KSHAL: A WEB-BASED INNOVATIVE SOFTWARE ALTERNATIVE FOR MARITIME LOGISTICS

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KSHAL: A WEB-BASED INNOVATIVE SOFTWARE ALTERNATIVE FOR MARITIME LOGISTICS

BY

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PLAGIARISM

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

The 20th Century was a milestone of evolutionary jumps in the number of critical changes in the business world. Technological innovations have not only been sparkled into our daily lives but also triggered the rise of intelligent systems that are integrating production systems, supply chains, customs authorities, b2b, c2c commercial activities and such. The boost of change came within the companies by the push of innovative technological systems. The internet made this jump more visible and widespread while providing new challenges and opportunities together. Dull software systems evolved into mobile or web-based, fully integrated multilingual assets that helped companies become new winners, or by another name, "record breakers" in the world markets. This thesis aims to enlighten the necessity of shifting companies to upgrade their software infrastructure into web-based, lightweight, budget-wise, feasible, innovative platforms that can create sustainable profitability while simplifying complex organizational problems. KSHAL project, a web-based maritime software alternative, will be the focal point of this thesis as an excellent example of planning, designing, coding, deploying and commercializing the whole software development process in one go.

Keywords: Shipping, Software, IoT, Transportation

ÖZET

20. yüzyıl, iş dünyasındaki kritik değişikliklerin sayısında bir evrimsel sıçrama taşıydı. Teknolojik yenilikler sadece günlük hayatımıza yayılmakla kalmadı, aynı zamanda üretim sistemlerini, tedarik zincirlerini, gümrük otoritelerinin bağlantılarını, b2b, c2c ticari faaliyetlerini ve benzerlerini entegre eden akıllı sistemlerin yükselişini de tetikledi. Tedarik zincirleri, tanımlanmış tüm parametreleri etkin bir şekilde analiz ederken, kurumsal girdilerin verimliliğini kontrol ederek ve hem karlılığı hem de müşteri memnuniyetini artırarak karar alma hızını yükselten bu yarışta lider pozisyonunu alan başlıca endüstriler arasında yer aldı. Artış, akıllı teknolojik sistemlerin ortaya çıkmasıyla sektörün içinden geldi. İnternet, bu güçlenmeyi daha görünür ve daha yaygın hale getirirken, birlikte yeni zorluklar ve fırsatlar da sağladı. Nesnelerin İnterneti, neredeyse tüm üretim ve hizmet tedarik eden kuruluşların gündeminde popüler bir konu haline geldi. Kötürüm, eski tip yazılım sistemleri, şirketlerin lider olmalarına yardımcı olan mobil veya web tabanlı, tamamen entegre çok dilli platformlara dönüştü. Akıllı sistemler dünya pazarlarında yeni rekortmen şirketler ortaya çıkattı . Bu tez, şirketlerin karmaşık altyapı sorunlarını basitleştirirken sürdürülebilir kârlılığa katkı sağlayan, web tabanlı, alt yapı gereksinimleri yönünden hafif, bütçe açısından hesaplı, basit arayüzü sayesinde kullanıcı dostu bir projenin hayata geçirilmesini ortaya koymayı amaçlamaktadır. Web tabanlı bir denizcilik yazılımı alternatifi olarak KSHAL projesi, tüm yazılım geliştirme adımlarını bir arada sunanmayı amaçlayan bir araştırma olarak, planlama, tasarım, kodlama, yayınlama ve ticarileştirmenin iyi bir örneği olarak bu tezin odak noktası olacaktır.

Anahtar Kelimeler: Denizcilik, Yazılım, Nesnelerin Interneti, Taşımacılık

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1. INTRODUCTION

Information technologies and intelligent systems became the backbone of the maritime industry during the last century. From shipping companies, customs brokerage organizations, to logistics entities shortly, all the actors of the supply chain management sphere have played their roles successfully to take the top place in this evolutionary change. The technological evolution became a permanent part of performing whatever service companies provide or whatever product they produce. While these improvements divert and reshape the orthodox business-making models, customers' behaviours and expectations have also taken their part in this impactful revolution and altered. With the rapid development of technologies, the social behaviour habits of consumers have significantly changed and are no longer in line with the non-internet era (Limlahapun & Kalganova, 2018).

The technological evolution simplified the long, costly and harsh processes in the maritime industry and opened new horizons ahead. When we go back into the '80s, it was paper-dominant times. The rendered services of shipping companies were hard to handle. The jobs were difficult to archive. More importantly, it was extremely complicated to analyze company figures, revenues, and projects compared to I.T. dominant contemporary times of the 21st Century's '20s. However, it may look like such a short run between the '80s to '20s, and the digital revolution's impact was immense. Markets have introduced new habits, new scales of services such as recommendation engines, electronic data interchange (EDI), single-window customs, A.I. powered self-driven vehicles including delivery cars, forklifts, even cargo vessels to corporate or to end consumers. The word "data" became a detached, standalone and powerful subject among the rest of the assets of the maritime

companies. As world trade grows, companies have no other chance to solve the problem of clustering the data they have but use advanced information technologies. It was not long ago that we were introduced to new jobs or departments in maritime companies such as data engineers or information miners. As time goes by, we tend to abandon our historical business-making patterns by replacing them with high-end intelligent tools. Bill of Ladings, which have been in use for centuries in their classical forms, "shapeshifted" from paper printed documents into digitally signed electronic documents within a blink of an eye. Cargo manifests, customs declarations, shipment instructions, invoices, warehouse inventory control lists, and countless documents were digitized and became simple items to produce, re-produce, authenticate, manage, archive, and distribute along the supply chains, end to end by few clicks on the computers. The data, information and knowledge are critical assets to the performance of logistics and supply chain management (SCM) because they provide the basis upon which management can plan logistics operations, organize logistics and supply chain (S.C.) processes, coordinate and communicate with business partners, conduct functional logistics activities, and perform managerial control of the physical flow of goods, information exchange and sharing among S.C. partners (Shi, Chan, & Waters, 2010).

As we arrive at the current day, it is hard to visualize odds of a maritime company that is active in all or one of the shipping, freight forwarding, container sales, vessel chartering, stevedoring divisions of the market not using any I.T. infrastructure that helps them to integrate their daily flow to the rest of their commercial partner systems. Supply Chain Planning Models, Network Planning, Vehicle Routing, Facility Location Models, Supply Chain Competition and Collaboration Models are subjects that are currently being

analyzed and solved by I.T. supported necessary algorithms (Simchi-Levi, Chen, & Bramel, 2014). It may be possible to indicate that today, there is no way to survive without operating advanced software programs on versatile hardware structures as a maritime company.

This dissertation aims to study the steps of building a web-based software alternative from zero ground up to commercialize the final product by selling it to corporate level buyers. This thesis intends to examine the significant milestones of realizing a complete software solution platform from choosing server-side structures such as database environments, computer coding language, budgeting, building, testing, deploying chapters of the whole picture. This research will try to enlighten the fundamental and less known, covert challenges of bringing expertise into an industry, which is maritime in our example and combining it with another, that is software development business, and try to create a collaborative environment from both for a forceful result. Another aim of this research is to discover and propose methods to solve economic, operational, technical and legal obstacles that may arise in the software development process. This dissertation will try to obtain findings on the possibility of bringing a creative, economical, and straightforward software solution as a final product without compromising from building an extensive data handling structure that provides a complete web-based I.T. system for maritime companies, particularly freight forwarders and the container merchants. It is indispensable to put forward all of the progressive milestones by digitizing the measurement methods of building web-based maritime software to understand better.

1.1 The Research Model

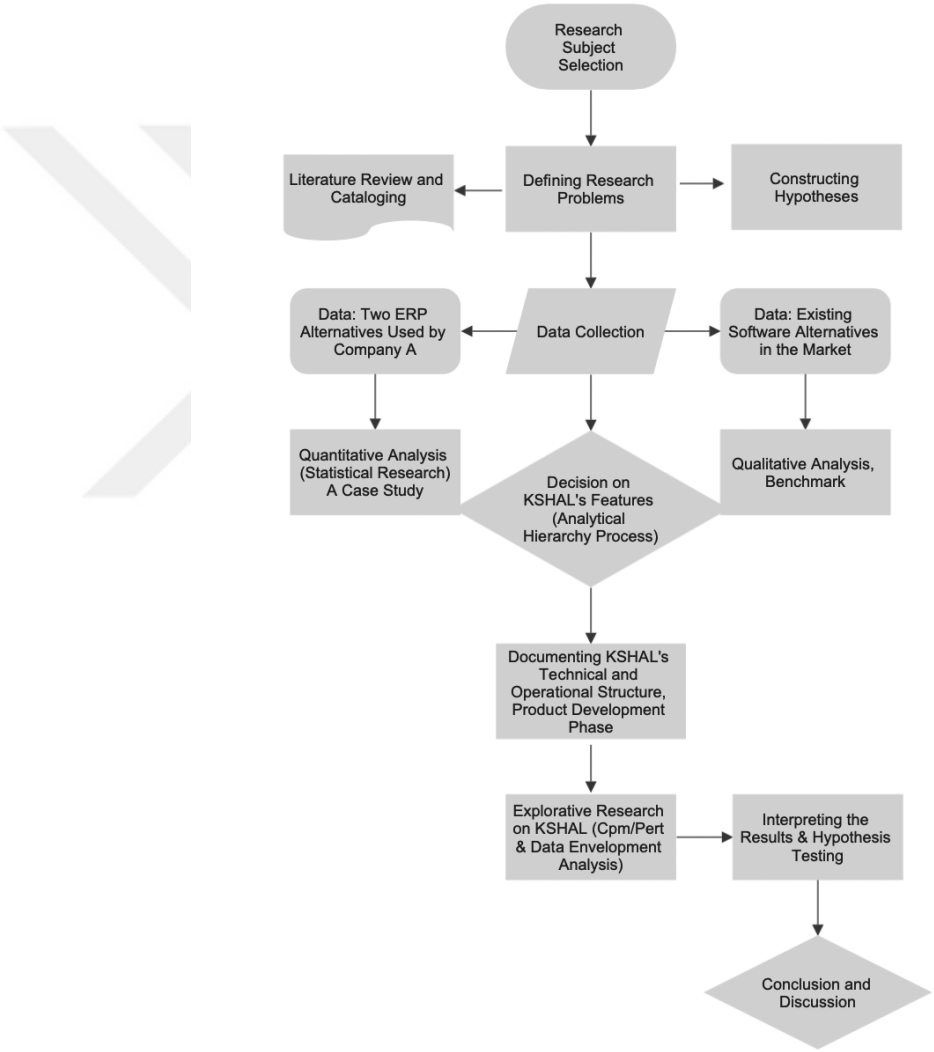
The research model of this study aims to use qualitative and quantitative methods in a balanced way to enlighten the results of the research questions. The quantitative methodologies are traditional, positivist, experimental, or empiricist as advanced by authorities such as Comte, Mill, Durkheim, Newton and Locke (Clarke, 2005). These methods, such as statistical tests, data envelopment analysis, project evaluation and review technique (PERT), were used to reach quantitative results. The qualitative methods are constructivist, naturalistic, interpretive, postpositivist or postmodern perspective as advanced by Dithey, Kant, Wittgenstein (latter), Foucault, Miles and Huberman (Clarke, 2005). These methods, such as one-on-one interviews, observations, survey querries, were used to support the foundations of the hypotheses of this dissertation.

The research model has ontological, epistemological, axiological, rhetorical and methodological assumptions. Ontologically, this dissertation focuses on the nature of the main problem with the research questions. The paper also purposefully aims to blend the individual perceptions of the researcher and the multi-angled facts of the research problem scientifically. Epistemologically, the research model also defines the role of the researcher in this research on whether the researcher is independent of what is being researched or interacts with the study. The research method was constructed to support the axiological foundations of the dissertation by using multi-criteria decision-making tools, analyzes, and statistical tests to assure us that the data, values, and results are unbiased. The rhetorical structure of the research is formal; the language is neutral and scripted in an impersonal voice. Finally, the methodological framework is multilayered by applying several

collaborative tests such as Analytical Hierarchy Process, Critical Path Method, Pert and Data Envelopment Analysis.

Figure 1

The Research Model



In the Literature Review part of this dissertation, there will be a detailed outlook, glancing into the historical background and development process of I.T. systems in the maritime industry in the 20th and 21st centuries. Leading ERP software companies in Turkey will also be indicated in this chapter. The research focuses on significant software

developers with the highest customer amount, user quantity, revenue and brand awareness in Turkey. They are the companies with critical importance in the Turkish maritime industry in past decades and current days. Each of these companies will take place in this part will be examined by criteria such as technological advances, database feasibilities, limitations and elasticity, the ability to keep up with market changes and customer demands, integration competence with third party organizations. In addition to the above, existing obstacles, challenges, and legal aspects of software development procedures for maritime companies in Turkey will be studied in the literature review. Finally, this chapter will assist us in assigning the subject to the next chapter by displaying findings on a progressive timeline at I.T. and logistics as two collaborating partners.

In section 2.2, there will be a detailed outlook and benchmark of major software companies aggressively peddling their products door to door in the Turkish SCM market. Those companies sharing the largest segments of the market pie will be reviewed in detail by using qualitative and quantitative methods to show their advanced features and weaker sides. That section will focus on four products developed by four different companies using different databases, software coding languages, and all require different technical inventories for a perfect runtime. In subtitle 2.2.5. the dissertation will be touching upon a few marginal and relatively small software companies without deeply elaborating their products. However, it is still worthwhile to indicate their tools, customer approach, and activity circles in the logistics sphere of the Turkish SCM industry. At the end of chapter two, there will be a clear map in our hands guiding us into start-up steps of developing a rock-solid, web-based maritime software. The text will focus on the challenges, limitations, and obstacles of software development in the Turkish market by approaching the topic from

several standpoints: economic barriers, infrastructure challenges, state-related limitations, and educational reasons by indicating the possible guidelines about how to untwist these hurdles. A significant portion of these complications, which were named in subtitle 2.3, is an organic corollary of a progressive timeline, a history, if we may call it, that needs to be enlightened for a better understanding of future mindset in software engineering for the SCM industry in Turkey.

At the end of the Literature Review section, there will be a neat picture in front of us containing the main parts of the existing conjuncture. The Turkish SCM Industry focal point will clarify the history of I.T. applications, competing for software companies, technologies, challenges, limitations, and obstacles of developing similar products.

Chapter 3 will be the cornerstone of this research that profoundly describes the know-how part of the software development process for the maritime industry in detail. The study will display a full-scale process of production steps from scratches or blueprints to taking the completed and deployed software to "live" and more. In that chapter, we aim to align this paper closer to the maritime industry terminology and understanding rather than diving deep into the engineering and coding part of the development project. It will help us understand the concept and benefits of using a web-based tool such as KSHAL and put out a lean, simple and effective dissertation for people planning to develop a similar product for their emerging interests and entities.

In few subtitles in this chapter, we will have to broach some necessary technical subjects, such as choosing a proper and effective database structure for the product, picking up a solid coding language as a must. Without getting into the back end - what we may call "the kitchen" - of the production process, the paper would hang in space and miss the shot.

The chapter is a complete walk-through of KSHAL, including commercializing the product, approaching potential customers, pricing methods, completing sales, contractual liabilities, error handling infrastructure. This chapter will be completed by a S.W.O.T. Analysis, which will deliberately squeeze and stress us for finding the weak points out and substantial parts of KSHAL, future opportunities in the market and threats. All the "pain points" will be discussed in subtitle 3.13. Even though that the kernel of our know-how in the KSHAL project is our sole capital, Chapter 3 will be a complete manual of KSHAL product for researchers.

Table 1

Applied Research Methods

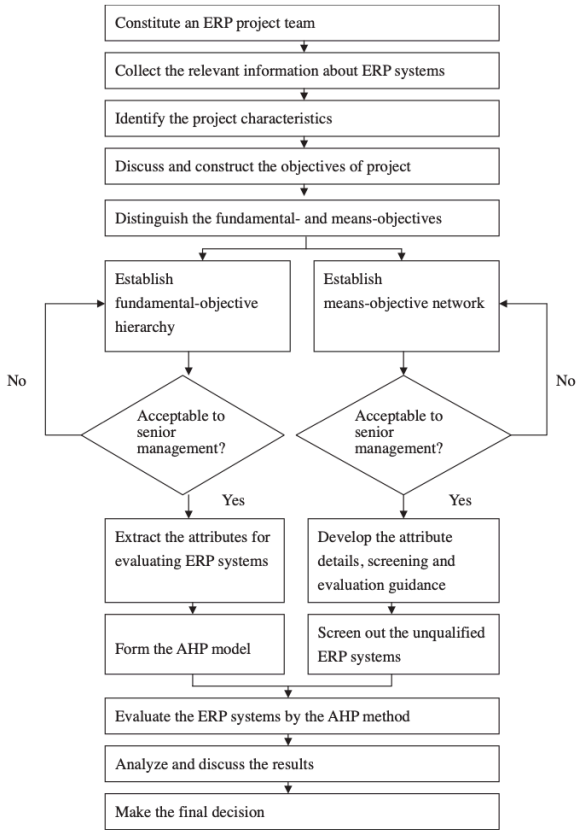
Method	Purpose	Section	Software
Swot Analysis	It has been used to reveal the strengths and weaknesses of different software.	2.2.1 - 2.2.5., 3.13.	-
Benchmarking	It has been used to detect the differences between different software.		Owasp ZAP, PageSpeed Insights
Statistical Applications	t-Test (in detecting the differences between the means of two data groups), M-W U, Wilcoxon, Spearman correlation tests (in investigating the presence of significant relationships between variables)	2.4.	SPSS
Analytical Hierarchy Process	To decide on DB, software language, pricing method and digital habitat for KSHAL	4.2. - 4.2.2.	Exper Choice, AHP OS, AHP Decision
CPM/PERT	In project planning of the development process, personnel, work distribution and cost items of the software	4.3. - 4.3.2.	-
Data Envelopment Analysis	For measuring the effectiveness and efficiency of the software in the customer network	4.4. - 4.4.2.	-

The research will benefit from the practical analysis skills of three collaborative and quantitative methods, which are Analytical Hierarchy Process (AHP), Critical Path Method (CPM) - Program Evaluation & Review Technique (PERT) and Data Envelopment Analysis (DEA). All these three are the tools that will assist us in finding out whether H0 is the proven path. Also, it is a noteworthy fact that these methods are influentially compatible with each other in the process of understanding how efficient KSHAL will function in real-time at maritime companies.

