes the reality instead of replacing reality (Augment, 2016; Azuma, 1997). AR technologies allow the user to see the real world mixed with virtual objects superimposed to or composed with it (Rubio et al. 2004: 243). AR increases user experiences, permitting extra information be augmented onto the real world meaning that creates selling opportunities (Olsson et al. 2013). AR technologies are implemented on smart mobile devices that combining touch-and-feel information in the physical world with online content in the digital world. AR tools manage real time interactivities between products, physical spaces, brands and consumers. It coordinates the digital environment on smart devices with the real time surrounding in a special way that boundaries between them disappears (Javornik, 2014). AR can be seen in different forms such as touch-screen recommenders, virtual mirrors, Google Glass, in-store product videos, virtual screen and aisles. In the field of Augmented Reality (AR), virtual objects are integrated interactively in real environments (Azuma, 1997). Augmented reality is relatively similar to other digital technologies in the sense that it is mainly used through smartphones (at the moment) and it is highly interactive for consumers (Augment, 2016).

As shipping industry is gradually being more involved in digital applications, more awareness regarding the various applications is gained in different fields of maritime industry. SAFETY4SEA conducted 'Share your Smart Shipping Insights' survey during Q4 2016 and assessed how maritime stakeholders have realized the current and future smart shipping challenges and have established the nature of ECDIS & e-Navigation, Cyber Safety/ Cyber Security, Autonomous Shipping and Future Trends within shipping. According to the findings of the survey, the five top rated smart shipping challenges are: Cyber Security (40,6%), Crew Training using new technologies and software i.e. Virtual Reality & Augmented Reality (33,0%), Energy Management & Emissions Monitoring (32,1%), E-Navigation (31,1%) and ECDIS (29,2%). This shows that the maritime stakeholders consider Virtual and Augmented Reality technologies critical in their activities related to maritime transport.

Port industry has been hesitant to apply the AR applications. One of the reasons for such hesitation is that AR technology is generally not well understood in the industry and also there is a lack of application provider focusing on the specific uses of AR in the port industry. Since the services provided at especially container ports may be considered complex, experienced consultants and technology providers are needed to integrate the AR applications with the port-specific services. The high degree of risk, safety, the environment, complexity and costs are considered as the main reasons for the slow acceptance among ports (Rushmore, 2016). Cargo movements at ports require maintaining reliable real-time information, where a glitch in the system can lead to costly and dangerous consequences. For instance, the trucks moving around can block sensors and the effective application of the system may not be possible (Rushmore, 2016). Although the applications regarding AR in the port industry are quite rare, new areas and opportunities for development can be suggested. Based on detailed scan of various port industry news, a categorization of possible uses of AR in the port industry is suggested by discussing the possibilities for gaining competitive advantage and generating blue ocean marketing strategies. Such categorization is mainly based on marketing mix components as; service (product), price, promotion and place (4Ps of marketing). As Baker (2007) points out, marketing mix offers a simplification to make a clear structure as a whole for marketing managers and guide them to achieve a certain task. As Kotler and Armstrong (2008) defined; marketing mix is the *"set of controllable, tactical marketing tools in order to get feedback of the certain markets".* Based on marketing mix reflections, possible AR applications of ports are provided. In addition to marketing mix components, internal marketing reflections are also added since AR applications considerably affect the working habits, hours and techniques of the employees at the ports. The next section discusses possible AR applications at ports based on service-based, price-based, promotion-based, place-based reflections and lastly internal marketing reflections.

4.1. Service-Based Reflections

Cargo Handling and Warehousing Services: Since ports' core business is basically focused on the cargo handling and warehousing of cargo for a certain period of time**,** any activity that can minimize the time spent and errors during operations can be considered as an efficient move for the port industry. AR technologies such as head-mounted display, cameras, a wearable PC and battery packs can provide energy for at least one work

shift. Through the use of vision picking software, ports can achieve real-time object recognition, barcode reading, and indoor navigation as well. One of the most important benefits of vision picking system is its provision of hands-free digital supports to workers during manual picking operations. Through the use of such system, workers can see the digital picking list in their field vision and see the best route, reducing their travel time by efficient planning (DHL, 2014). Ports similarly can adapt such systems in order to track and trace the containers, find the most suitable way for the storage of containers by finding the best route and minimize the time spent for each operation at the terminal area. In this case, wearable AR devices should be used and integrated to the current port operations system and daily operational activities of the workers.

Another application of AR in cargo handling operations at ports can be the use of AR smart glasses in handling operations as in the case of airport service operator SATS. SATS's ramp operators are expected to provide important information such as real-time loading instructions for smart goggles to be used at Singapore's Changi Airport (Today Online, 2017). Using AR technology, operators are expected to scan visual markers in baggage, cargo, containers and trunk to give details such as weight, unit number, loading order, and position assigned to the aircraft (Today Online, 2017). As a result, this hands-free technology enhances safety and improves the accuracy and efficiency of luggage and cargo operations. (Today Online, 2017).