Chapter four will start by processing an AHP application that will question and investigate which database platform is best to begin with, which coding language is more flexible, robust and economical, which critical and necessary investment items must be chosen. Finally, there will be a comparison between all the available resources, technological infrastructure and basic setup to give the project a go. While developing and implementing KSHAL, this dissertation also benefited from the *ERP System Selection Framework* model shown in Figure 3.

Figure 2

Comprehensive ERP System Selection Framework



Note. From "An AHP-based approach to ERP system selection. Wei, Chien, Wang, 2004."

The criteria and alternatives used in our AHP analysis were selected/sourced according to the technological infrastructure of competitor ERP programs in the market feedback from international freight forwarding companies participated in our questionnaire about what sort of ERP tools they use at their organizations and several academic resources including the article that was published "An AHP-based approach to ERP system selection." in International Journal of Production Economics (Wei, Wang, & Chien, 2004).

According to Wei, Wang and Chien, there are six major factors in their AHP analysis while developing and implementing an ERP as; total cost, functionality, user-friendliness, flexibility, reliability. Also, based on the same paper, the vendor factors indicated reputation, technical capacity and service. Therefore, the criteria (Cost/ROI, Reputation, Security, Stability) used in our AHP analysis effectively correspond with Wei, Wang, Chien's approach to the subject. Anand Teltumbde indicates criteria as vendor credentials (reputation), return of investment and costs, flexibility, technology in his article titled "*A Framework for Evaluating ERP Projects.*" matching the criteria and alternatives of this thesis (Teltumbde, 2010). While deciding on the database for KSHAL, our research was also attributed to matching AHP criteria just by enriching the perspective of the KSHAL project. Salvador Bueno and Jose L Salmeron have determined 17 criteria for decision-making in their paper titled "*Fuzzy Modeling Enterprise Resource Planning Tool Selection.*" published in 2007. These criteria are, in order, feasibility, security, ease of adaptation, reliability, modularity, the need of determination, ability to provide information, intuitiveness, cost, consultancy fee, maintenance costs, general requirements, need for an expert team, average implementation time, complex parameter situation, Planning was evaluated as the definition of objective concepts (Bueno & Salmeron, 2008).

Our research also attributed to similar criteria studied in their paper, including cost, maintenance fees, security, reliability and more.

In addition to the resources as mentioned above, Korean scholars BS. Ahn and SH. Choi has determined five main criteria: business functionality, supportive service, technology, costs, vendor credentials in their AHP experiment while deciding which ERP product is best for their home-shopping company customer. The criteria involved in our AHP analysis effectively relate to their paper titled "*ERP System Selection Using a Simulation-Based AHP Approach: A case of Korean Home-Shopping Company.*" published in 2008 (Ahn & Choi, 2008).

Turkish researchers Ertuğrul Karsak and Okan Özoğul constructed their Fuzzy AHP model based on three main criteria: cost, quality and supplier (Karsak & Özoğul, 2009). The "supplier" criterion in their paper is the corresponding title as "reputation" in our study; also, stability and security criteria from our AHP model efficiently serve the same fields of interest as "quality" indicated in their research paper.

Table 2

Main AHP Criteria References

Main Criteria	Wei, Wang, Chien	Teltumbde	Bueno, Salmeron	Ahn, Choi	Karsak, Özoğul	Ünal, Güner
Cost/ Roi	✓	✓	✓	✓	✓	✓
Stability	✓	✓	✓	✓	✓	✓
Reputation	✓	✓	✓	✓	✓	✓
Security	✓	✓	✓	✓	✓	✓

According to Can Ünal and Mücella Güner's research paper titled "*Selection of ERP Suppliers Using AHP Tools in the Clothing Industry.*" functionality, implementation approach, support, organization's credentials, experience, flexibility, customer approach and future strategies were their top tier criteria while defining the ERP supplier (Ünal &

Güner, 2009). The other attributed researches influenced this study to benefit from AHP methodology are as follows;

Table 3

Referred Researches reg. AHP

Discussion Area	Supporting Literature
Software Selection with AHP in Eductation	Ereeş, Kuruoğlu, Moralı Source: DOI: 10.5923/j.fs.20130302.03
Opensource Software Selection with AHP	Yusoh, Chamili, Che Pa, Yahaya, Source: 10.11648/j.ajsea.20140306.13
Software Selection with AHP	Bansal, Kumar, Garg, Source: http://dx.doi.org/10.5267/j.msl.2017.3.003
ERP Selection for Korean Company by using AHP	Ahn, Choi, Source: doi:10.1057/palgrave.jors.2602365
Implementation of an Online Software	Goepel, Source: 10.13033/ijahp.v10i3.590
ERP System Selection	Touendegh, Erkan, Source: https://www.researchgate.net/publication/ 273696277_Erp_System_Selection_By_Ahp_Method_Case_Study_From_Turkey
ERP Selection with the support of AHP	Czekster, Webber, Jandrey, Augusto, Marcon, Source: doi.org/10.1080/17517575.2019.1606285
Cloud-based ERP Selection	Vargas, Ishizaka, Source: doi.org/10.1016/j.compind.2017.06.007
ERP Selection for a Manufacturing Company	Klos, Trebuna, Source: DOI: 10.2478/mper-2014-0023
ERP Selection	Motaki, Qualid, Source: DOI: 10.5120/ijca2017915636
Selection of Programming Languages with AHP	Juhartini, Suyanto, Source: DOI: 10.18421/TEM73-17

CPM/PERT methodology is often used in time-critical projects to measure the timeline steps, efficient usage of the budget and expenditures from start to end. The methods are essentially network-oriented techniques using the same principle. PERT and CPM are time-oriented methods in the sense that they both lead to a determination of a schedule for the project. The significant difference between the two approaches is that the time estimates for the different activities in CPM were assumed to be deterministic, while in PERT these are described probabilistically. These techniques are referred to as project scheduling techniques (Sri Vidya College of Engineering and Technology, 2015).

This method will guide us to determine how fast a turnkey I.T. solution on a scale of KSHAL might be ready for final users without bugs and flaws. It is one of the critical analyses of the research when considering salary levels of software engineers that may turn into painful and disastrous toils that many companies occasionally fall into. All the costs must be planned in detail, and they must be measured with the help of CPM/PERT on how long they may be sustained and/or born by the investors. The budgeting leg of software

development is always a challenge from the fiscal step, allocating fixed and dynamic costs to human resource planning that responds to "How many developers, analysts, support technicians will be employed?" questions. The other problem that gets visualized and solved by CPM/PERT is how long it will take to distribute and collect individual projects from the staff. *Software development* is a unique business that stands between craftsmanship and artistry. No software can be deployed at one go without extensive and detailed project planning.

On the one hand, the data is our leading player through the coding process, and it is a vital part that solidates the foundation of our product. It is all about how we store our data and recall it quickly whenever we need it. It is also about how we re-use the data effectively in the future while benefiting from A.I. fuelled recommendation engines and deep-learning analysis. CPM/PERT will assist us in defining the proper steps, the time we spend on each house (or call it a "station", if you may) and the resource we allocate for every action that runs parallelly or serially with each other. If we stepped in by focusing on only one station while neglecting or over reckoning the others, we would stick at one place along the way.

A database needs a proper back-end programming language to be interpreted. The industry struggles to interface programming languages and databases. Applications that access databases are awkward to design and develop. Careful optimizations are often needed to attain good performance, resulting in programs that are difficult to maintain and evolve (İbrahim & Wiedermann, 2016). There is no use in having a front-end built of the product without a database infrastructure that works fast and secure in the background. These both can be constructed in the same timeline, but any miscoordination between them

may fail the whole project by blocking the other. CPM/PERT methodology will take the research into the deployment date and hand the flag to DEA calculatedly. CPM/PERT will also allow us to benchmark the results with competitor platforms in this research. Finally, it will give us a glimpse of how a web-based software designed for the maritime industry gets built from the starting point to the finishing line.

DEA will bring us feedback about how the customers benefit from KSHAL in their operations per diem. We will be comparing three different customers in two countries that have analogous markets. This analysis will take place among over 50 CALs. Data enveloping method is a tagging that feedback data collected from the users operating on KSHAL in their daily operations including sales operations, container warehousing, customer relations, price quotations, cost house registry, documentation and bookkeeping activities. *DEA* is a procreative benchmarking tool that will draw a line between efficient and inefficient users.

In this research, DEA will be applied in several fields of user experience questions based on how many Bill of Ladings they issue, how many price quotations the users generate through KSHAL, the quantity of the users at each customer company, the amount of cargo information handled through KSHAL and more. As an instrument of diagnostics, DEA will deliver a comprehensive analysis that will show the ratio of each customer's contribution to the software and the benefit they obtain from the product. In section 5, we will be expressing the results of the dissertation.

We will be sharing our futuristic forecasts about what is ahead of I.T. and maritime industries and what type of new models might be considered as of today. How should we define our position while the world markets evolve and traditional methods of commerce

re-shaped? Shall we follow the trends or become one of the creators of those trends which will build the forthcoming generation of maritime business? Mainly, "what is beyond what we have and where we are going to?" will be elaborated in section 6.1. At last, this paper will criticize itself in section 6.2 by indicating the challenges and limitations experienced during the research and scripting the text.

Qualitative research methods usually collect three types of data:

1. Environmental data; It is related to the psycho-social, cultural, demographic and physical characteristics of the environment in which the research was conducted.

2. Data relevant to the process; It is about what happens during the research and how it affects the research group.

3. Data on perceptions; It is about what the individuals included in the research group think about the process. To collect these three types of data, the researcher most commonly uses three methods; interview, observation and written materials (Halim Kazan, 2014).

In this research, the research environment geographically covers Turkey and Ukraine. It demographically focuses on small and medium-sized freight forwarding companies employing up to 100 employees who have access to mainframe and company ERP. In addition to this group, this research also collects data from I.T. companies that are situated in Turkey and producing shipping industry-specific ERP programmes for the freight industry and benchmarks.

The purpose of the statistical benchmark is to determine whether the studied software is superior to the other or not. The data relevant process of the research was built by data envelopment analysis that recollects user data and interprets this information to

measure the aftermaths of their experience and the level of interactivity with KSHAL. DEA (Data Envelopment Analysis) visualises which subject group benefits the most out of the web-based platform engaged their daily shipping and logistics operations. The data perception step was fulfilled by the AHP process, where a questionnaire was replied to by 20 freight forwarding companies located abroad on what type of ERP they have, what sort of database their shipping software works on, and what they think is best for their ERP to be deployed on. Same attendees also commented on which pricing system is best for their company. The trend analysis method is used when this research is evaluated in terms of the time it covers. The purpose of trend analysis is to spot a prevalent trend within a user group and/or to determine how a trend developed/would develop over time (Trend Analysis, 2019).

The study overlooked two different ERP programmes used at a shipping company performing the exact shipping and forwarding operations in two extra-time intervals. Based on this perspective, it is temporal (to analyze the trend within a user group defined by a specific period), intuitive (to analyze the trend within or across user groups based on the logical explanation, behavioural patterns by the researcher) and longitudinal operational study. Statistical tests show how trends mark sales, profits, expenses, the number of shipments, the efficiency of human resources based on these two different ERP products. The scale of the applied analyzes performed in this research is varied. For example, while DEA was used on people (working at shipping companies), the AHP survey was shaped by several organizations (freight forwarding companies) putting their feedback. In addition to this, the DEA is a field experiment as all the data collection was performed at participants' premises.

Based on the above manifestation, the model of this thesis is **empirical research based on an experiment and a case study**. The experiment documented (explorative research) in this study is developing a web-based shipping software from the sketching stage to the deployment stage and testing its feasibility, advantages and vulnerabilities economically, technologically. The case study is unique as it exposes pre-and post-development stages of the specific modules (such as container sales, freight quotation, and shipping module) of KSHAL.

1.2 Background

There are **three major problems** this research focuses on. These three problems form the basis of the text and provide us with a reliable guideline on bringing a practical application alive. The issues we will indicate next are interrelated and actively corresponding through the development, promoting, experiencing phases. The problems will give us insight into project development requirements, challenges, and opportunities and draw a comprehensive map for those who would like to practice software development, product design and increase effectiveness for maritime companies. Therefore, it was necessary to cluster the problems of this research under three sections. The first cluster is allocated for the group of more minor issues related to the developer's end.

This cluster will club questions or problems related to **Start-Up mentality**, budgeting, human resources, design, development, and creating differences while not burying the ideas under chunks of occupying “dead” decisions. The second cluster is a base for several more minor questions or problems related to **innovation and market trends**. Both terms are relatively supportive to each other, and one triggers another in real life. Innovation, or General Product Innovation (GPI), shapes market trends while market trends

pull or push innovative technologies. Hence, a GPI substantially improves product functionality (where products can be physical goods or non-physical services) while drawing on an established set of technical principles. GPI commonly occurs within product lines (for simplicity, we will refer to the organizational unit responsible for a product line as a "business" while noting that some businesses may offer multiple product lines), which tend to draw on common pools of knowledge. For instance, consider applications software. In January 1994, Microsoft's spreadsheet business introduced Version 5.0, a GPI for its Excel for Windows product line. Version 5.0 of Excel was a GPI because it provided substantial new features for graphing and charting and retrieving and manipulating data, built on the industry's existing knowledge base in software design. Later that same year, in turn, the business introduced Version 5.0a of Excel. The release was not a GPI because it primarily refined existing functionality by correcting several automation and implementation problems that surfaced from the Excel 5.0 version release. Identifying the distinction between GPI and minor changes typically depends on criteria relevant to a particular industry and technical setting. The empirical section of the paper uses a multi-dimensional approach to identifying GPIs that are appropriate in our analytic setting (Turner & Mitchell, 2010).

We will gather all essential questions in this cluster seeking answers about how innovative our product is and how the market will respond to our technology, match the customer demands, go beyond it, and more. In the final and third parts, the research will gather the problems related to **customers or KSHAL users**. We will look at the issue through the customers' eyes by lining up some questions on how, why, and when in this part. For example, will users spend less time on more significant tasks by using our

software comparing their previous ERP? It will be discussed in the third cluster. The questions, which are grouped in three collections, will explain the background of this research and what problems this research aims to solve. They will also act as a gateway to the hypothesis section of this research and will assist us in acknowledging the hypotheses related to our study.

As a known fact, every successful product is there thanks to an investor who saw both the problem and its answer. This study will benefit from the researcher's maritime industry and freight forwarding market experience exceeding two decades linked to a detailed market outlook based on analytical observations primarily focusing on the I.T. division of the business. It was inevitable not to come up with a problem that is eagerly giving way to one or multiple solutions about software-centric issues in the maritime industry after decades-long active coalesce with loading, unloading, cost controlling, pricing, reporting tasks of daily operational flow. In this respect, KSHAL is both an alternative method of solving software problems in the maritime industry and a bridge that takes the other researchers seeking solutions for similar topics.

The background of this research gets fed on by three clusters of problems as named above, which will be introduced in detail in the following paragraphs. Today, there are several domestic and international solution platforms available for maritime companies. In this text, our research will focus on the Turkish Maritime Market, and it will be our **research space.** This boundary will not set the analysis back from benchmarking our perspective with the international akin of I.T. products in the shipping scene. However, conversely, it will provide a clean focal spot to deliver an adequate answer for what the Turkish freight market needs.

What might be a feasible, effective and efficient I.T. solution for small to medium-sized maritime companies that actively deal with container shipping, freight forwarding, brand new or second-hand container sales and warehousing in Turkey? How to design, engineer and construct dynamic software as a unique solution for their needs? The first cluster of questions relates to starting it from zero ground up to the software deployment process. What might be the benefits for the investor of such a start-up, and what are the challenges? What are the steady costs, and which are the dynamic costs we will have to bear? How may we link the customers' needs and demands with an innovative work model that uplifts their operational and fiscal efficiency to the next level? Why do we need a web-based maritime software alternative whilst there are already up and running products in the market? Investor-related questions, as our critical topics, are the justification of existence for this research. Without an investor who decides to step into such a start-up, we would never elaborate the questions in other clusters.

The background of this research is based on creating a dynamic, economically affordable and yet simple to use web-based software alternative for shipping and freight forwarding industries. The word "dynamic" must be explained in brief here. The research will show that the competitor products come by strict restrictions that imprison the creativity of their customers. Some database structures they use are intolerant to different alphabets (i.e. Chinese, Arabic, Cyrillic, or Hebrew) that prevent their customers from using the same software in their international subsidiaries or offices. So, what we create must not have that rigid restriction that the number of other products has. Few software examples require customers to install Microsoft Office Programs to transfer their data while creating routine reports. We must create a solution that cooperates and collaborates with

multiple types of office programs comfortably and freely, such as Libre Office. The word of dynamic represents the software's capability of collaborative affinity with third-party programs and languages and even hardware types. What will be our product's advanced assets against existing software alternatives? What will be the depth and direction of our know-how diversifying KSHAL than the juxtaposed competitors? Should we aim to exceed each of them technologically and in a pricing sense beyond, or should we lock on one particular antagonist product to run over? These questions are clubbed in the innovation-related cluster that takes one-third of the background of this research.

The final cluster of problems is classified in customers'/users' end. No matter how much an investor ever believed in their product, the success is justified by customers' decisions. All of our efforts, struggles and achievements are crowned, praised or trashed by those who experience our product and decide if it works or not. What is the correlation between available I.T. solutions and complaints of customers? How may we reconceptualize enhancing end-user satisfaction through our technology? How advanced is our target audience when taking tech, I.T., software, ERP topics into consideration? How simple our screens and task flows should be designed as many efforts languish as they become a control mechanism over the sales force, sales personnel do not enter the necessary data into the program, or the information is not used for the intended purpose (Poirier, 2002).

The background of this dissertation is coming through these problems that will be answered during the following chapters. Furthermore, this text has the role of acting as a handbook and a pathfinder for investors willing to create an I.T. product with brand equity and protect their software(s) from cannibalization problems. Finally, at the end of the

research, this study will intend to look at the horizon of the futuristic ERP implementation models such as the Software as a Gateway (SaaG) model where software companies provide their products in exchange for having full rights to analyzing customers' datasets and create intelligent reports which may be purchased by whom using the program.

1.3 Theoretical Approach

Good research is grounded in theory. Theories consist thus of plausible relationships produced among concepts and set of ideas, providing both a framework for critically understanding a phenomenon and a basis for considering how what is unknown can be organized (Kawulich, 2009).

The theory is compulsory to further scientific acknowledgement by creating a systemized structure competent for elucidating and prognosticating phenomena. Maritime, shipping, freight forwarding, transportation, logistics are interrelated disciplines where relevant theories are used to the full extent. The maritime industry, which runs through the most challenging competition conditions, is sensitive against specific market changes that create a bullwhip effect on companies' balance sheets. In this respect, maritime companies are eager to find alternative methods to increase their profits while decreasing their vulnerability to economic changes. This dissertation will evaluate four relevant theories that will give us a glorious chance of discussion about our pathway through building up the software and measuring its overall effects on investors, markets and customers. On top of that, any practice which is not supported theoretically remains limited and stumpy. The theories we will refer to will enlighten a part of this research in their leagues.

Firstly, we will be referring to **Porter's Value Chain Strategy**. This theory can be taken as a peerless management tool often used in the logistics industry to get into details

of companies' departments or activities, splitting their functions into pieces. Value chain analysis describes the activities within and around an organisation. This idea was built upon the insight that an organisation is more than a random compilation of machinery, equipment, people and money. Only if these things are arranged into systems, and systematic activates will it become possible to produce something for which customers are willing to pay the price. Porter argues that the ability to perform particular activities and to manage the linkages between these activities is a source of competitive advantage (Recklies, 2001).

Porter's Value Chain involves five primary activities; inbound logistics, operations, outbound logistics, marketing and sales and other services. The generic value chain model perceivably identifies and appraises all activities with compeer weight. Value chains facilitate the steps which take a product from an incubation level to markets. The essential linkages are assisted by both structure and efficient communication between forthright, indirect and support elements. The model founded and introduced by the economist Michael Porter indicates ten cost houses that assist divisions for improvement. This study takes Porter's strategy as the main road to go through, starting from the development process to after-sales supporting activities. Porter's ten cost drivers (a.k.a. cost houses) are as follows;

- **Economies of Scale:** A decent picture of need includes cost analysis for the size of the demand, whether local, national or global.
- **Learning:** Activities that change the environment for efficiency or improvement, such as scheduling, asset use and office or warehouse layout.

- **Capacity Utilization:** Procedures that keep capacity at efficient levels to prevent under-utilization or the addition of unnecessary capacity.
- **Linkages Among Activities:** Identifying areas of cross-functional improvement through coordination and optimization.
- **Irrelationships Among Business Units:** Opportunities to share information and resources.
- **Degree of Vertical Integration:** Identifying areas of joint integration or, in some cases, de-integration.
- **Timing of Market Entry:** Driven by economic or world conditions and competitive position in the marketplace.
- **Company's Policy of Cost or Differentiation:** Identified value integrated into the process.
- **Geographic Location:** This includes wages, climate and raw materials. In our case the list expanded by technological devices we use, internet speed, licensing fees...etc
- **Institutional Factors:** These include taxes, unions and regulations.

However, this theoretical approach will not be the only contrivance used in this research. In this context, our dissertation will apply for more theories to gain a solid ground for its hypothesis. These theories, which are cited in this section, affect our research, assisting our hypotheses by comprising reliable academic sources.

In this respect, this paper adjusts **Time in Transit Theory** to its narrative content. This theory was introduced by Japanese academics Kiyoyasu Tanaka in 2010 by aiming of delivering a contemporary approach that is analyzing freight and distance alternatives.

Distance as a variable derivative has a significant influence on freight. Tanaka concentrates his argument around a tradeoff between freight- cost-time and timely delivery to build this model. Using the Japanese Census of Logistics, his paper examines the cost influence of distance and time across shipping modes. Tanaka states that he found the results puzzling because business enterprises are likely to pay more for short-distance shipments by truck, ship and railroad transportation. Tanaka's statement is in itself confounding because the effect of short distances on rates as per-mile freight rates tend to decline with distance as the ratio decreases (Llanes, 2016).

KSHAL will use this theory in its pricing modules, suggesting alternative shipping lines that operate on several different routes for the same cluster of destinations. Thus, users will have the advantage to screen the variants and picking whichever is feasible for their shipment at that time being.

One of the fundamental challenges of freight forwarding companies is controlling their costs in an everchanging, active and relatively unpredictable market conjuncture where the competition is a harsh and fast response for quotation demands coming from customers is a game changer weapon. Based on our observations, it happens so often that one sales officer spends a certain amount of time retrieving costs from shipping lines, airline cargo sales agents (GSA's), or other vendors while these costs are already in the hands of another sales officer sitting by. This miscoordination causes a time loss that triggers losing a customer, being neglected by the vendors, inefficiency of human sources, and more. In maritime and logistics, fast response for customers' freight inquiries is essential for a competitive price offer in gaining new customers. KSHAL's cost-controlling infrastructure concentrates on providing complete control on buying and selling prices for

the assigned users. By referring to Tanaka's theory, this study will prove the correlation between distance and trade costs since the most considerable part of cost items (freight fees and fuel consumption) increases linearly over distance. Any software available in the market nowadays, offered in the maritime industry for corporations, must catalyze the hardship of getting into the right costs and placing correct quotations to customers. KSHAL will touch on Tanaka's Time in Transit Theory while conceptualizing pricing mechanism in the software by taking distance, the port of loading (POL), port of destination (POD), type of cargo, type of containers and transit time between origin and destination in consideration.

The third theory that this paper is scholarly influenced by is **The Theory of Constraints** (TOC). TOC is a methodology for identifying the most important limiting factor (i.e. constraint) that stands in the way of achieving a goal and then systematically improving that constraint until it is no longer the limiting factor. In manufacturing, the constraint is often referred to as a bottleneck (Kolinski, 2016).

TOC knowledge covers the following areas of management: operation (production) management (Make to Order (MTO) environment and Make to Availability (MTA)); Project Management – CCPM – Critical Chain Project Management; distribution and supply chain management (supply chain integration, inventory management, distribution, reverse logistics, just in time deliveries, storage and end-user distribution, pick and pack, track and trace); finance and measurements (Throughput Accounting); sales management; marketing (developing market offers), managing people; strategy and tactics (developing a company) (Novakovska-Grunt & Moroz, 2013).

Theory of Constraints, shortly TOC, is one of the foundations of this research referenced theoretically. It is a technical method of seeking improvement of the system/within the system. Theory of Constraints (TOC) is a decision-making paradigm that enables focused system improvement by thoroughly examining the process to identify the system constraints. These constraints pave the way for finding the focal point of development (Shahriar, Rahman, & Amin, 2020).

TOC has a strong relation with I.T. systems at companies. TOC has a different way of defining what I.T. means for companies and developing and implementing it in organizations to support their goals. For instance, with the Theory of Constraints, the goal in I.T. strategy development is not just system utilization but also quality utilization and improved decision-making capabilities. The TOC perspective leads organizations to shift their ERP programs from dull software to lightweight, economical, sustainable and intelligent tools.

Constraints can be observed or experienced in all divisions of maritime companies, and software is there to take an incentive initiative to mitigate the congestion that drains our customers' profitability, effectiveness, and competitive superiority in the maritime industry who have bought or will buy KSHAL. A lean, simple to use, easy to learn, and powerful software is a critical player challenging constraints at companies, especially in shipping entities where data is a major player of the operational flow.

During the following chapters of this dissertation, we will see that some rival software products create phenomenal difficulties on the shoulders of their customers by inconsistent fees and by unbearably delayed after-sales support times. On such occasions, such products become constraints instead of solution providers for whom use them at their

companies. TOC was first introduced by Israeli physicist Dr Eliyahu Moshe Goldratt in his book **"The Goal: Excellence In Manufacturing (1984)"** and mostly benefited by production companies seeking a solution to overcome their manufacturing-related problems, which we may call constraints. This theory defines the production system as a chain. A chain is an analogy for a group of independent links working together toward the overall goal. Thus, TOC assumes that the existence of one cause triggering several adverse effects is possible. Therefore, according to Goldratt's theory, every system has at least one constraint.

Theory of Constraints is an outgrowth of two trends that began in the 1960s and are still going strong today: Systems Thinking and Six Sigma. The Theory of Constraints is a way to design, build, and manage information systems in the way KSHAL intends to develop. TOC provides techniques for analyzing the relationships among people, processes, technology, data and goals. The Theory of Constraints emphasizes that planning involves finding the right balance between competing requirements in multiple dimensions (i.e., "the balanced scorecard"). TOC embodies four key areas: constraint/relationship management, constraint management; performance measurement; and goal setting concerning constraints. These areas form a framework for analyzing, developing and managing an organization's (or enterprise's) critical information systems.

Constraint Management is concerned with allocating scarce resources to satisfy competing needs. The I.T. context involves identifying and managing different forms of constraints inherent in I.T. activities such as hardware, software, personnel availability, environment, technology selection, and technical process. There are several constraints: organizational or social; physical (e.g., space); financial; business process; and user-

defined. The Theory of Constraints suggests that each of these constraints requires different management strategies.

Constraint Management emphasizes the importance of properly allocating resources to achieve goals. I.T. defines constraints as inherent conditions, rules, and procedures limiting resources to achieve organizational goals and objectives. This constraint management aspect of TOC distinguishes it from other management theories, such as Systems Thinking, Six Sigma, and Lean production. Technical incapabilities generate competitive disadvantages at shipping companies. Therefore, these incapabilities are tagged as 'bottlenecks' in TOC. Especially while implementing an ERP, shipping companies face several hardships such as unbearable software prices, expensive maintenance fees, high hardware investments and more. Therefore the first step is to identify the constraint in the supply chain that limits supply chain profitability. Then, the chain members have to focus on the constraints as the performance of the entire supply chain depends on them (Sukalova & Ceniga, 2014).

This paper aims to underline the importance and advantages of lean and affordable software alternatives and apply these products in shipping and freight forwarding companies to eliminate 'bottlenecks' in their services chains, operational flow, customer relations, I.T. maintenance and managerial control processes.

The five steps of the Continuous Improvement Methodology used by the TOC are to identify system’s constraints, to exploit them, to subordinate everything to the above decision, to elevate the system’s constraints and to get back to step one, but not allow inertia to become the next system’s constraints (Moellmann, Alves, Marins, & dos Santos, 2010).

While the sales forecasting is generally performed based on demand time series, the inventory (shipping containers in this case) stipulated levels at container warehouses are set up based on non-updated production capacity data and the average lead time to replace the inventory sold. Therefore, comparatively innovative ERP solutions are expected to take an active role at SCM companies, alerting top management when and how many containers should be stored at which warehouse to increase sales and decrease excess storage costs. The best advantages to perform SCM under TOC's rules are that the management is more straightforward than before, more information visibility, and decisions are focused on the causes that consume the buffers that protect the factories and dealers warehouses against delays (Moellmann, Alves, Marins, & dos Santos, 2010).

This dissertation deducts a part of its focal points from TOC by attributing its process improvement approach. Then, the research seeks solutions, answers, and innovative alternatives to designing a shipping ERP that delivers the same as its competitors but is economically more affordable, secure, and technologically more accessible than its rivals. The theoretical deduction from the Theory of Constraints empowers the clarity of the conclusion of this dissertation by many aspects, including measuring the economic feasibility, technological competence and innovative design, problem-solving in shipping operations by designing a web-based, alternative freight ERP product and measuring the contribution of this research to science as the thesis methodology benefits from multiple research techniques.

Last but not least, the fourth theory to be referenced in this dissertation is **The Contingency Management Theory (CMT),** which was proposed by the Austrian psychologist Fred Edward Fiedler in his landmark article titled "**A Contingency Model of**

Leadership Effectiveness" that was published in 1964. The primary driving force behind this theory is that no single management method befits every organizational entity single-handedly. Even though they might have specific similarities, every organization is unique by its size, attributes of its technological inventory, and leadership style.

According to the CMT, several external and internal factors will eventually influence the selected management modus operandi. In this research, we will elaborate and expand the potential of this theory by adding our research analysis and findings. Although CMT is substantially introduced as linked to leadership activities at companies, that theory also underlines the importance of technological creativity methods achieved while eliminating barriers in front of practical organizational tasks. Contingency theory is knowledge, and when applied, it makes the organization have a more efficient transformation process. Organizations are a human group, and the application of contingency theory helps to satisfy their needs (Betts, 2017).

This dissertation will construct its roots and expression through these four theories mentioned above while not limiting itself to being assisted by several others, namely, Joe Bain Jr's Structure-Conduct-Performance paradigm (SCP). SCP will be a subsidiary to interpret the dynamic behaviour of buyers and sellers to affect markets, making it harder to predict and establish fixed market structures. The SCP paradigm is recommended when analyzing market structure characteristics, firms' conduct and performances, allowing for the utilization of a wide range of variables. Likewise, SCP provides a valuable framework that includes the domains of activity and the markets as the basis for analyzers (Stanciulescu & Molnar, 2017). This study will use KSHAL as a tool to get the company information accessible by users to monitor inventory movements, calculate storage charges

or generate a bill of lading without compromising customer relationship management(CRM).

As a conclusion of this title, the theory is crucial to developing any sphere of research. Therefore, the main objective of this title was marshalling correlative theories with our research area in an effective array to increase the strength of hypothesis(es), which this dissertation aimed to illuminate and prove. Additionally, our scientific inclination is that research must explicitly identify the theoretical foundation being applied.

1.4 Hypothesis of the Dissertation

Any scholar candidate who is after a problem and a solution that arose from their curiosity, observations and previous technical hardships must cast a wider net to understand the depth of the issue. Every agile researcher should own a specific problem and internalize it dearly. Unique solutions sparkle and bloom out of problems that dedicated researchers ask authentic and accurate questions to solve. It is all being performed for that candid and explicit "a-ha moment" at the end of the thesis. Thus, hypothesis questions are the kernel of dissertations in all aspects. The precision of questions that researchers ask through their exploration illuminates the bleeding edge of their main problem.

Consequently, a hypothesis is the barebone of the whole paper. No research, empirical or otherwise, can avoid interpretive assumptions. They are found at many levels in methodology: in formulating general perspectives (e.g., seeing translation as reported speech, or as cannibalism), in definitions and classifications, in operationalizations (we can measure quality as...), in interpreting results, and so on (Chesterman, 2011).

Without reinventing the wheel, we must acknowledge that quality comes first before quantity comes down to hypothesis questions. An excessive number of questions may take us away from our core, decreasing their leverage effect on the conjecture. On the other hand, multidimensional questions must be asked to "open the kimono" and get what we need out of the research. The triaged questions we ask through building up a sturdy hypothesis tailwinds our assumptions, brings scalability to our findings and enriches the quality of the paper.

Every question we asked through the steps of building our hypothesis has been thought over scrupulously and reconsidered before including them in this paper. The

questions we ask here are the bricks we use while making our hypothetical proposition and defence. Therefore each of them has its role of enlightening a dark spot or a part of a problem, if you may tag.