SATS's smart glasses are equipped with an integrated processor with video recording and wireless capabilities to enhance the visibility of ramp processing operations in the airport area by providing real-time land use processes (Today Online, 2017). In this case, it is also possible to better observe the loading process which provides more flexibility in human power management. (Today Online, 2017). A similar approach can also be used at the ports that terminal area visibility with real-time data options can be collected through such devices in order to monitor the ship handling operations.

Terminal Area Planning and Port Expansion: In today's port environment, ports are not only considered as the nodes that provide handling services to the ships, but also, they house a growing number of value-added services such as packaging, repair, labeling, product assembly etc. As DHL (2014) mentioned, AR can be used to visualize any planned rearrangements, making it possible to place interactive digital representations of proposed future modifications in the present. Hence planners in the port administration can test whether or not

measurements of planned modification will fit in place and model new work flows. For instance, a port organization can plan a dedicated area for the product assembly or packaging operations within the port area and check whether or not such planned area will fit within the concept of the port area and the current demand by the port customers to have such a service from the port.

AR may provide opportunities for users to visualize, and talk about, objects that are not present based on a three-dimensional (3D) overlay. Within product visualization this could be new buildings not built yet in the port area (Rushmore, 2016). Hamburg Port Authority (HPA) declared that the port has started to apply new visualization forms for better data analysis and infrastructure planning with the further development of virtual and augmented reality (Port technology, 2016).

Docking/Anchorage Services: Information about navigational dangers and presentation of data about other ships may be some other areas for AR in the port services. While ports may have such support systems for ships in terms of their approach, anchorage etc, ships may also employ such technologies during their arrival to the port. Information about the seabed in the form of three-dimensional bathymetric maps and profiles facilitate anchoring. Information on the current weather and the traffic in specific regions may also help the optimization of the planning of the voyage. Port of Antwerp uses virtual buoys in this case. The crew may generate virtual temporary and preliminary corrections, virtual port approaches, virtual areas such as anchorages and fairways. As in the case of ECDIS, these virtual corrections can appear in the form of layers applied to the actual chart, AR objects would appear on a computer or on a special screen installed on the bridge (Filipowski, 2013: 259).

Salvage and Repair Services: According to a project (US Navy's Divers Augmented Vision Display) conducted by US Navy, there is a high-resolution, see-through head-up display embedded directly inside a diving helmet. AR delivers an image and outline of objects, overlaid on the actual diver's vision. There are ongoing studies where components are being designed to include both helmet and full face masks (Rushmore, 2016). This system can be used for commercial salvage and repair to be used in the service delivery process of the ports.

Geotagging: In Rushmore's (2016) article, few examples were provided in case of the use of AR in port service-related activities. In case of a need to check the hydraulic oil on a crane, the technician may not be experienced enough to know where to look for the particular crane and

AR overlay can provide an exact location functioning as geotags in the ports.

Multimodal Operations: Transport industry makes extensive use of digital data and planning software for optimized load planning and vehicle utilization (DHL, 2014). In the multimodal operations of the ports, the transfer of containers from the terminal area to the trucks or trains or vice versa requires the detailed check of information regarding content, weight, size, destination, etc. As discussed in DHL's report AR devices can support by replacing the need for printed cargo lists and any instructions regarding cargo loading and discharging. For instance, in railway transfer, the operator at the handling equipment can obtain real-time information on their AR device about which container to take next and which wagon to place in the train. The AR device can display loading instructions with arrows or highlights identifying suitable target areas inside the vehicle. In contrast to current paper-based lists, AR-supported cargo lists would also allow for real-time- something that happens quite often during loading process (DHL, 2014).

Port Operations Control: AR applications are provided to offer various solutions to the operators at the port. In the control of the operations conducted at the port, AR can act as the main player in the minimization of the errors as well. For instance, Port of Rotterdam has started to use AR glasses so that experts can remotely observe situations when faults occur on board survey vessels operated by the Port of Rotterdam Authority. These smart glasses improve the deployability of the vessels (Port of Rotterdam, 2017).

Martin Enevoldsen, business developer at Unity Studios pointed out that one of the biggest strengths of AR is that it allows users to study actual surroundings with a 3D overlay through the use of possible tools such as Hololens, Meta2 and DAQRI Smart Helmet. Enevoldsen added that *"In regards to the remote-control tower, the adoption of AR could make the remote control towers a real possibility. While the existing crane operators can adapt to office-based working environments best via the 360-degree vision offered by AR, new joiners can be trained and worked under the same (office) environment. In regards to maintenance, health and safety, of similar capacity, AR could enable remote workers for maintenance, inspection, etc."* (Rushmore, 2016). Through the use of DAQRI Smart Helmet, port organizations may provide their workforce with intuitive augmented instructions so that the workers in the terminal area can understand the processes quickly, spend less time on each step and minimize the errors. Also, such helmets may provide the port

workers distributed information and situational awareness outside of the control tower to improve efficiency by reducing the amount of movement. Moreover, by providing remote expert option, workers at the port area may give and receive needed assistance displayed directly in the team's point of view. Both the expert and the onsite team member can quickly resolve issues and concerns (Daqri, 2017).

In terms of controlling the vessel traffic in Port of Hamburg, the port applied AR in its operations and vessel tracking system by visualizing the vessel traffic. The port achieved new visualization of IT data and physical data with AR (Baldauf, 2016).

Safety and Security: In the field of safety and security, there might be huge fire and emergency personnel could have their vision blocked; an AR overlay may allow the emergency services to get to assets to shut down the equipment (Rushmore, 2016). Hence ports can apply such AR-based mechanisms to minimize such risks and eliminate the possible consequences related to the case.

Another critical use of AR can be related with the content of the container. Considering the cargo type, the workers can find the container correctly identifying located in it. Information collected by sensors of temperature, pressure would facilitate better use of handling equipment and increase control over cargo operations. Information about the ballast and the related data would give the officer in charge a complete review of the current situation and increase the safety of the handling operations (Filipowski, 2013: 259).

4.2. Price-Based Reflections

According to an expert, Cliffton Dawson, in a virtual/augmented reality analytical research firm in San Francisco, "*ports need to consider the cost versus revenue balance before integrating AR to their systems. Although the cost of introducing AR is decreasing dramatically, it may not be worth in some industries such as basic/low cost product assembly which may be the case of small ports"* (Rushmore, 2016). However, big ports especially in container business, can generate new ways of differentiation through the application of AR Technologies.

Microsoft Hololens is a technology with built-in sensors by letting the user to use her/his gaze to move the cursor so that the user can select holograms. Also simple gestures can be used to open applications, select and size items and drag and drop holograms according to the needs of the

industry (Microsoft, 2017). The cost of Microsoft Hololens is $3,000-$5,000 per unit (Microsoft, 2017) while simpler systems are mainly considered as $1,000 a unit. The port industry has to consider the sensors and the cameras needed as well as the software costs. In addition, the amount of such technologies needed (e.g. one for each container stack or each container yard) is a critical and risky decision since minimal coverage could make the system impractical. As one of the experts mentioned, the potential for AR in the port industry is enormous and return on investment (ROI) could be within 12 months in some cases (Rushmore, 2016).

4.3. Promotion-Based Reflections

HPA has established collaborative projects with the students at the University of Hamburg, where students are researching and developing applications for daily use at port operations through the use of AR (Port technology, 2016).

Kao Ming Container Terminal Corp. (KMCT) in Taiwan applied AR as the latest interactive technology that users could see the virtual images on the screen via web camera (KMCT, 2017). The terminal uses AR to demonstrate the terminal infrastructure and cranes by allowing the website visitors to print the special web page by following the instructions. After downloading AR software and turning the web camera on, visitors are asked to remain the AR graph card flat on the camera to see the interactive content. By rotating the AR graph card, the visitors can travel inside the terminal and see the virtual 3D image.

In addition to promotion-based reflections of AR, the ports can achieve success in the enrichment of the promotion materials such as brochures and magazines with AR technology. Nowadays many companies use AR in their catalogs and brochures to achieve a fun gaming experience and introduce their products and services in a better way. For instance, Siemens used AR to make their brochures and displays livelier through augmented reality. In their current AR-aided product demonstrations, users can scan Siemens brochures to simulate a virtual model of their new Acvatix product line with detailed technical specifications (Augment, 2017). Ports may also benefit from such implications by enriching the content of their promotion materials and possible port users and customers may get the advantage of getting to know in detail.

Another field for AR to be utilized in port businesses may be through the possible port visits. Port visits can be used as critical promotional activities both for the current/possible customers and many stakeholders such as universities, municipalities, trade organizations etc. by the ports. AR glasses provided during the port visits can enable better visualization and enriched information regarding the sections of the port visited. Since there are many safety and security related measures taken at the ports, visitors at the port area may not have the chance of experiencing the basic functions, activities and operations at the port during their visits. Hence, such AR-based applications may help the ports to open up themselves to the visitors in an entertaining way.