As technological advances shaped current market conditions, internet speed, cloud computing trends, and hardware infrastructure at companies, classifying ERP's was also evolved. A few decades ago, the conventional method of using software programs passed through the occasion that they were required to be installed into a server computer hosted inside the company. Besides installing a database, runtimes, compilers and a few more supportive components into the server, the end-users who were supposed to use that software also had necessary scripts installed into their local personal computers or workstations. Technically, it would not be wrong to say there were many installing going on at companies. In addition to these tasks, there were several licensing fees, service fees, data and energy backup units. In these ventilated safe rooms, servers are stored in an IT department that solves either user, hardware, or software-related problems. Sadly, that old-school picture described above is still visible at many companies in Turkey. The old, chunky, inconvenient, and costly era is transitioning into a contemporary cloud-based user experience epoch. The transition is not taking a single step at once but moves by station, and each station is a milestone for the maritime industry from that perspective. According to Panorama Consulting's reports about the market of ERP systems, cloud-based and cloud-hosted ERP systems grew from 15% market share to 42% between 2014 and 2015. These results can be interpreted as a sign that migrating from on-premises to cloud-based ERP is fast. According to the report released by the same entity in 2016, 44% of the ERP systems

were deployed as cloud-based systems during the past year (Panorama Consulting Group LLC, 2021).

Fiber optic internet connections took the computing trends to the next level in the world and Turkey as of the 2000s. This development put a part of the software industry into a visionary league while putting some orthodox companies in a straw man fallacy position. While discerning and farsighted developers had already been involved with cloud-based ERP products, others were not eager to adapt to change, which was already there. The servers hosted "in-house" were the first to leave home to co-location places, followed by personal computers. PCs have been replaced by 'thin clients', which are more simple devices than personal computers, yet they are more robust and stable. Efficient and effective deployment of these devices leads to many advantages as;

- The use of Ultra-Thin Secure stateless devices instead of PCs leads to decreased maintenance, employee user time, IT Operations and Software license costs, leading to Reduced TCO and better ROI.
- Decreases risk of Virus attacks
- Eases Management and operations
- Reduced downtime and gives a highly available architecture.
- Decreases the chances of theft of data from the client end.
- Leads to fewer environmental requirements and lower energy costs.
- Stateless Ultra Thin Clients like Sun’s Sun Ray Thin Clients offer better security and additional features like hot-desking and session mobility.
- Thin Clients should be deployed as Secure Client access devices and should not be considered as a replacement for Multimedia PCs (Ahuja, 2007).

While web-based commercial software programs were sighted on the horizon, some market leaders of the logistics software industry in Turkey surprisingly resisted the unavoidable change. In the following chapters, this study will dive into the details of the historical background of those times in the limits of the Turkish Maritime Market by questioning why those companies behaved the way they had. Furthermore, the interviews with the company owners, marketing managers, or CEOs will support our perception of understanding today's needs. Consequently, this research aims to create a solid academic touch base between the past and today in the perspective of software development in the maritime industry in Turkey.

Today, cloud-based computing has already taken the lead, and there is a significant shift from the above-defined swimlane to web-based platforms. It is not a premature attempt to describe web-based platforms as the new normal of current times. This organic growth and change opens the doors of new opportunities for hyperlocal maritime companies and eventually solves the problems that others who have missed the train could not. At this spot, the primary concern of this research appears. How do we develop a contemporary web-based, innovative software alternative for the maritime industry in Turkey? What stages and steps do we need to put on the table while budgeting the project? Which innovative tools shall we provide to our customers, and what those tools change in their daily operations? Where will the core of the software be stored, and how will it be served to customers? When is the appropriate time to deploy it as a ready product? Finally, how do we peel the onion through the pipeline of attracting customers and get the product monetized?

This research takes all these featured questions and more into the spotlight and delivers a consistent scientific solution by supporting theories, methods, hypotheses used in it. The dissertation will seek reliable findings empowering the assumptions built around the research problems on developing a web-based innovative software alternative for maritime companies in Turkey. KSHAL is being designed for small to medium-sized maritime freight forwarding companies employing up to 50 employers, who are considered or classified as CALs (Client Access License) in our analysis. Their activities are container trading, buying and selling second-hand or brand new shipping containers, container storage activities for own or third-party inventories in multiple warehouse locations, container shipping, and freight forwarding activities utilizing sea, air, rail and multimodal transportation.

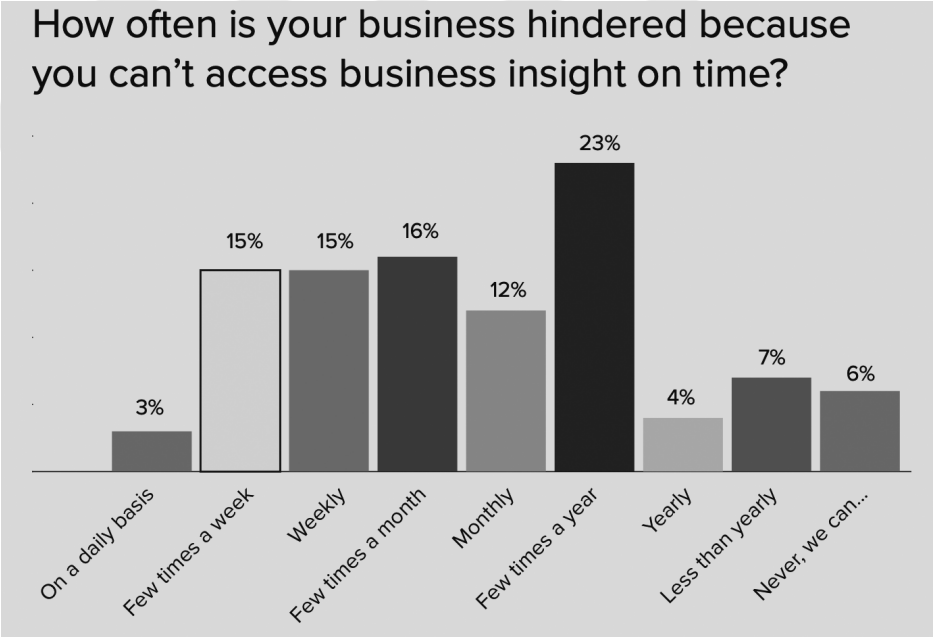
In addition to this, sales, customer relationship management, marketing, documentation, operations, price quotations, reports, error handling, and dashboarding are inseparable functionalities of the above-listed practices. This description draws us a picture of whom we estimate to design the product and endeavour to sell it. On the other hand, if we keep several balls in the air, it would be futile to satisfy neither the investors of KSHAL nor the software buyers. Therefore, the project's motto is to keep it simple and functional rather than boiling the ocean. The screens of KSHAL must be designed for easy navigation of novice users.

Nevertheless, it is supported by a high-end coding method and a reliable database structure, providing a driving force, security, and accessibility. Significantly, the accessibility criterion has critical importance among the other criteria mentioned above. The practical, secure, fast reach to company data is a game-changer parameter on many

occasions in the shipping and logistics business, particularly when the competition gets stiffer every day. According to the research published by Purestorage, the cloud services company, half of the respondents indicated they had lost a business opportunity due to the lack of necessary information. This situation occurs a few times a year for 31% of organisations and weekly for another one-third of companies (Purestorage, 2019). Therefore, it shows us how crucial it is for companies to get their data accessible by the right people in the right shape and time.

Figure 3

Data Accesibility Research Answers



Note. From purestorage.com

The same research adds that 78% of businesses believe they can boost business performance by 21% if they can quickly access their business insights; only 6% of businesses already have access to insights on time. Respondents indicate their business is hindered by a lack of timely business insight, mostly a few times a year (23%), and some

even a few times a month (16%) and a week (15%). The UK organisations are most likely to possess the information necessary to make the right decision. However, on average, 8% of employees do not have access to the information they need. The main reasons for this are doubts about the use and value of data (58% and 67% for Germany and UK, respectively), lack of technological ability (27%), and the fact that business is siloed (33% UK and 27% France) (Purestorage, 2019).

Several criteria have been considered while defining the research questions and factual research boundaries, such as personal inclination, resources availability, relative importance, researcher's knowledge, practicality, data availability, feasibility, and area culture. Hence, the research questions are as follows;

- Whether a web-based maritime software creates an effective use or a practical value in adding efficiency to the shipping operations of users?
- Does a web-based maritime software construct a substantial benefit on customer relationship management divisions of small and midsized freight forwarders and supply chain companies?
- If a web-based maritime software engenders a momentous improvement on sales and marketing activities of small and midsized freight forwarders and supply chain companies or not?
- Do web-based maritime ERP programmes deliver an essential refinement effect on the operational documentation process of small and midsized freight forwarders and supply chain companies or not?
- Does a web-based maritime ERP trigger remarkable progress for good data handling of small and midsized freight forwarders and shipping companies?

- Whether a web-based maritime software provides a noticeable decrease in operational software-related expenditures of small and midsized freight forwarders and supply chain companies?

If we compile the questions mentioned above in one powerful statement, the primary hypothesis of this paper is; (H1) a web-based innovative software named KSHAL as an ERP for maritime companies creates an outstanding efficiency and effectiveness on their business operations. Accordingly, the **null hypothesis** (H0) is; there is no noticeable improvement in the overall operations of maritime logistics companies when they assign a web-based platform such as KSHAL as their primary ERP software.

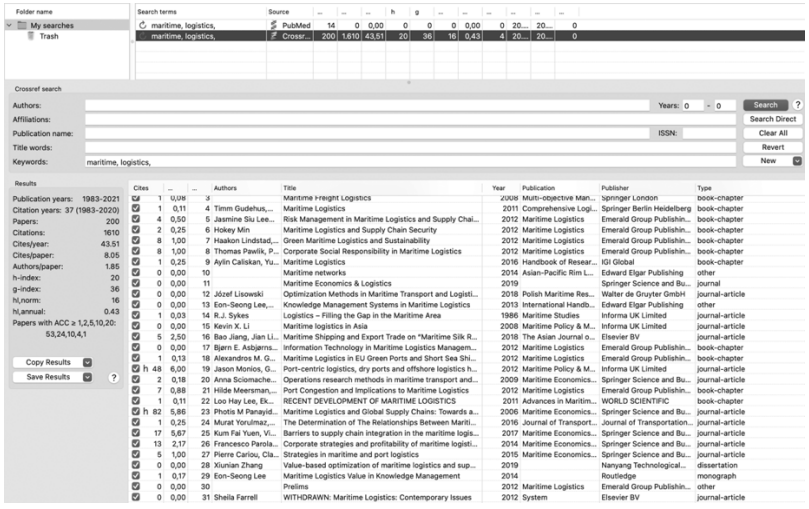
2. LITERATURE REVIEW

A determined and well-planned literature search is one of the strongholds of an accomplished paper. This dissertation benefits from hundreds of academic publications which had been published between 1983 and 2020. The documental foundation of this study was supported by articles, PhD papers, industry-related periodicals, web portals and social media, webinars and one-on-one meetings with key players, moguls, pioneers, free thinkers of the research subject in Turkey. Most of these resources will be cited throughout our text and indexed in the References section.

Harzing's Publish or Perish (HPP) software became the main tool during the literature research, compile, verify and categorize process of our groundwork. The literature review covers the period between 1983 and 2020 while assembling the references (Harzing's, 2020).

Figure 4

Harzing's Publish or Perish Literature Search Software Screen



This particular era is also constituting the linchpin of our theoretical approach. Through HPP, several academic indexes have been searched and sorted to gain access to

relevant data. Crossref, Microsoft Academic, Google Scholar, Scopus, Web of Science, and Researchgate were the major indexes we applied. At the same time, we use keywords such as maritime software, shipping ERP, logistics technology, cloud computing, web-based ERPs, software development, new trends in shipping, A.I. applications in the maritime industry and more.

Elsevier's Science Direct was another helpful instrument for exploring the notable amount of enlightening and enriching materials supporting our thesis. Most sources that contributed to our research have been selected among the publications with an academic accreditation and scientific background. Nevertheless, magazines and periodicals were not neglected along with the literature review thanks to their hypersensitivity for industrial, theoretical, technological advances and innovations.

Apart from the above, physical publications have been reached and taken into the pool of references used in this paper. This paper consisted of two communicating research divisions; one is maritime, and another is technology; it was compulsory to select publications speaking of both languages. One of the challenges was that the topic might have quickly progressed into the technical direction by concentrating on coding languages, software engineering, database mechanisms and the other niche fields, which would set this research as challenging to read, understand and be useful for people in the maritime industry. Therefore, the resources we have cited have been merely inclined to maritime, shipping, transportation titles with technology, IoT, web-based software development subtext.

The secondary challenge of being involved with tech or IT-related researches is that relative trends change, morph, evolve and even disappear at an enormous speed; so do

reference publications and sources. Therefore, to carpe diem and keep the area of interest fresh, it was a laborious but fruitful experience to reach out to visionary publications. In light of the above, our dissertation has a salient role of acting as a bridge "solutioneering" between technological fields and freight industry by blending those departments in a well-interpreted context.

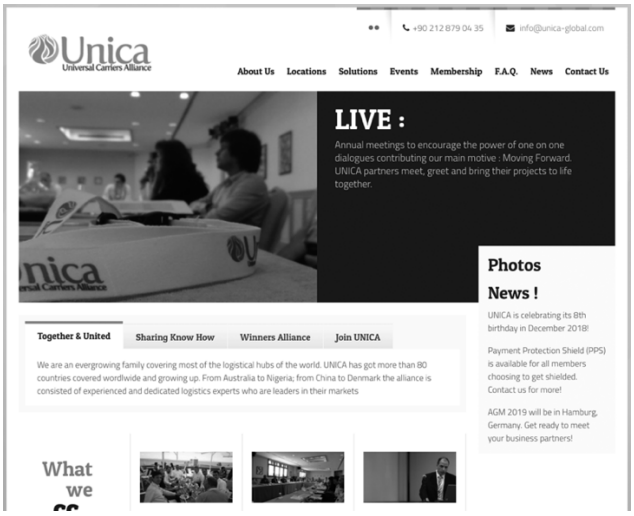
"***The Handbook of Logistics & Distribution Management, 4th Ed.***" which was published by Alan Rushton, Phil Croucher and Peter Baker in 2010, was one of the main contributions to this dissertation along with "***The Logic of Logistics - Theory, Algorithms and Applications for Logistics Management, 3rd Ed.***" that was published by David Simchi Levi, Xin Chen and Julien Bramel in 2014 through Springer. Suman Sarkar's "***The Supply Chain Revolution - Innovative Sourcing and Logistics for a Fiercely Competitive World***" was a tremendous resource expanding the vision of this study, while "***Supply Chain Optimization***" written by Joseph Geunes and Panos M. Pardalos in 200 was adding visualization to our heavily data-driven field of research. The terms of sustainability on operations, customer satisfaction, profitability and company growth is a frequently heard and used definition since last two decades in management sciences and economics; Paulina Golinska's "***Logistics Operations, Supply Chain Management and Sustainability***" was one of the publications this dissertation have benefited from whilst "***Technology Management for Sustainable Production and Logistics***" written and co-edited by Arkadiusz Kawa in 2015 delivers a broad sense of profundity to this analysis.

Besides published or broadcasted sources we have reached, it was necessary to hear from the industry leaders dealing with software development for freight companies in Turkey for decades. One on one, exclusive interviews with people like Ergin Kargalıoğlu

from SOFT Bilişim, Gökhan Girgin from SELECT Technologies, Aynur Kaya from DOA Software were illuminative experiences that are cultivating the importance of our dissertation but also a splendid supplement for people willing to see the core competency of relevant industries straight from the bakery. Universal Carriers' Alliance (UNICA) is a freight forwarders network with over 60 freight forwarder members from all world continents except arctic territories. Twenty of these companies have contributed to our research by answering our AHP questionary regarding which DB structure they are using, which coding language was their ERP built by, which deployment environment would they prefer to have their ERP ran and what software pricing methodology they would choose to be involved with for their organisations (Universal Carriers' Alliance, 2021).

Figure 5

Universal Carriers' Alliance



Note. From www.unica-global.com

As a summary of this section, the thesis purposedly compiled a balanced variation of supportive resources from both popular and academic leagues to create a broader volume of perspective while seeking reliable answers to its central questions.

2.1 History of I.T. Applications in Logistics

The first internet connection was relayed between METU and its counterparty in Washington on 12nd of April 1993. Also, in 1993, METU and TÜBITAK established a dedicated 64 Kbps Internet connection between METU and NSF with funding from the State Planning Organization. The decision to connect to NSF rather than CERN was based on traffic analysis of the EARN/BITNET connection, which showed that about 80% of the traffic entering Turkey came from the United States, and most international traffic originating in Turkey also terminated in the United States. The connection with NSF marked the official birth of the Internet in Turkey (Wolcott, 2000).

Compared to other media sources, radio, tv broadcasts and printed media, the internet has gotten the best attention from individuals to corporations in a glimpse of an eye. Four years later, there were a dozen of internet service providers (ISP) in the country. The internet was a revolutionary change in the SCM sphere in all aspects of Turkey. It was both a game-changer and a booster in this field. The fourth industrial revolution can be described as "a shift in the manufacturing logic towards an increasingly decentralized, self-regulating approach of value creation, enabled by concepts and technologies such as cyber-physical system (CPS), Internet of Things (IoT), Internet of Services (IoS), cloud computing and additive manufacturing and smart factories", according to Marko Rüsch and Erik Hofmann (Rüsch & Hofmann, 2015).

Comparatively simple programs used by transportation companies have evolved into advanced communication tools and detailed resource planners. Cargo plans which we call "disposition drafts", have been moved from paperwork to digital platforms step by step. Electronic Data Integration (EDI) technology has helped maritime companies to exchange

cargo manifests electronically between their international agents. The customs in Turkey are interconnected by the support of both the internet and newly built software platforms such as Bilge (Durusoy, 2016).

The internet triggered several monumental changes in operations, sales, management, and customer relations. GPS-assisted Automatical Identification Systems (AIS) has emerged from being used by the limited number of government departments, port or customs authorities to web broadcasted positioning utilities that help merchants and the maritime industry players track their goods on whichever vessel they like just by few mouse clicks. Along the way of this change, software companies providing various solutions to shipping companies had already changed their vision to mobility. Sales teams would take more active roles with quick response times for customer requests by instant quotations. While inefficiency was vaporizing and vanished, obscurity on managing a large number of sales teams in wide area networks was getting more visibility by internet-supported software tools.

The efficiency of a global supply chain network is predicated on the availability of an efficient, reliable global transportation system. No supply chain can operate efficiently if the assets used in the conversion of raw materials, manufacturing and distribution of the product are not being managed effectively (Cheng, Geunes, & M. Pardalos, 2005). This fact is valid for industry-specific expert ERP systems as well.

It is an elusive discussion that came first whether the benefits of the internet on SCM industry or the demand of the maritime sector to have innovative IT infrastructures that lead companies to transparent management systems. Anyhow, it is a fact that both sides have benefited from this interactive demand and supply process. The software companies

that were unfamiliar with what maritime, logistics, freight forwarding industries need get to know more about glossary of terms in this field while practising more on delivery types, transportation modes and papers generated by shipping companies, while the opposite side was also learning new operational possibilities to improve their services.

The SCM industry was among the top 5 flagship industries that demanded more from the IT sector and the retail industry, banking, military services and IT business itself. As a result, the SCM market was demanding and one of the fastest industries that adapted to the change, coop with it, and led the digital revolution in many ways.

Fiberoptic connections went on the public's disposal as of the 21st century's first decade, and it was followed by high-speed mobile internet that is being scaled up to 4.5G as of 2020. Increased speed and bandwidth of the internet means more data to handle in a shorter time. It also means deeper data analysis and prescriptive solutions out of those that experts have analyzed. Since the 2010s, the maritime industry has become more involved with deep learning, AI, prescribing logistics, autonomous vehicles, robotics, dark companies, blockchains, augmented reality, simulations and digital twins. We can observe that the progress is impressive in such a short period. Not a long time ago, shipping companies were issuing the bill of ladings written by typewriters. Nowadays, web-based platforms such as INTTRA aim one-time data entry through a single-window process to electronically publish the same documents. The Single-window process could not be performed without having the internet or compatible IT inventories. The Single-window environment aims to expedite and simplify information flows between trade and government and bring meaningful gains to all parties involved in cross-border trade.

In a theoretical sense, a "Single Window" can be described as a system that allows traders to lodge information with a single body to fulfill all import- or export-related regulatory requirements (Butterly, 2019).

It is all about the data being submitted into a chain of transactions along with the SCM stations, from the start to the end. Whoever submits the first data is tagged as a critical player, and the rest of the entities benefit from having the same data running through their systems. This idea which governments support, could not be that triumphant without blockchain hash batches. This crypto data transferability provides fast, secure and effective communication between the shippers, carriers, customs and third parties involved with this same delivery.

Among those listed above, prescribing logistics as a newcomer is another exciting trend that bucks traditional methods in the world of transportation. The influence of the word "prescribe' is coming from medicine as we know it. New mechanisms in data handling technologies helped companies analyse more extensive sets of data, sort them out in a shorter time, restructure & categorise the data more accessible, and interpret it for good as accurately as possible. Top performing companies are transforming and harnessing data adopting advanced analytical and dynamic optimisation capabilities. Starting with descriptive analytics of the current state, they are moving to predictive analytics to describe the future or alternate states and prescribing analytics to optimise outcomes during the supply chain planning and execution phases (AberdeenGroup, 2019).

The significant data movement in analytics made the data owned by maritime companies more accessible and understandable by management. Companies had an ample opportunity to develop recommendation engines guiding them to the make right decisions

before anything unwanted, possibly or unwillingly, occurs. In a way, simple "dumb" software systems became "smart", fortune-telling prevention engines that keep companies making probable managerial or operational off-beam decisions. For example, how many containers should we store at Tel Aviv warehouse, and what type? It is prescribed by the intelligent systems we have, monitoring and analyzing the last decade's sales peak points correlated by certain repeating events such as holidays or harvest and crop seasons. What if we operate dozens of container terminals at all through the Mediterranean ports? That question is being solved by prescribed logistics methods assisted by innovative software platforms used by maritime companies.

Significantly few companies have shaped up the history of IT in logistics in Turkey in the beginning as that segment was considered a niche market. However, two prominent actors in this industry were SOFT and SELECT corporations. These companies will be investigated in detail in chapters 2.2.1 and 2.2.2, besides relatively younger companies that have later joined the race after these two pioneering companies. Anyhow, although these companies have brought significant dynamism into the shipping and freight forwarding industry in Turkey, along the way, they also have sidelined the obstacles against innovation for the sake of protecting their profit margins and market segments. As a result, the Turkish Maritime Industry would have used newer products much earlier than their international competitiveness had. This dissertation will also aim to enlighten this problem with further investigation and reviews.

The study will focus on two main periods as before and after the 21st century. Among those two periods, the real epochal change happened by the paradigm shift between conventional software programs installed and used on the local server-side to newly built

web-based products that require fewer hardware investments and fewer CAL fees but require higher internet speed and broader bandwidth. Thus, our historical outlook will follow an inductive process axiologically by taking the review from details and bringing it into a conclusive point that will show the background of the change in the IT industry in Turkey during the last two decades.

2.1.1 Up to the 21st Century

According to Dr. Murat Erdal's "***International Freight Transport by Railways***" book which was published in 2009 by UTIKAD, the chronology of cargo transportation in Turkey has four periods as follows (Erdal, Güvenler, & Sandalcidis, 2009);

- Before The Republic (Up to 1923)
- The Republic Era (Between 1923 and 1950s)
- Road Freight Dominan Period (Between 1950 and 2000)
- The Current Phase (From the 2000s till today)

The maritime industry is the oldest disciplined shipping sector among other modes of transportation, namely rail freight, road freight, air freight, pipeline and energy transportation and multimodal freight. As long as history goes back to when sails were invented, the history books indicate that trade lines were built by naval and cargo ships discovering the globe port by port either by wind or by force of arms. Despite the history of humanity primarily written by wars, blood and enslavement, those ships carrying slaves, soldiers, weapons, and powder also connected cultures and trades of all the nations on earth. Van Gogh was inspired by Japanese screenprints, which were used as packing paper to wrap up porcelain dinnerware imported from the Far East to Europe carried by ships. The famous spirit called rum was invented by natural cause of long journeys between the North Europe to Australia and The U.S.A. Some historical references took the maritime industry's beginning to 3000 B.C. to a region known as Pakistan and India. As our main subject is not investigating the historical background of the maritime industry as a whole, it will be enough to move the text right back into our title. The maritime industry was also the driving force and the pioneering transportation services sector in the Ottoman Empire and later in

Turkey since railways have begun carrying passengers and goods as of the 1850s. The first Ottoman railway company was incorporated in 1857. The Ottoman state primarily desired the construction of railroads to increase its political control over its territories. The poor roads hindered wars in remote locations and the mobilization of troops to fight against rebellions. It did not have the funds to finance the building of railroads and the current technological knowledge for building railways. So, the foreign railroad firms of major European powers constructed and operated many railroad lines (Hanedar, 2013).

Despite the lack of well-equipped marine ports, modern piers, freight stations, railways and maritime cargo shipping sectors were the main powerhouses of the transportation industry in young Turkey up until the '50s. The port and pier operatorship and stevedoring business sectors were under the management of foreign companies until the 1930s. The young republic has paid utmost attention to the modernization and reorganization of existing ports by introducing new laws. We noticed the priority of this renovative approach from Mustafa Kemal Atatürk's speech at the TBMM on the 1st of March 1923 as he pointed out the importance of Mersin's commercial potential. During his speech, Atatürk mentioned that a commercial and a modern maritime port would be built in Mersin as necessary permits are granted by the TBMM. By abolishing capitulations in 1926 and putting the Cabotage Law, Article No:815, in use, the maritime industry had new milestones changing the shape of the shipping business in Turkey. This change was followed by establishing The State Ports General Directorate (SPGD) in 1939 by article 3633. By this regulation, SPGD was put in charge of running state-owned ports, providing stevedoring at terminals, acting as a ships husbandry service supplier to incoming and outgoing vessels, bunkering and pilotage. It was evident that the Turkish Maritime Industry

was more disciplined and modernized with new state policies and newly established transportation entities. The new logic and paradigm were also the reason for organic growth in the transportation industry in Turkey. It is possible to express that all necessary commercial ports had been either built or reconstructed within the first two decades of the young republic. Izmir, Mersin, Trabzon, Iskenderun, Samsun ports became main hubs for international shipping in Turkey.

The maritime industry had a priority next to other modes of transportation until the 1950s when road freight opportunities started to sparkle at the horizon of Turkish economic scenes. Trucks became more affordable vehicles as of the '50s and helped the economy get the benefit from them by positioning these units easily at any location that has even a moderate road connection for "door to door" deliveries (Ministry of Foreign Affairs, 2020). While maritime required bigger investment budgets, trucking entrepreneurship could jump-start by smaller financial allocations. The first international trucking companies had been incorporated in the late '50s or the beginning of the '60s. They were the first comers of the private investors in the global transportation industry of Turkey.

Thanks to the market concept back then, the trucking business has made this sector more accessible by small and medium-sized entrepreneurs. Horoz Transport was established in 1942. Sağlık was born in 1950, Gökbora was founded in 1954. Hareket Project Transportation Llc was incorporated in 1957. Elmas followed it in 1958, Magdenli in 1966, Ceynak in 1969, Turksped and Orkun Group were incorporated in 1969, Bakımcı in 1970, Ulusoy was established in 1928 but focused on international road freight service as of the 1970s. In addition to this Borusan transportation division was founded in 1973; Omsan and Solmaz were born in 1978.

All these companies listed above had started their commercial life by centralizing their primary business activities in the trucking field. The Turkish economic conjuncture was a considerably closed environment for foreign investments until the beginning of the '80s. It was heavily dominated by government entities managing critically essential bodies such as marine and airports, railways, airlines and customs bonded warehouses. The privatization era has begun with Mr Turgut Özal's prime ministry as of the 1980s. He was a profound supporter of the libertarian economic policies and free-market structure, which have opened the shipping industry, among all the other business sectors, to the attention of foreign investors. Özal attaches high importance to the liberal economy such as freedom of enterprise, free market and privatization in its applications and has achieved significant successes in this field (Eray, 2018).

Several monopolistic organizations have been privatized with this flow of open economic policies in Turkey until the end of the 20th century. During these two decades between the '80s and '00s, there was a fierce boom in the maritime industry, transportation sphere, and SCM divisions. During these two decades, the pioneers of freight forwarding in Turkey were born, namely; Barsan (1982), Enco (1985), Balnak (1986), Mars and Sertrans (1989), Ekol and Reysas (1990), Netlog (1994) and Kita (1995).

The progress of the software industry has gained an accelerated movement upwards at the beginning of the '90s. The typewriters used to write TIR Carnets were abandoned and replaced with primitive versions of expensive personal computers (PC). A common practice had a PC in every company initially due to the unaffordable prices of those devices. SELECT Technologies was born in 1994 during the last decade of the 20th century to provide custom-made transportation solutions for freight forwarders, shipping companies

and customs brokers. SOFT IT Solutions was founded only two years after The SELECT and stimulated the market for software developers for the SCM sector.

In this sense, it is possible to praise these two entrepreneurs as godfathers of the shipping software industry of Turkey. The date range between 1990 - 1995 had played the utmost important role while changing the old technological habits in Turkey. Özal's libertarian economic policies opened the doors of customs for both local and foreign corporations to relay tradelines between each other more effortless than before. As the economy and state infrastructure got modernized, the benefits of the change were blooming. In retrospect, Özal's influence embodied a strong positive dimension. The continuity of leadership throughout the 1980s was instrumental in Turkey's swift recovery from the deep economic crisis that the country had found itself in during the late 1970s (Oniş, 2004). Thanks to Özal's free-market applications, during the '90s, a record amount of maritime, shipping, freight forwarding and logistics companies have kick-started in Turkey. However, most of these conglomerates are still the upscale trend-setting entities of the maritime industry in Turkey.

While the transportation market is emerging in Turkey, the I.T. industry was also moving forward with immensely remarkable inventions. Computer processor company, Intel's X86 processors, were game-changers at both; data processing speed and pricing scales. These processors have set P.C.s more reachable for the end consumers. Microsoft released their groundbreaking flagship operating system, Windows 95, on the 24th of August in 1995. Unlike its predecessor, the Win3.1 that was a 16-bit operating system, the Win95 was a 32-bit operating system sold at relatively lower prices to reach masses and the masses did they reach. Legendary 'desktop" feature has first appeared on screens of

computers with Windows 95. Some followed it -nowadays, considered as simple changes as right-click function and plug and play utilization.

The most significant change that took place with the Win95 was the user experience (UX). The operating system has made all tasks relatively straightforward, more understandable and inter-compatible with third-party hardware and software. The industry had what they needed at the first batch. An affordable, fast, reliable hardware that every company can buy without being stressed about its price and a simple operating system that delivers a smooth ride to even novice users working at all departments of companies from the warehouse to the front desk, sales to operations, documentation to accounting. IBM and Microsoft front have gained almost a monopoly status against their rivals, namely Apple. However, they have kept the price of the operating system as low as possible to expand the number of their customers all over the world. It was a noteworthy success, but there were still missing points for the maritime industry to complete the picture; an ERP and a reliable database engine.

Databases (DBs) have played a compelling part in the recent evolution of computers. The first computer programs were developed in the early 1950s and focused almost entirely on coding and algorithms. Back then, there were no DBs as we know it until the '60s. In 1960, Charles W. Bachman designed the Integrated Database System (Foote, 2017). IBM followed that invention, and they have created their database structure which was named IMS. These two were the 'primogenitors' of today's databases; anyhow, IBM's contribution to DB technologies was far devoted than the others back then. Michael Stonebraker and Eugene Wong from UC Berkeley have successfully demonstrated that a relational data storing, analyzing, structuring, classifying model called INGRES could be

efficient and practical in 1973. This method has pushed IBM to develop SQL (Structured Query Language) in 1974. SQL as a low-level coding language that only works on DBs has been invented by Donald D. Chamberlin and Raymond F. Boyce, mainly based on Edgar F. Codd's relational database management systems (RDBMS).

The data as a value, even as capital, does not come in good shape all the time. It needs to be sorted out, classified, refreshed, validated and restructured. As the data held by maritime companies grew, it came to the table as a problem of managing this data and how to interpret it for the proper use of companys' sake. The need has brought NoSQL to the stage as a responding tool to work on through document databases, key-value databases, wide-column stores and graph databases. NoSQL databases are often categorized according to the way they store the data. They fall under categories such as key-value stores, BigTable implementations, document store databases, and graph databases. NoSQL database systems rose alongside major internet companies, such as Google, Amazon, Twitter, and Facebook, which had significantly different challenges in dealing with data that the traditional RDBMS solutions could not cope with. NoSQL databases are often highly optimized for retrieve and append operations and often offer little functionality beyond record storage. The reduced run time flexibility, compared to full SQL systems, is compensated by significant gains in scalability and performance for certain data models (Berg & Seymour, 2012).

MongoDB is an excellent example of those NoSQL databases that work fine with big, unclustured, unsorted data. NoSQL type of databases are highly scalable, relatively cheaper, can process unstructured or semi-structured data and have an 'easy going'

relationship with other collaborative tools whilst they are resource-intensive, demanding high RAM and CPU allocations.

IBM was not alone during their attentive approach to DBs. Larry Ellison, who co-founded Oracle Corporation in 1977 with Bob Miner and Ed Oates, was also keen on putting out an alternative DB architecture capable of handling heavy-duty missions. Ellison was also influenced by Edgar Codd's "Relational Model of Data for Large Shared Data Banks" paper which was published in 1970 (Codd, 1970). Just two years after their incorporation, Oracle V2 was released in 1979. Oracle DB, in all aspects, is more expensive than its competitors but capable of handling more prominent data structures thanks to its unique procedural language extension as known as PL/SQL.

Not long after the DB trends sharpened and evolved to a promising and challenging direction in the '80s, Microsoft's turn was to release their MS SQL Server product in 1989. MS SQL Server was a comparatively cheaper product than Oracle, yet it was strong enough to respond to heavy DB queries. Moreover, the DB market enriched and shared by IBM, Oracle and Microsoft were still big enough to host more newcomers.