4.4. Place-Based Reflections

In the port marketing literature, place is discussed from various viewpoints in defining the marketing mix of the seaports. Branch (1998) defines "distribution" as being the marketing environment of the seaport where the sale is conducted. On the other hand, Frankel (1987: 604) argues that distribution refers to the delivery system alongside, sea island, topping off operations, lightering transshipment and impact of technological changes on infrastructure. Mester (1991) by focusing on the role of intermediaries in the distribution function discusses distribution in terms of channels from which customers may purchase the seaport service, that is, via direct customers such as freight forwarders or an organization within seaport, or by active marketing seaport operators. In the distribution of the seaport service to the customers and the intermediaries, AR applications can be used especially in the information-based service exchanges. Freight forwarders mostly prefer to be closer to the port information system in order to monitor the latest changes at the terminal regarding their customers' cargo movements. In this case, detailed real-time information obtained from the operators at the terminal area via AR devices can be transferred to the information system of the freight forwarders or agents. Hence a transparent and detailed flow of cargo-related information can be exchanged between the related parties.

4.5. Internal Marketing Reflections

Use of AR can bring out valuable outcomes in terms of internal marketing activities. As Rob Smith from The Houston Consulting Group mentioned, AR Technologies can open up opportunities for job planning and job safety analysis. People can review the job and the specific areas of a port that they will be in, the location of the equipment and the possible dangers around the equipment such as crane movements. Crane operators may familiarize themselves with the environment that they were going to be working before the actual operation starts. This allows for a thorough safety review and a better-trained crane operator (Rushmore, 2016).

Another application of AR could be the visualization of workflows in order to instruct new employees (especially in the operational level at the port area) as well as virtual information management and sharing that can be used to clarify tasks and provide information to the right people at the right time. According to Fox Chu, managing director of Accenture Ports, ports have adopted virtual reality technology for more than a decade in training; with augmented reality, this can be advanced and the effectiveness could be further improved (Rushmore, 2016).

In addition, vision picking systems discussed in cargo handling and warehousing section can also be applied in internal marketing applications of ports. As mentioned by DHL (2014), such systems can reduce the amount of time required to orientate and train new employees, as well as bridge any language barriers with migrant workers. Since there can be many employees from various nationalities in different ports, such systems may help to increase the motivation of the personnel as well.

5. BLUE OCEAN STRATEGIES IN AR-ORIENTED PORT INDUSTRY

AR applications are mainly considered novel steps in various industries and port industry is one of the industries that only a few applications are experienced in limited number of ports. Since blue ocean strategies mainly focus on the uncontested areas that the organizations may consider in order to be competitive, AR can be considered as an opportunity for port organizations to be active in uncontested areas. When the 20 biggest ports' websites – the list was gathered from UNCTAD's Review of Maritime Transport report- were examined by authors, it was observed that only a very limited number of ports (e.g.

port of Hamburg, port of Rotterdam) applied AR in a very limited scope in their operations. Hence any port that can adapt successful AR applications in terms of various component of marketing mix, may succeed in the new era of industry 4.0. Although AR applications are widely discussed in logistics literature (Cirulis and Ginters, 2013; DHL, 2014; Piotrowicz and Cuthbertson, 2014), port industry mainly lacks an extensive understanding of the possible uses of AR in various port processes.

To form blue ocean, organizations mainly should follow two strategies. Establishing completely new industries is one way of forming blue oceans such as eBay did with the online auction industry. The second strategy, which is generally more common, is formed through a red ocean strategy when a firm changes the boundaries of an existing industry (Kim and Mauborgne, 2004: 72). Kim and Mauborgne (2004: 35) suggested the *Four Actions Framework*, which identifies the components of Blue Ocean Strategy while also ensuring guidelines to create a new strategy profile. The framework forces companies not only ask all four questions according to four actions framework but also to act on all four to create a new value curve. Figure 1 shows the Four Actions Framework (Kim and Mauborge, 2004: 35-36). The framework gives companies four immediate benefits (Kim and Mauborge, 2004: 37):

- It pushes them to simultaneously pursue differentiation and low costs to break the value-cost trade-off.
- It immediately flags companies that are focused only on raising and creating and thereby lifting their cost structure and often over engineering products and services—a common plight in many companies.
- It is easily understood by managers at any level, creating a high level of engagement in its application.
- Because completing the framework is a challenging task, it drives companies to robustly scrutinize every factor the industry competes on, making them discover the range of implicit assumptions they make unconsciously in competing.

Considering the current dynamics of the port industry, such framework can be adapted to the port organizations in the path of applying possible blue ocean strategies within their organizations. Figure 1 shows the AR-oriented version of Four Actions Framework for the port industry.