In 1995, the first open-source DB platform, MySQL, developed by Swedish engineers David Axmark, Allan Larsson and Michael Widenius, was introduced. MySQL has two revolutionary differences from the other DB products in the industry back then. First of all, it was an open-source platform that was revealing the coding poetry to whom interested in developing their versions of the DB or creating new applications by using it and second of all, MySQL was free of charge under the terms of the general public license (GNU) aside from its several paid versions. The rebellious MySQL was an impactful change in the scene, thanks to its free license feature that helped students, individuals,

researchers, engineers, literally whoever could not afford to pay for MS SQL Server, Oracle V2, or IBM's DB licenses to engage in DB related software development, particularly web-based platforms. As a result, MySQL made web-based software development easy for the masses and became indispensable for the market up to the current time. MySQL is still one of the top choices for web platforms handling small up to medium size queries.

In 1987, Progress Software Corporation was born as a DB company built upon their product called Progress. Progress never went widespread in the industry as MySQL or Oracle V2, but it had its niche segment, especially among UNIX-based ERPs. This dissertation mentions Progress in this text because Soft Transportation Solutions still uses this DB actively, but it has never been one of the top ten DB platforms ever. PostgreSQL became the 2nd license-free platform after MySQL. PostgreSQL was first introduced in UC Berkeley in the U.S.A. PostgreSQL has earned a strong reputation for its proven architecture, reliability, data integrity, robust feature set, extensibility, and the dedication of the open-source community behind the software to consistently deliver performant and innovative solutions. PostgreSQL has been used to implement many different research and production applications. These include a financial data analysis system, a jet engine performance monitoring package, an asteroid tracking database, a medical information database, and several geographic information systems. It has also been used as an educational tool at several universities. As observed, the era between the '80s up to '00s had an immensely robust, almost monumental effect on the software world as we know it today. While the internet was appearing at homes by dial-up connections, the DB companies were sprouting through. The number of maritime entities increasing but becoming technologically more demanding and well organized when we look at them

through the eyes of software developers for the shipping industry. The supply chains that run the world at their fingertips today owe it all to the initiatives taken between the '80s and the '00s. Currently, engineers use coding languages such as C and C++ to develop products run on databases like MS SQL Server, IBM DB2, Oracle, MySQL, and PostgreSQL, which were invented between those years. MS SQL Server held the leadership flag long ago and still keeps it since then as an industry leader owns 18.6% of the market. MySQL follows it with a solid 15.37%, while Oracle and PostgreSQL have nearly 10% combined. In the following chapters, we will benchmark coding languages, databases, operating systems and ERP alternatives with all their details to find out which is the best for a web-based software alternative for the maritime industry. How fast could a DB go on a single read, single write and single sync steps? What is their accuracy during aggregation or while defining the shortest path? How hard do they go on CPU or memory usage, and how fragile they are on big data analyzes?

As a conclusion of this title, the shipping world had a considerable alteration within two decades up to the '00s, not only in Turkey but also in the whole world. On the other hand, the conventional transportation sphere had a successful mutation and drastically digitized most of its components, departments, tasks, operations in Turkey. The speed of change was triggered from both ends. IT companies have become accustomed to the needs of the SCM industry, and freight forwarders have become experienced in creating innovative services through the support of advanced and sophisticated hardware and software tools.

2.1.2 As of the 21st Century

The new millennium had begun with new opportunities and hurdles for the shipping industry in Turkey. On the one hand, there was a boom of start-ups in the logistics and transportation industry due to increased import, export and transit operations through Turkish ports and warehouses; on the other hand, relevant laws and procedures did not regulate the market. The cocooned industry was in the bloom of opportunities at both national and international sides, and to get access to these interactions, few obstacles including juridical regulations, the establishment of educational entities, technological capabilities, infrastructural stabilization of ground services, standardization of port, warehouse management systems must have been solved.

Table 4

Economical and Social Indicators (2000-2010)

Years	Added Values (Thousand Turkish Liras, 1000 TL)			Fixed Capital Investments (Thousand Turkish Liras, 1000 TL)		
	Transportation	GDP	Transportation / GDP	Transportation	Total FCI	Transportation /Total FCI
2000	8.908.992	72.436.399	0,12	4.663.254	16.116.404	0,29
2001	8.580.577	68.309.352	0,13	2.740.334	11.195.045	0,24
2002	9.618.386	72.519.831	0,13	2.406.210	12.881.304	0,19
2003	10.473.106	76.338.193	0,14	2.547.176	14.818.710	0,17
2004	11.597.023	83.485.591	0,14	3.873.703	18.884.408	0,21
2005	12.950.854	90.499.731	0,14	4.793.671	22.251.225	0,22
2006	13.830.467	96.738.320	0,14	4.951.056	25.234.306	0,20
2007	14.811.164	101.254.625	0,15	4.991.921	26.259.984	0,19
2008	15.026.108	101.921.730	0,15	5.552.179	24.891.676	0,22
2009	13.936.885	97.003.114	0,14	4.833.871	19.880.712	0,24
2010	15.402.230	105.738.813	**0,15**	6.589.978	25.894.268	0,25

Note. From " Added Values and Fixed Capital Investments (FCI) in Transportation Sector " Büyükkeklik & Ozoglu, 2013.

As it is shown above, the progress of the transportation industry in Turkey became more than visible. It is most likely a record breaker within the first decade of the new millennium as proof that the logistics sector is an important actor in economic development

due to its strong relations with the industry sector and services sector (Büyükkeklik & Ozoğlu, 2013).

In 2003, the Road Transportation Law Article 4925 was put in force purposely. The law aimed to regulate the road transport market by classifying sub-sectors in the industry and assigning a specific license for each sub-sector. The new law did not receive a warm welcome from the market and was firmly rejected by several NGOs, claiming it was hurriedly prepared and incomplete. Despite the objections, the law has been taken into force and brought a new understanding to the transportation industry. Article 4925 was heavily influenced by truck owners' demands and their years of long lobbying activities over government departments at The Ministry of Transportation and Communication.

In all aspects, article 4925 was a downfall for the SCM sphere in Turkey and did less than anything but set barriers in front of entrepreneurs willing to invest in the crawling Turkish maritime sector. The discipline and modernization which was needed, born within the market by the individual efforts of farsighted SCM companies. While article 4925 was applying specific fees for certain licenses and leaving the rest of the problems to the shoulders of freight forwarding companies, the law has been acknowledged as a tool that the government tickets the investors based on what they were willing to do. According to Article 4925, if a trucking company wants to perform international freight transportation, it has to own eleven freight units (combination of a lorry and 13.6 meters long semi-trailer) capacity equivalent fleet or a similar quantity of vehicles registered on its C2 license. It has to pay a 60.667 TL license fee. In the face of willingness to act as a freight forwarder with no fleet but significant know-how, proper legislation, staff, contacts, capital and goodwill, the company must apply for a TIO license and pay 183870 TL as licensing fee to the

ministry. The truckers who were considering freight forwarders as rivals rather than collaborators had a significant influence on this conjuncture with no corresponding or a similar example anywhere in the world.

The new transportation law had several side effects and flaws. While the world logistics markets tended to shift their paradigm from conventional transportation to 3PL and 4PL SCMs by enriching their customer-oriented approach, the Turkish logistics market was drowning in a pitfall of aggressively investing in trucks fleets rather than focusing on technological SCM solutions. After a while, it took the industry to realize that the fleet is in surplus, compared to demand, which exists in domestic and international scenes. The excessive truck fleet has caused more unbearable amortization and maintenance fees, less profitability, upsetting amount of human errors, laytime expenditures and horrible deficits on balance sheets. The secondary purpose of article 4925 was to try to push freight forwarders out of the market by applying unreasonable license fees. While a C2 for trucking companies was 100.000 TL, it was 500.000.- TL for freight forwarders. UTİKAD, which is the association of freight forwarders in Turkey, has protested and criticized these fees, loudly (Utikad, 2020).

On the one hand, it created unfair competition between a trucker and a freight forwarder in favour of truckers; on the other hand, the law officially positioned the government standing by a specific segment of the transportation sector while keeping the others distantly. A certain amount of freight forwarders, comparatively more active, flexible, energetic, farsighted and tech advanced entities, had to spend a significant portion of their capital for the R2 license that would cost them an arm and a leg. It will not be wrong to put it in words that article 4925 has slowed down the economic boost in the SCM

industry in Turkey by applying an enormous amount of licensing fees, more than regulating and disciplining the market. Shipping companies had to spend their funds on these unexpectedly high fees, which they could use on high-end software and hardware tools to accelerate their national and international growth. As we look at the problem from where this dissertation stands, it seems like article 4925 was a regressive move of the government that was loaded on the shoulders of freight forwarders, shipping companies and the maritime logistics industry.

As soon as the industry stabilized after the redundant change has occurred in article 4925, a flood of international investors began to enter the market in Turkey. In this respect, the first decade of the 21st century was the merging era between shipping companies. There were 72 foreign companies in the SCM industry in Turkey until the '00s, and it became 480 by the end of the 2nd decade of the 21st century. Aramex, Yusen Logistics, Hitachi, CJ Group, Toll, Abraaj Group, Kerry Logistics, Mirage Cargo and Austria Post were among those international investors who have discovered the potential in robust and dynamic Turkish logistics market and invested in either by acquisition the whole shares of the local corporations or merging with them in joint ventures. It was not just a buy-out process for the international investors but also a technology transfer, a know-how injection and a seamless integration opportunity for the Turkish transportation industry. When the big players of the shipping world had arrived, they came with their IT systems, warehousing solutions, distribution models, even with their unique freight algorithms. Multinational companies with their hyper location operational infrastructure set the ERP requirements to reach all areas without technical obstacles. Especially after 2010, with the availability of

highspeed 4.5G mobile internet, it became mandatory to have the mainframe of software applications deployed on the web.

While their international rivals had already completed the transition of moving their ERP services to the web, the Turkish software companies have neglected the need or have ignored it. The industry had a small pull-down by promoting relatively old database technologies and cumbersome software products sold in four up to six figures in the U.S. Dollars. For example, SOFT Technologies, which has been among the most vital IT solution providers for the Turkish maritime industry for decades, had shown a solid but futile resistance against the winds of change that were already blowing through their roof. They stuck with the Progress (OpenEdge) database that has its rigid limitations and expenses. While smaller ERP alternatives with flexible membership and payment conditions, even the LE version of SOFTwas priced from five figures of the U.S. Dollars and up. The Progress cannot register and display any alphabet, but in Latin, so does the SOFT. Suppose a maritime company would have a branch in Ukraine, Russia, Israel, China, Japan, or Saudi Arabia that was a direct "no way" to use SOFT. The company wishes to acquire a licensed ERP for their operations, accounting jobs and report creation needs was/is expected to invest in two servers as hardware (one for the ERP and one for the rest of the tasks), operating system licenses, office licenses for each user, database fee at the beginning and also annually, a dust-free room, back up and ups units, dedicated routers besides of the highly-priced ERP alternative that is not capable of including partners and customers into the same digital structure.All freight forwarders currently need to have a 'device' with an internet connection to have their fully functional ERP running at a fraction of the cost compared to conventional systems.

2.2 Leading ERP Solution Providers in Turkey

In Turkey, the last decade of the 20th century was dominated by two software merchants in the shipping sphere, SELECT Technologies and SOFT. These two companies had also shaped the operational workflow of a significant portion of the active companies in the maritime logistics business. Their screen flows, hardware requirements, documentation capabilities and limitations, business models have been taken as a point of reference by the shipping companies, freight forwarders and software developers. Whilst SELECT had begun with a trucking software built on Microsoft's Access DB and coded with DELPHI, which worked locally in a LAN for a freight forwarder enterprise called Balnak, SOFT had begun with an accounting program. It continued to build maritime modules around that kernel. SELECT has never chosen to code their built-in accounting module and always preferred to collaborate with third-party partners by integrating their structure with theirs. A solid and reliable accounting module of SOFT was always advantageous for the company while promoting their product as a unique, monolithic ERP solution that delivers all the services single-handedly which a shipping company needs.

According to PriceWaterhouseCooper's research dated 2019, the volume of the SCM industry in Turkey is 55 billion USD. Nearly 2000 companies shared this turnover as members of both UND and UTIKAD combined. UND (Uluslararası Nakliyeciler Derneği) stands for hauliers and freight forwarders which own trucks while UTIKAD (Uluslararası Taşımacılık ve Lojistik Hizmet Üretenleri Derneği) stands for freight forwarders which have more advanced operational infrastructure than ordinary truckers. From this perspective, the maritime sector is an attractive and intriguing market for software companies in Turkey.

IT companies are primarily situated in Technology Development Areas (TDA). As of 2015, 50 TDAs are hosting 3233 technology establishments that employ 27264 research and development (RD) and 4932 support personnel. Techno Parks, which are situated in TDAs, are incubation centres for software developing companies. Among that software companies, 77% of them are located in Istanbul, Ankara and Izmir. There are 35 large-scale software companies actively operating in the Turkish software market. Their product range is rich and diverse, from construction software programs to defence, health, textile, telecom and transport & logistics solutions. According to sector-wise analysis, 20% market shares of software companies are covered by the transport and logistics division, which is one of the strongest leagues compared to other sub-segments such as Manufacturing and Automation 40%, Telecom 30%.

Despite its relatively large market share, the number of software companies that centralized their RD in maritime, shipping, transport and logistics is small. The software market for the maritime industry is still a niche environment. One of the barriers in front of this niche segment is the progressing speed of the logistics entities in Turkey. While a software company may expect more significant turnovers and comparatively more satisfying profit per customer ratio when they supply products that answer to everyday needs, such as accounting or CRM, they tend to route their attention towards such areas rather than focusing into the maritime industry, which, by a point of view is a difficult segment to access in and gain new customers from. The maritime market is one of the complicated industries to get into. The quantity of transport and logistics companies are not as sparkling as others in retail, e-trade, textile, health and agriculture. The software demand of maritime customers in Turkey is well shaped, prudent but still has orthodox

traditions. Each software company sells their portfolio view before they promote their IT solutions. It is a more deterministic and decision-making tool for buyers of which other shipping and forwarding companies use specific software programs while choosing a new IT program. If a strong rival or an arch-contender uses specific maritime software, that is considered an upvote through the decision-making process of a potential buyer. In this volatile market structure that is mainly influenced by complex and orthodoxy behaviours of the buyers, the quantity of maritime software providers that allocate significant amounts of funds on RD remains stubby and meagre.

The second obstacle that blocks the path to an energetic and farsighted maritime software industry in Turkey is the human factor. Software development is all about speaking a language that we may call computer programming, constructed by mathematics's syntax. The contribution to software development begins with an analytical mind that manages clear reasoning with a mathematical background. The success of having a generation of people who understand algebra and using numbers to interpret algorithms and codes into real-life solutions runs through contemporary education. However, suppose unstable government policies neglect a constitutional right to reach modern education in fair conditions. In that case, the result will not benefit from having a better society before having competent software engineers. Due to this inherited obstacle with years of historical roots in the Turkish educational system, the Turkish software market has difficulties transitioning from a subcontractor status into a trendsetting, leading international player.

The third obstacle in front of RD operations in software development for the transport and the shipping industry is the lack of a professional management approach. The kickstarting system is a significant motive and an inspiration for new incorporations that

allow several investors to inject funds into creative, sustainable and reliable business ideas openly. When we shift our sight into the Turkish type of entrepreneurship in the software industry, we mainly observe the entrepreneur archetype as a software developer with brilliant technical skills who is eager to develop a solution that works and lacks managerial knowledge. The success is not based on the IT solution alone but all the other departments and administrative organs built around it. At certain times, it is heard that a failed project either falls because of a weak feasibility study that was not performed efficiently in advance or inexistent marketing, PR, top management functionalities. A skilled software engineer is not always a gifted and expert manager in human resources, accounting, marketing, decision making, budgeting, and strategic planning. Those tasks must be performed by professionals who fill the right shoes. However, software engineers often become software project managers with little or no training in project management. As a result, sometimes, they rely on hearsay or their assumptions to formulate strategies and a plan of action for managing software projects. This has led to several software project management misconceptions or fallacies that can have critical adverse effects on software projects (Moreno, 2016).

The production of good software is notoriously difficult. In the best of circumstances, designing, writing and implementing software is a task demanding unremitting effort and intellectual skill. Circumstances are rarely the best: users may not make their requirements clear and may make conflicting or impossible requests; users may fear the change that a new computer system will impel; business requirements are constantly changing, and project champions may quit (Seen & Mingins, 2001).