According to Figure 1, ports can follow the four actions framework to create blue ocean strategy. With AR technology, ports can reduce operational costs even though, there could be an initial investment cost at the beginning. The widespread use of AR technologies in ports will enable more optimal use of tracking and tracing technologies, thus eventually will lead to lower cost in midrange and long term.

Since AR is a new concept especially in port industry, all of factors that are shown (service, price, promotion, place and internal marketing reflections of AR) in Figure 1, which is compiled by authors, must be created for port industry.

The widespread use of AR will help to eliminate manpower-based operations, paper-based port operations, time spent at the port area, possible accidents, infrastructure planning problems and paper-based promotion materials. With use of AR, same work can be done with fewer employees. In addition, AR is expected to reduce the consumption of paper used in operations and make it easier to track works through smart devices and reduce consumption. Integrating container monitoring systems with AR technologies and handheld terminals is expected to eliminate a considerable amount of time. With AR, new simulation methods can be created and used for approaching channel and dock. With these types of simulations, possible accidents in the approach channel and at the dock can be eliminated. Moreover, the use of AR during the construction of port processes can eliminate infrastructural problems. Besides, with the AR potential growth scenarios for ports can be formed and infrastructure problems can be avoided. Since AR is made with smart devices, it can be predicted to reduce paper consumptions when used in marketing activities.