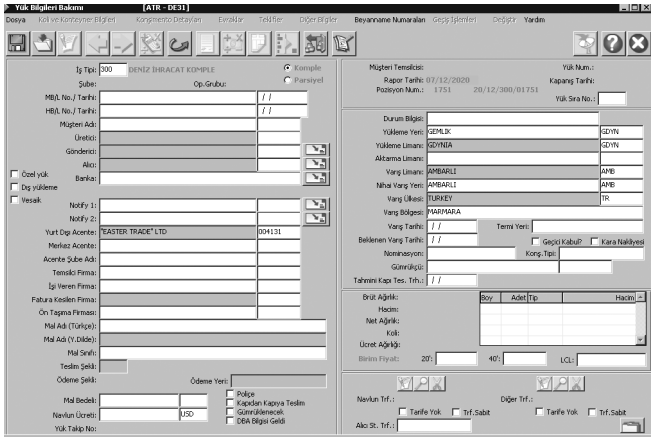
From this point of view, if the kickstarting type of business funding gets sincerely internalized in Turkey, sufficient funds controlled by professional management teams at software companies will create a leverage effect for the whole industry. Developing software and managing a company are two hats worn mainly by the same individuals at start-ups in Turkey is an obstacle that the industry needs to overcome this obstacle. We see senior developers as marketing managers or co-founders who must focus on innovative solutions drowned by balance sheets on several occasions. In conclusion, the Turkish software market for the maritime industry will accomplish more if professionalism becomes widespread among the existing companies. This is one of the main reasons why the companies are not able to export their products.

2.2.1 SOFT Business Solutions A.S.

Code is poetry if it is purposedly considered as art. Coding is a language or a method of communication between humans and transistors that compute the data on the information highway bilaterally. With this point of view, it will not be too difficult to tag coders as artists who blend artistry and craftsmanship in the same pot as effectively as creatively as possible. SOFT Business Solutions (SBS) has shown the artistry of coding successfully since 1996 in maritime, freight forwarding and logistics. Today, SBS is one of Turkey's most prominent and leading solution providers for shipping companies considering the number of customers served and software products supplied to customers. SBS has nearly 700 transport and logistics companies in their portfolio, and SOFTas a software program, has 155 individual modules which respond to every single possible sub-division of logistics operations seamlessly.

Figure 6

Cargo Screen



Note. From www.soft.com.tr

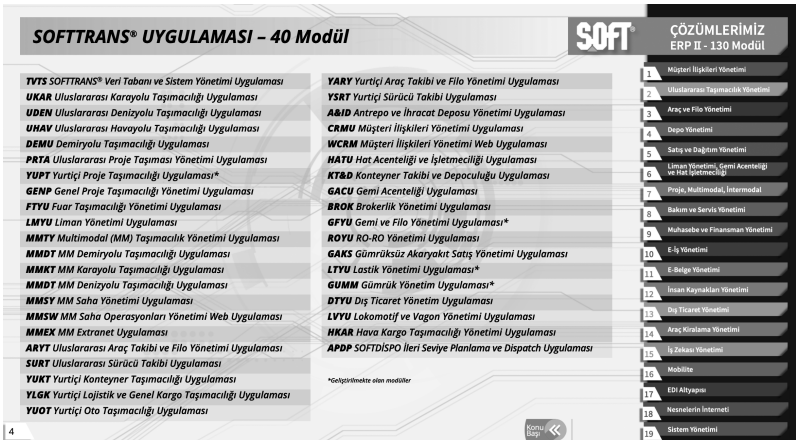
SOFT runs on the Progress DB, runtime ten, and it requires Microsoft Server to be installed to private servers in advance. SOFT is a resource-consuming product when it

comes down to the hardware requirements side to get the software working fully functional. A potential customer is asked to purchase servers as hardware with several HDDs and RAMs with Microsoft's Server licenses, CALs and Microsoft's Office programs to have SOFT just starting to work. Also, SBS insists customers purchase a secondary server that works as an integrator gateway between SOFT and E-Government applications such as E-Invoice, E-Archive, E-Bookkeeping.

Based on the case studies we experienced during over last ten years of using SOFTin extensive shipping operations, road freight cargo planning, airfreight tasks, sales activities, book-keeping, accounting, creating managerial reports and archiving; it is possibly one of the most accurate, versatile and satisfying software solutions for the maritime industry of Turkey up to date which also has its weaknesses and threats that will be shown in a breakdown underneath.

Figure 7

Features of SOFTTRANS



Note. Appendix F - SOFT Company Brochure 2017

SOFT as an ERP has four major application strongholds;

- Softtrans : The section hosts SCM modules

- Softfinance : Bookkeeping and Accounting Modules
- Softinterface : The interface of the software for all modules
- SoftE-Docs : E-Documentation Infrastructure
- Soft Mobil : Mobile Apps Integrated to Mainframe

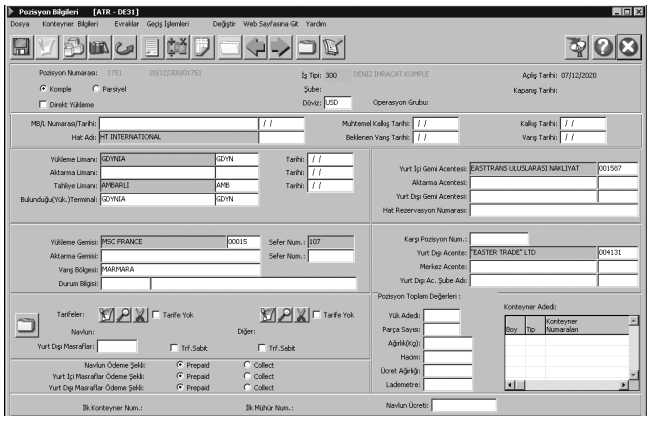
Softtrans has 130 individual modules, including road-sea-air-rail freight, project transportation, domestic trucking, fair and exhibition shipping, port management, multimodal transportation, truck and driver surveying, domestic container haulage, domestic courier transportation, vehicle transportation, customs bonded terminal management, CRM, shipping line agency, brokerage, ro-ro management, fuel supply management, tire management, locomotive and wagon management, foreign trade, truck disposition management and more (Soft Information Technologies, 2020).

At first sight, there is a complete software image on the table with full coverage capability of all the needs of SCM companies. On the other hand, there are many duplicate modules with slight differences that were named separately, which are practically doing the same jobs but sold in different packages. For example, if a customer deals with project transportation, SBS offers two modules: "Domestic Oversize Cargo Transportation Module" and "International Oversize Cargo Transportation Module". Delivering an oversize cargo from a factory to a domestic port is one leg of the process and carrying the same load abroad is another whilst they tend to be gathered, monitored and operated under the same umbrella rather than slicing up the bread and selling it as two products. The same approach is observed for vehicle control modules. SBS has two separate modules, priced separately for "International Vehicle and Fleet Management" and "Domestic Vehicle and Fleet Management". This might be a profitable method for the solution provider, but it is

not feasible for buyers to pay for two for one module that may easily cover all their needs at once. In small or large trucking companies, Fleet management is not separated as domestically and internationally but based on trips, most likely for roundtrips. Cost calculations for a truck are based on a round trip that it makes from whichever loading point it starts until it returns to the same cost calculation spot, which might be the same place that it had started or else. There are no rigid or sharp differences between controlling operations of the fleet, whether they operate on domestic or international routes, except minor cost factors that can be sufficiently handled in the same module or even in the same interface. SBS provides solutions with hundreds of modules, but it was evident that the number of the modules exaggerated for the company's profit-centric decisions, not because it has such a diverse and broad spectrum of tools. It is, in a way, a curse for software companies in the long run.

Figure 8

Position Screen



Note. From www.soft.com.tr

In the meantime, finance is the wheelhouse of SBS. Unlike its competitors, SBS had begun building SOFTon an accounting program environment by placing the fiscal

modules to the core of their product. According to SBS's marketing strategy, which gave them a sustainable customer retention ability, accounting had a key role and utmost importance at SCM companies. In this respect, SOFT was the first and only absolute turnkey solution for maritime companies in Turkey; it still -in a way- is. In the following sections, there will be a detailed benchmarking study between these products indicated in this dissertation; anyhow, vital financial controlling tools have given SBS a leading and pioneering position among the other IT companies.

If a SWOT analysis applied on SOFT, strengths are;

1. Quantity of modules that are responding to the complex needs of maritime companies.
2. Built-in and integrated solid, reliable and effective accounting and finance modules.
3. Over 60 experienced RD staff solely working on SCM-focused applications.
4. The solid financial structure of SBS enables the company to undertake large projects with ease.
5. Industry standard-setting software with a unique operational workflow that top-tier maritime companies in Turkey use.
6. One and only absolute turnkey IT solution provider in Turkey supplies all the solutions, end to end, linking all necessary steps in SCM's as they are built in-house.

Weaknesses that need to be improved by SOFT should be as follows;

1. Comparatively expensive and challenging to acquire for small and medium-sized maritime companies.
2. Due to the excessive amount of customers, slow feedback and error handling time.
3. Visible bureaucratic obstacles in front of creative demands coming from users.

4. Inherited limitations of Progress as the DB choice.
5. It still works locally as an installed product and is not deployed onto the web.
6. Unbearable maintenance and service fees, especially for small and medium-sized entities.
7. Language problems as the product have coding flaws observed in translations.SOFT comes in Turkish as default, and each different language is sold separately.

These points are pretty manageable by an expert company such as SBS, which has over two decades of experience in Turkey's maritime, transportation, shipping, SCM sphere. However, among a few others, one of the deadliest managerial deficiencies in the corporate blindness that blocks the sight of management to foresee the changes coming through. Resisting to change is the worst nightmare for a company developing fresh ideas and supplying them to a tech-driven industry such as SCM. Among those weaknesses listed above, insisting on Progress DB is the most important one that needs to be deciphered, which critically slows down SBS moving forward. The Progress DB is unable to handle other alphabets but Latin. SOFT can not be used in Arabic, Hebrew, Chinese, Cyrillic (based on the version this study has tested) and all the other forms of alphabets. It is a primary technical deficiency that must be reconsidered at first if SBS is willing to sustain its expansion in domestic and international logistics markets.

At this spot, it is necessary to evaluate the threats SOFT receives as follows;

1. Resistance to change as a result of corporate blindness due to orthodoxy in executive departments.

2. They were promoting relatively old technologies while their rivals were actively campaigning for their cloud-based products.
3. Unable to reach small companies and new incorporations due to rigid pricing policy and heavy hardware investment requirements.
4. Stays, thinks, acts locally. Locking itself in this circuit will not protect the company from the competition and pressure of international opponents active in international markets, resulting in a loss rather than gain.
5. Cloud-based, budget-wise, more affordable products were hovering in the market, aiming small up to mid-sized shipping companies as their target customer segment. Those which promote their web-based and relatively easier to acquire products mainly steal from SOFT clienteles.

SBS also has big opportunities, as shown below;

1. Vigorous know-how to develop expert systems in the maritime market which others do not or barely have.
2. Aiming to release LE version of SOFT and focusing onto small and medium-sized transport companies by affordable prices and technical requirements.
3. Expanding cloud-based products and having them capable of working with different alphabets.
4. Re-shaping their customer-centricity by accelerating response times on client feedback.
5. Carrying SOFT as a reliable and self-proven ERP to international markets by concentrating hyperlocal and multilocational shipping companies worldwide.

SOFT is integrated with the Bilge Platform, the customs software infrastructure, Traxon, an IATA booking feature that host to host connects several thousands of freight forwarders, airlines, GSA's in one platform and INTTRA web-based container booking system. The software can also be integrated with DESCARTES, AMS, CARGOWISE, ENS System, NCTS/T1 Systems, and more. These features, which EDI and XLM based connections are performing, are also available in other commercial competitors such as SELECT and XINERGY. From a broader perspective, it is visible that SOFT can offer any interactions based on EDI and XML infrastructures.

As a summary and a conclusion of this title, SOFT is a reliable and settled ERP alternative for the maritime industry members in Turkey. Referring to the SWOT analysis applied above, the company has three significant obstructions which must be solved first-hand to gain sustainable profitability and competitive advantages;

1. Pricing Policy: SOFT is sold in five digits of USD as a start-up package with a basic setup. The software contract comes with a mandatory monthly maintenance fee that runs between three digits up to four digits of USD and annual Progress DB license fees. By all means, SOFT is the most expensive, cumbersome and yet comprehensive ERP product in the market. During the research for this dissertation, as we interviewed over 25 shipping, freight forwarding, maritime companies which have switched their IT infrastructure from SOFT to an alternative one was indicating the pricing, especially monthly maintenance fee payments was the main idea supporting the change of the software from one to another.
2. Choice of DB: The Progress DB does not create executables (.exe files), so it is impossible to develop an application and deliver it to customers without a Progress

license. This fact alone makes Progress a DB an obstacle to reaching small enterprises economically. In addition to its expensive pricing, the Progress DB is one of the weakest SQL engines for 3rd part tools and has no online DB defragment utilities. If benchmarked, the Progress DB Open Edge, which was released on March 2020 with MS SQL Server which was released in November 2019, it is observed that the Progress DB supports only Progress proprietary ABL (Advanced Business Language) whilst MS SQL Server supports C#, C++, Delphi, Go, Java, JavaScript (Node.js), PHP, Python, R, Ruby and Visual Basic.

3. Delayed Transition to the WEB environment: SBS is a loyal defender of conventional on-premise and analogously old-school software deployment methods by carrying all necessary files into client's servers, installing them locally, and figuring out all maintenance, support, development, and update tasks and requirements remote desktop connections. At the same time, the trends have already gone in a different direction. As competition gets more challenging and the demands of SCM companies get even more diversified every day, an ERP must take the lead of change rather than following the footprints of a passer-by. While all its rivals moved their platforms to the web, SBS has not made any significant change to carry SOFT ultimately onto the cloud environment.

As per today's maritime industry software choices, SBS is the market leader ERP producer by far. Despite all its weak points, SOFT still sells. SOFT delivers a reliable IT infrastructure without a compromise to those who can afford it. Anyhow, it is predictable that the company will approach a crossroads where it needs to make a critical decision between whether to keep the existing technology and managerial perception or to replace

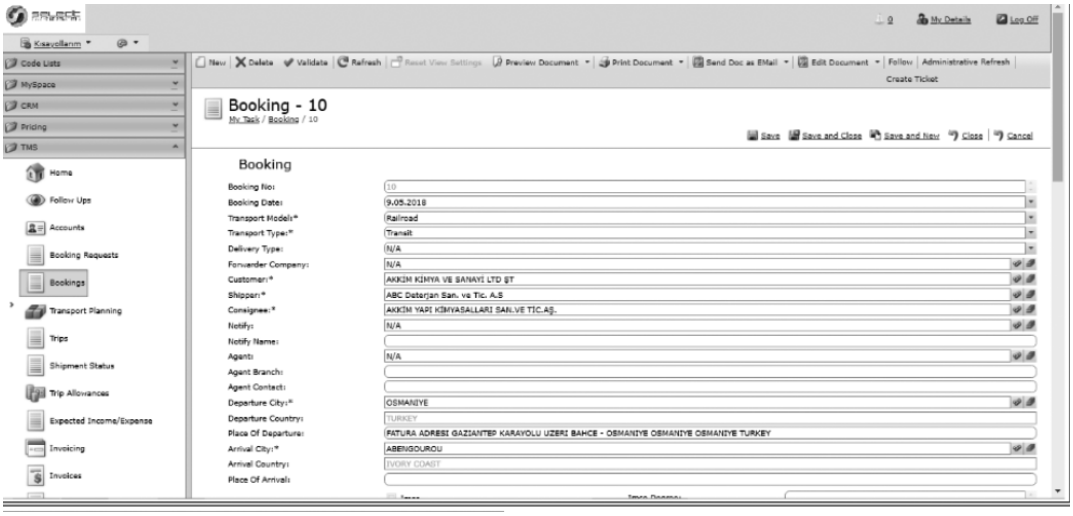
it with a revolutionary cloud-based brand new product that brings flexibility, feasibility, multilingualism that requires somewhat fewer hardware investments on servers, hard disks, backup units, power supplies, cabinets before it is too late. As a piece of supportive information to our text, according to Aberdeen Group's recent report on supply chain intelligence, it was indicated that; cloud-based transportation and visibility systems allow for intelligent multiparty collaboration and omnichannel fulfilment (AberdeenGroup, 2019).

2.2.2 SELECT Information Technologies AS

Recently, a new term as SaaS has been introduced to the IT industry as a brand new concept nobody had acquaintance with before. Along the journey of developing, promoting and buying tech products, it was always considered a conventional commercial transaction as products -including software- exchanged by money. However, with the cloud-based computing platforms becoming popular, affordable, reachable by both developers and customers as of the '10s, the new method as "Software as a Service" had sparkled through this unique habitat. Saas is a cloud-based service where customers access an application via an internet browser or via mobile applications instead of installing software to local computers or networks to run. Saas system brought a revolutionary change and a completely new understanding to the software industry for both buyers and sellers.