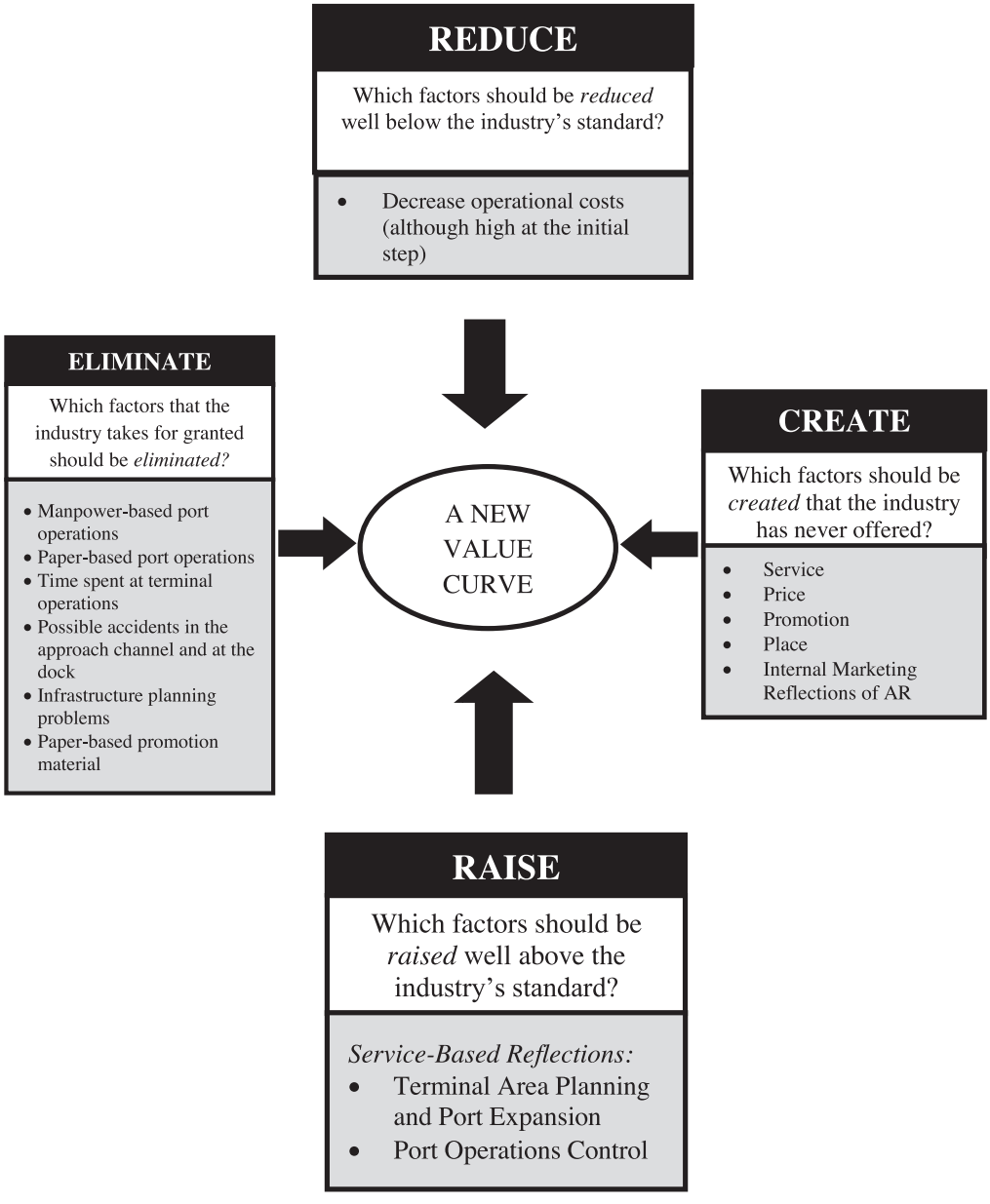

Figure 1: Four Actions Framework Adapted for Port Industry with AR Applications

With the help of AR, service-based reflections such as terminal area planning and port expansion and port operations control can be raised well above the port industry's standards. As seen in the example of Hamburg, AR can be used in terminal planning activities and in future, it can be predicted that the effects of AR can be further increased in port expansion and planning activities. As noted in the Rotterdam example, AR technology plays an important role in pulling down the mistakes to the minimum level especially in improving the deployability of the vessels. To create blue ocean strategy, other ports can take Port of Hamburg and Port of Rotterdam as examples and the number of ports that implement AR can be increased.

6. CONCLUSION

Since the aim of this paper is to provide an insight regarding the Augmented Reality concept in port business and discuss how such applications can serve in building blue ocean marketing strategies, an initial perspective on how Augmented Reality will help ports during the blue ocean marketing strategy creating process is provided. The conceptualization is based on the ¨Four Actions Framework¨. The adapted framework showed that with AR, ports can reduce operational costs; while service, price, promotion, place and internal marketing reflections should be created. Also, AR will help to eliminate manpower-based operations, paper-based port operations, time spent, possible accidents, infrastructure planning problems and paper-based promotion materials; while service-based reflections such as terminal area planning and port expansion and port operations control can be raised well above the port industry's standards.

The limited resources, which are sectoral magazines and reports, are one of the limitations of this study. Another limitation is that the study is based on website search. During this process, except a few ports, it was very difficult to reach the information in terms of the possible AR applications at the ports. Moreover, the basic applications of AR are mainly discussed within the view point of container terminals and ports. Hence the study mainly excludes the possible applications of AR in other terminal types such as dry and liquid bulk, LNG, LPG, cruise etc.

As a future research idea, the framework created for this study can be improved by port specialist via focus group or face-to-face interviews. In the following years, as the AR applications become widespread in ports, the study can be expanded to cover more sophisticated uses of AR. Another research can be conducted with terminal operators, port users

and customers about the AR and its possible usage areas in ports. Last but not least, the same framework can be applied different industries of the shipping industry as well.

REFERENCES

Acciaro, M., Vanelslander, T., Sys, C., Ferrari, C., Roumboutsos, A., Giuliano, G., Lam, J. and Kapros, S. (2014). Environmental sustainability in seaports: A framework for successful innovation. *Maritime Policy & Management*, 41(5), 480-500.

Arduino, G., Aronietis, R., Crozet, Y., Frouws, K., Claudio Ferrari, C., Guihery, L., Kaprso, S., Kourouunioti, I., Laroche, F., Lambrou, M., Llyody, M., Polydoropoulou, A., Roumboutsos, A., Van de Voorde, E. and Vanelslander, T. (2012). How to turn an innovative concept into a success? An application to seaport-related innovation. *Journal of Research in Transport Economics*, 42(1), 97-107.

Azuma, R. T. (1997). A survey of augmented reality. *Presence: Teleoperators and Virtual Environments*, 6(4), 355-385.

Baker, M. J. (2007). *Marketing Strategy and Management*. Basingstoke, Hampshire, UK: Palgrave Macmillan.

Blanco, B., Perez-Labajos, C., Sanchez, L., Serrano, A., Lopez, M. and Ortega, A. (2010). Innovation in Spanish Port Sector. *Journal of Maritime Research*, 7(1), 71-86.

Branch, A. E. (1998). *Maritime Economics: Management and Marketing*. Cheltenham, United Kingdom: Stanley Thomes.

Cahoon, S., Pateman, H., and Chen, S.L. (2013). Regional port authorities: Leading players in innovation networks. *Journal of Transport Geography*, 27, 66-75.

Chang, S. C. (2010). Bandit cell phones: A blue ocean strategy. *Technology in Society*, 32(3), 219-223.

Chakrabarti, M. (2014). Blue Ocean Marketing Strategy (BOMS): An Overview. Abhinav International Monthly Refereed Journal of Research in Management and Technology, 3(6), 68-73.

Cirulis, A. and Ginters, E. (2013). Augmented Reality in Logistics. *Procedia Computer Science*, 26, 14-20.

De Martino, M., Errichiello, L., Marasco, A. and Morvillo, A. (2013). Logistics innovation in seaports: An inter-organizational perspective. *Research in Transportation Business and Management,* 3, 123-133.

Filipowski, D. (2013). See more-analysis of possibilities of implementation AR solutions during bridge watchkeeping, in A. Weintrit (Ed.), *Marine Navigation and Safety of Sea Transportation*, pp. 255-260. New York: CRC Press.

Frankel, E. G. (1987). *Port Planning and Development*. New York: John Wiley and Sons.

Hall, P.V., O'Brien, T. and Woudsma, C. (2013). Environmental innovation and the role of stakeholder collaboration in West Coast port gateways. *Research in Transportation Economics,* 42, 87-96.

Hartel, J. (2016). *Digital transformation of ports: A status of Port of Hamburg and the Port of Singapore*, Bachelor Thesis, Hamburg University of Applied Science, Hamburg.

Heaver, T. (1995). The implications of increased competition among ports for port policy and management. *Maritime Policy and Management,* 22(2), 125-133.

Jacobs, W., and Hall, P.V. (2007). What conditions the supply chain strategies of ports? The case of Dubai. *GeoJournal,* 68(4), 327-342.

Javornik, A. (2014). Classifications of Augmented Reality Uses in Marketing. In: *Proceedings of IEEE International Symposium on Mixed and Augmented Reality 2014 Media, Art, Social Science, Humanities and Design*. Fukuoka, Japan.

Kagermann, H., Wahlster, W. and Helbig, J. (2013). *Recommendations for implementing the strategic initiative INDUTRIE 4.0. Final Report of the Industries 4.0 Working Group*, Berlin.

Karataş Çetin, Ç. and Sait, P. (2014). Liman inovasyonları ve bilgi sistemleri: Türkiye limanları üzerine bir araştırma. *Girişimcilik ve İnovasyon Yönetimi Dergisi,* 3(2), 81-104.

Keçeli, Y. (2011). A proposed innovation strategy for Turkish port administration policy via information technology. *Maritime Policy and Management*, 38(2), 151-167.

Kim, W.C. and Mauborgne, R. (2004). Blue ocean strategy. *Harvard Business Review*, 82(10), 70-79.

Kim, W.C. and Mauborgne, R. (2005a). *Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant.* Boston Massachusetts: Harvard Business School Press.

Kim, W.C. and Mauborgne, R. (2005b). Blue ocean strategy: From theory to practice. *California Management Review*, 47(3), 105-121.

Kim, W.C. and Mauborgne, R. (2005c). Value innovation: A leap into the blue ocean. *Journal of Business Strategy*, 26(4), 22-28.

Kolberg, D. and Zühlke, D. (2015). Lean automation enabled by industry 4.0 technologies. *IFAC-PapersOnLine*, 48(3), 1870-1875.

Kotler, P. and Armstrong, G. (2008). *Principles of Marketing*. Upper Saddle River, New Jersey: Pearson Prentice Hall.

Leavy, B. (2005). Value pioneering – how to discover own ¨blue ocean¨: interview with W. Chan Kim and Renee Mauborgne. *Strategy and Leadership*, 33(6), 13-20.

Lee, J., Kao, H.A. and Yang, S. (2014). Service innovation and smart analytics for industry 4.0 and big data environment. *Procedia CIRP*, 16, 3-8.

Mester, B. (1991). Marketing from the port's point of view, in R.W. Stuchtey (Ed.), *Port Management Textbook: Volume 3 - Port Marketing*. Bremen: Institute of Shipping Economics.

Notteboom, T., and Winkelmans, W. (2001). Structural changes in logistics: how will port authorities face the challenge? *Maritime Policy and Management, 28*(1), 71-89.

Olsson, T., Lagerstam, E., Karkkainen, T. and Vaananen-Vainio, M. (2013). Experienced user experience of mobile augmented reality services: A user study in the context of shopping centers. *Personal and Ubiquitous Computing*, 17(2), 287-304.

Piotrowicz, W. and Cuthbertson, R. (2014). Introduction to the special issue information technology in retail: Toward Omni-channel Retailing. *International Journal of Electronic Commerce,* 18(4), 5-16.

Popa, C., Cotorcea, A. and Filip, N. (2017). Key trends in the global port due to traffic volumes. *Mircea cel Batran Naval Academy Scientific Bulletin,* 20(1), 48-51.

Priemus, H. (2001). Mainports as Integrators of Passenger, Freight and Information Networks. From Transport Nodes to Business Generators; the Dutch Case, *European Journal of Transport and Infrastructure Research EJTIR, 1(2),* 143-167.

Quintana, C.G., Olea, P.M., Abdallah, P.R. and Quintana, A.C. (2016). Port environmental management: Innovations in a Brazilian public port. *RAI Revista de Administaçäo e Inovaçäo,* 13, 261-273.

Rubio, M., Quintana, A., Perez-Roses, H. and Camahort, E. (2006). Jittering reduction in market-based augmented reality systems. *Lecture Notes in Computer Science 3980,* 510-517.

Rubio, M., Quiros, R., Pulido, E., Fabregat, G. and Huerta, J. (2004). Annotation of Features in Outdoor Augmented Reality Environments, in: 7th AGILE Conference on Geographic Information Science. Heraklion, Greece.

Sengupta, K., Heiser, D. and Cook, L. (2006). Manufacturing and service supply chain performance: A comparative analysis. *The Journal of Supply Chain Management,* 42(4), 4-15.

Sledzik, K. (2013). Schumpeter's View on Innovation and Entrepreneurship, in S. Hittmar (Ed.), *Management Trends in Theory and Practice*, pp. 89-95. Zilina, Slovakia.

Van den Bosch, F.A.J., Hollen, R., Volberda, H.W. and Baaji, M.G. (2011). *The strategic value of the Port of Rotterdam for the international competitiveness of the Netherlands: A first exploration*. Rotterdam: Erasmus University.

Van Manen, T., Bloem, J. and van Doorn, M. (2014). *SMACT and the City*. Groningen, Netherlands: LINE UP.

Vanelslander, T., Sys, C. and Carlan, V. (2016). Innovation among seaport operators: A QCA approach for determining success conditions. *International Journal of Transport Economics*, 53(3), 1-35.

Yang, C.C., Marlow, P.B. and Lu, C.S. (2009). Knowledge management enablers in liner shipping. *Transportation Research Part E*, 45, 893-903.

Internet References:

Augment (2016). *Augmented Reality and Future of Marketing.* http://www.augment.com/blog/wp-content/uploads/2016/10/Augmented-Reality-and-the-Future-of-Marketing.pdf, Date of Access: 10 July 2017.

Augment (2017). *10 Use Cases of Augmented Reality in Marketing*, http://www.augment.com/blog/10-use-cases-of-augmented-reality-marketing/, Date of Access: 14 July 2017.

Baldauf, U. (2016). *Smart PORT Hamburg.* https://eamcommunity.files.wordpress.com/2016/05/smartport-hamburg-iot-und-architektur.pdf, Date of Access: 10 July 2017.

Daqri, (2017). *Smart Helmet*. https://daqri.com/products/smart-helmet/, Date of Access: 11 July 2017.

DHL. (2014). A*ugmented Reality in logistics: Changing the way we see logistics- a DHL perspective.* http://www.dhl.com/content/dam/downloads/g0/about_us/logistics_insights/csi_augmented_reality_report_290414.pdf, Date of Access: 12 July 2017.

Gaydhani, N. (April 2017). *The Daqri Smart Helmet- A closer look*. https://www.linkedin.com/pulse/daqri-smart-helmet-closer-look-nathan-gaydhani/, Accessed Date: 14 May 2018.

KMCT (2017). http://www.kmct.com.tw/en/interactive-2.php, Date of Access: 10 July 2017

Microsoft (2017). *Mixed Reality with HoloLens.* https://www.microsoft.com/en-us/hololens/why-hololens, Date of Access: 10 July 2017.

Odom, J. (December 2017). *What's the difference between HoloLens, Meta 2 and Magic Leap*. https://next.reality.news/news/whats-difference-between-hololens-meta-2-magic-leap-0181804/, Date of Access: 14 May 2018.

Port of Rotterdam (2017). *Port of Rotterdam Authority contracts four PortXL start-ups.* https://www.portofrotterdam.com/en/news-and-press-releases/port-of-rotterdam-authority-contracts-four-portxl-start-ups, Date of Access: 10 July 2017.

Port Technology (2016) *Hamburg: The Connected Port of the Future.* https://www.porttechnology.org/news/hamburg_the_connected_port_of_the_future, Date of Access: 10 July 2017.

Rushmore, M. (2016). *Gradual acceptance*. http://www.portstrategy.com/news101/port-operations/planning-and-design/performance, Date of Access: 11 July 2017.

Today Online (2017), *SATS unveils AR glasses to speed up ramp handling operations.* http://www.todayonline.com/business/sats-unveils-ar-glasses-speed-ramp-handling-operations, Date of Access: 10 July 2017.

UNCTAD. (2017). *Review of Maritime Transport 2016.* http://unctad.org/en/PublicationsLibrary/rmt2016_en.pdf, Date of Access: 14 July 2017.

Westerman, G. (2011). *Digital Transformation: A Roadmap for Billion-Dollar-Organizations*. https://www.de.capgemini-consulting.com/resources/digital-transformation- roadmap, Date of Access: 10 July 2017.