Figure 9

STEPS Dashboard



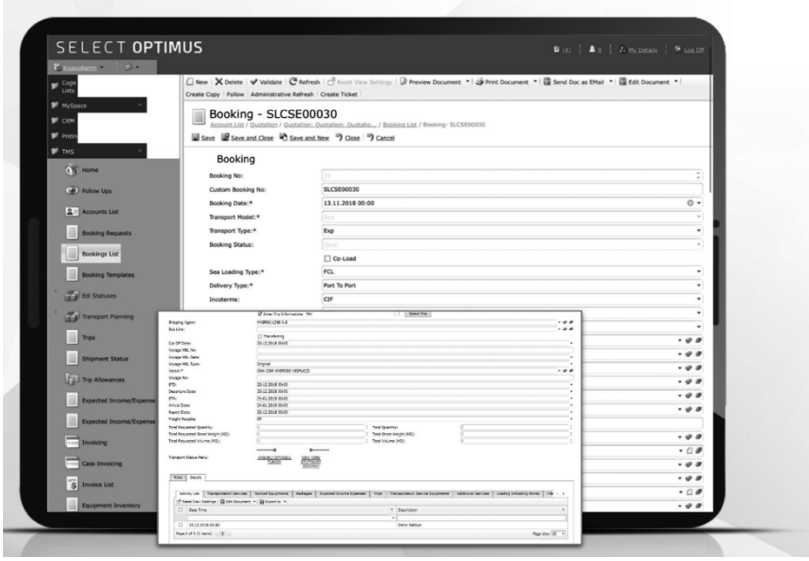
Note. From SELECT Company Brochure, October 2020

Saas applications created better accessibility, compatibility and operational management than traditional It platforms, which must be installed manually. Also, Saas

models offered lower upfront costs than conventional software procurement methods, giving enough boosting power to small maritime companies to compete with more prominent shipping companies on fairgrounds. SaaS is a model of software deployment where an application is hosted as a service provided to customers across the Internet. SaaS is generally used to refer to business software rather than consumer software, which falls under Web 2.0. Removing the need to install and run an application on a user‘s computer is seen as a way for businesses to get the same benefits as commercial software with a smaller cost outlay. SaaS can alleviate the burden of software maintenance and support, but users relinquish control over software versions and requirements (Kulkarni & Gambhir, 2012).

Figure 10

STEPS Cargo Submitting Screen



Note. From SELECT Company Brochure, October 2020

Select Information Technologies A.S. (SELECT) was established in 1995 in Istanbul as one of Turkey's first software development companies, concentrating its

activities into shipping, maritime, transportation, and logistics industries. SELECT, by that perspective, is among the godfathers of the software industry in that field. It was founded by a software engineer Mr Gökhan Girgin who took roles at both departments; R&D and management. However, in the latter stages of his career, he moved himself to management rather than development by supervising the coding part closely. In addition, SELECT had begun promoting their first product called the STEPS, the primitive version of SELECT Optimus Saas.

Their first large-scale customer was Balnak Holding, a freight forwarding and logistics group with over three hundred CALs needing to use an ERP simultaneously in their daily operations, accounting tasks, and managerial reporting duties. STEPS was used actively at Balnak from 1997 to 2001 as the leading operational software for road, sea, air departments. One of SELECT's main disadvantages was the lack of accounting modules embedded in STEPS software. SOFT had a significant gain against STEPS in that league as it was solely built upon an accounting kernel. As of today, no other maritime software could surpass SOFT by that wise. As Balnak, SELECT's biggest customer, switched their ERP to SOFT; the loss gap was imparable. With this negative impact, SELECT has chosen the right direction to reform its overall outlook and its products from zero ground by rebuilding them as cloud-compatible and web-based tools foreseeingly.

Today, SELECT is the secondary market leader as an ERP developer and supplier company to the maritime industry in Turkey, considering the turnover, quantity of customers, amount and diversity of products they have. Based on SELECT's announcements, they have over 500 shipping, freight forwarding, transport, logistics customers in their portfolio, which impressively shows how agile, resourceful and reliable

their two major products are STEPS ERP and STEPS Optimus SaaS. STEPS ERP is traditional software that works on MS SQL DB and is written by C++ as a coding language. STEPS ERP is also sold by modules just like its rival SOFT. This marketing method comes with advantages and disadvantages, which will be studied deeply in this chapter's benchmarking section. Anyhow, STEPS ERP has lesser modules in comparison to SOFT. There are 13 modules on STEPS, while there are over 150 modules in SOFT. The modules which are available on STEPS ERP are as follows;

1. CRM Module
2. Fleet Management Module
3. Rail Freight Module
4. Sea Freight Module
5. Air Freight Module
6. Warehouse Barcode Module (RFID)
7. Vehicle Tracking Module
8. Inttra Integration Module
9. Koç Zer Integration Module
10. Accounting and Finance Module
11. Driver Tracking Module
12. Repair house and Garage Module
13. Logistics Warehouse Module

SELECT ERP has positioned itself as an ERP solution as skilful as SOFT but a more flexible, feasible and economical tool for the SCM industry in competition directly with SOFT by disregarding the other minor opponents at the first stage. Their market

acquisition strategy was based on a similar SWOT analysis this dissertation has in the previous section applied on their direct competitor, SOFT. In this respect, cloud technology, which became common and utilized web-based programming and prevailed over traditional ERP selling methodologies, has opened a new development path for SELECT, which was relatively a smaller company and a quicker one to adapt to changes swiftly.

While the IT market is getting diversified and enriched by newcomers, shipping companies have also improved their services, quality approach, customer quantity, operational route maps, and shipments handled under their roof. As a result, selling an ERP solution to maritime companies with unique, different, ad hoc operational flows became a more complicated and sophisticated task. This accelerated change in almost all business sectors created a FOMO (Fear of Missing Out) feeling on both buyers and sellers.

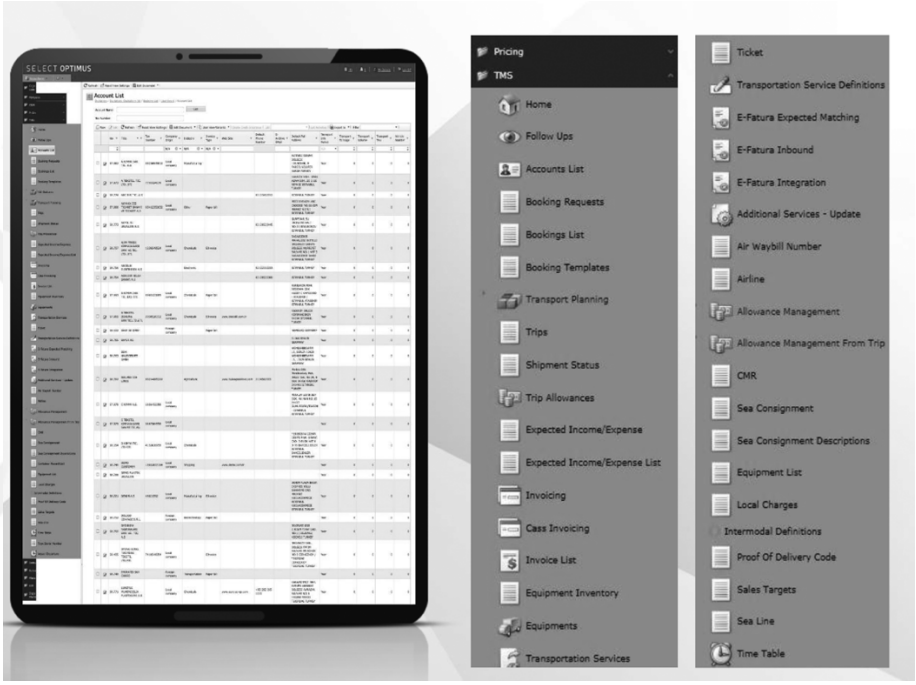
This feeling was conceptualized the SELECT's central policy on how to develop their new software titled SELECT Optimus Saas (OPTIMUS), by calling it "The Next Big Thing". OPTIMUS was designed as a maritime software that completely works on the web by using the benefits of cloud-based technologies, mainly of what Microsoft's Azure offers to RD teams, including virtual machines, managed disks, SQL DBs, sufficient broadband data width and reach, ready to go AI applications support. Of course, carrying all the IT infrastructure onto the web was the next big thing all along, but SELECT had first used it to tag one of their products (Appendix G).

According to our interview with specialists from SELECT, OPTIMUS automatically carries the information from the first point to the last point (end-to-end), which minimizes errors and the loss of time. It provides their customers lower costs and

competitive advantages, improved visibility, operational and financial control (Girgin, 2021).

Figure 11

STEPS Web Platform



Note. From SELECT Company Brochure, October 2020.

The OPTIMUS targets 3PL/4PL companies, freight forwarders, truckers and logistics companies that operate warehouses. It works in multiple languages, as MS SQL makes it easy to design software programs parametrically. New languages can be added simply by adding PO files to related directories on the server-side. If we apply a SWOT analysis for SELECT considering two of their products as STEPS and OPTIMUS, strengths are;

1. The flexible and affordable pricing system of OPTIMUS starts from 40 USD per user/month for the basic package, 70 USD for the standard package and 100 USD for the business package.
2. The reliable corporate image. SELECT is the first software company in Turkey focused on the shipping, transportation industries since1994.
3. SELECT ERP can deliver solutions to the basic needs of SCM companies at cheaper friction costs compared to SOFT.
4. They are using a more advanced DB with more substantial capabilities as MS's SQL comparing to Open Edge of the Progress considering indexing, data handling limitations, tables and views utilities and multi-version concurrency control features.
5. Starting up to use OPTIMUS requires no server as a hardware investment.
6. No extra DB licensing fees are paid annually to the vendor.
7. All data backups taken, controlled, monitored by SELECT.
8. OPTIMUS works on all operating systems and internet browsers, and mobile devices as it is a web-based software solution.

At one angle, STEPS and OPTIMUS look like "The Next Big Thing", but from a different point of view, several qualitative and quantitative weaknesses exist as follows;

1. A high one-time set-up fee with four digits in USD shadows and hinders the price-wise flexibility and limps strategies to attract more customers shifting their ERP infrastructure into OPTIMUS from other competitive software products.
2. Lack of software modules that may not respond to medium and big-sized SCM enterprises' extensive operational and managerial demands as capable as its main

competitors. Whilst SOFT hosts hundreds of modules and integrations, OPTIMUS draws a somewhat shorter line and a weaker image beneath the SBS product pantone.

3. Having no professional top management structure, which might be classified as a managerial curse when the founder acts as a senior developer and also as a C.E.O. and as a marketing manager at the same time, turns the company into a "one-man show". This image obstructs potential customers to imagine what will happen to SELECT after the leader of the company.
4. OPTIMUS has a crowded, disorganized and jumbled screen-flow that cumbers the easy-to-navigate user experience goal.
5. There is barely an accounting and finance modulation that delivers the actual substance of a proper accounting module which is expected to accomplish detailed book-keeping, legal accounting and finance tasks.
6. High ping times, which create undesirable lags on data exchanges bilaterally between the client and the software, due to hosting an excessive amount of customers in the same insufficient cloud ecosystems decelerates standardized, fast and reliable data relays between OPTIMUS and CALs.

But, notwithstanding the above, SELECT has specific opportunities as follows;

1. The growing quantity of start-ups in the maritime industry, which is in the range of SELECT's direct target client audience, encourages feedback for the company, giving the sales boost that it already seeks.
2. The advantages of cloud-based product development and supply and also working on the same kernel make it much easier to apply software updates at once and for

all. The same ability sets international markets as more accessible and discoverable for SELECT since OPTIMUS is an operating system-free, web-based platform that comes with minimal hardware requirements while providing full-scale shipping tools within its existing modules.

3. SELECT is one of the first vendors which pronounces blockchain integrations besides EDI, and XLM connections, Artificial Intelligence (AI) / Business Intelligence (BI) tools, chatbot integrated smart customer support infrastructure (CUX), voice recognition and command features that may create a unique market segment for the company and the product. In addition to this, BI tools, in particular, can turn realms of noisy data into a coherent picture if appropriately applied. However, they are not designed to provide precise prescriptions for how data should be used in decision making. Any software correlates and combines the technical part of AI and the socio-economical part of BI in one pot; that platform will become the day's winner. SELECT must use this opportunity without goofing it up.
4. Currently, the only company that provides a Koç-Zer integration is the mainframe used by customers, vendors, and third-party partners of Koç Holding while buying or selling any of their products. If SELECT promotes this attribute of OPTIMUS, it will also create a remarkable gain for the company.
5. SELECT's ultimate growth hacker is its short ROI commitment for potential customers. It is the cheapest ERP on a top-tier scale that makes STEPS or OPTIMUS more appealing for entrepreneurs who are battling harsh competition in the maritime industry while trying to shorten their ROIs.

SELECT is not alone in the market, and it has few threats that may vitiate their plans as ;

1. Even though it has creative tools to go worldwide, STEPS seems stuck with the Turkish market. Based on our interviews and their demonstrative documents, it was observed that they have neither severe projections when and how it will be moving forward to have OPTIMUS as a product sold internationally or budgeting any funds to advertise it in specific target markets be rather effortless to get into.
2. There is a thin red line between keeping it simple and falling short on delivering good products. Today's ERP platforms must aim to create soft, lean, simple but powerful to operate with interfaces for their customers. This goal requires harmony between software engineering and skilful design. SELECT has a pitfall that traps the product in a position where it offers less than its rivals. To make it concrete, port management divisions, customs brokerage utilities, exhibition logistics infrastructure, cargo disposition feature, fuel management software are some of the few that SOFT has, but SELECT does not. Any company that offers such a full spectrum of solutions on cloud-based IT habitats would directly threaten SELECT.
3. A certain amount of new software companies coming along and joining the race. Some of them are international corporations such as SAP, developing multilayered IT solutions for small up to giant sized companies from retail, construction, aviation to tourism, transportation, and banking industries. On the other hand, much smaller companies sell their products to much smaller entities such as WINNAK, NEOLOJISTIK, SIBER, 1CI and EKOBIM, for almost at no cost comparing what SELECT charges for its products. There is a tough competition pushing vertically and horizontally and creating threats for a company like SELECT.

4. The transportation industry in its limits is a closed circuit where almost all actors, key players, corporations are mainly known and visible. It is an expanding and transparent industry but a sparse and narrow one. Having a company history and experience in software development for more than two decades in the maritime industry is not the guarantee of being around for another decade unless creating a diversified product sold in domestic and international markets offensively.
5. MS SQL and ORACLE DB, which SELECT uses, are paid license products. At the same time, PostgreSQL, MongoDB, MySQL, MariaDB and Redis are open-source platforms with a bigger elasticity, low start-up fees and fewer maintenance expenses. Alternative software products which may use one of these or such databases are possible threats for a product that works on MS SQL and ORACLE DBs.

In conclusion, While SOFT is still standing as an installed product with slight web interface features, SELECT has two solid, thoroughly tested and working products to install onto customer servers and computers traditionally (STEPS ERP) and another that works as a web-based ERP named as OPTIMUS. SELECT is the second biggest software supplier of logistics and maritime industries in Turkey. Their nearly thirty years of business existence approves that the company is stable to realize innovative projects and reputable to gain new customers. According to our one-on-one interviews with various experts from freight forwarding companies in Turkey, the common perception about SELECT is inclined to the point that it is taken as a substitute product of SOFT. It is priced one pitch lower than SOFT. It has fewer modules than SOFT, and it has a minor RD team compared to SOFT. In addition to this, SELECT is one of the most severe threats to SOFT.

2.2.3 XINERJI

Xinerji Technology is another software solution provider experienced and specialized in the maritime industry requirements. The company was established at Bosphorus University Technology Development Center in 2003. Over the years, XINERJI has changed the company name to TLE Software Solutions A.S. and re-branded their software as T-MAXX and CARGOMAX FI. Today, TLE has three RD hubs in Istanbul, Ankara and Sofia, employing over 70 white shirts serving over 70 corporate clients. Currently, T-MAXX and CARGOMAX FI are being used by over 5000 individual users combined. TLE holds several accreditations, such as TUBITAK RD Certificate and NATO Software Security Certificate (Xinerji Software, 2021).

Unlike SOFT and SELECT, which solely specialised in the SCM industry, producing software packages only for logistics, shipping, transportation, customs business areas, TLE has separate RD departments focused on banking-finance, defence industry and mobile applications. According to the company's presentations, it is crystal clear that TLE is a software company capable of building all sorts of software programs, including package programs for the maritime industry. From this point of view, this strategy brings diversification to the organisation, and it adds a broader perspective to the company's development policies; on the other hand, compared to its two main rivals, TLE may come as third in being dedicated to one core market segment, named as SCM industry. In addition, TLE is the first software company that introduced a web-based ERP for the logistics industry in 2005 titled TMS, short for Transport Management System. However, from 2005 to 2018, TLE has shown little or no progress in the SCM market as an IT

company, mainly because of their other projects for the banking industry (HSBC & Abank), gamification jobs, defence industry-oriented programs.

As of 2020, TLE offers various solutions for the maritime industry which different product names as follows;

1. TMS: CargoMax, T-Maxx
2. WMS: LogiMaxx
3. SFA: SalesForce Administration
4. Mobile: Sales Related Apps

TLE uses PostgreSQL as a database infrastructure for its solutions and CentOS (The Community Enterprise Operating System) for running the Tmaxx Server application. *CentOS* is a Linux distribution that comes as a free license operating system on the server-side for users and PostgreSQL. These two choices are giving TLE a significant advantage to save four figures of expenses in USD while marketing their products, while SOFT is using Progress DB, which is one of the most expensive DB products in the market, and SELECT uses MS SQL and Oracle DB as both are also costly alternatives comparing PostgreSQL and CentOs. It is accurate to indicate that TLE has surpassed its competitors by those advanced choices while building up its program. TLE quotes just 1 USD for Tmaxx serverside operating system, database engine and CALs, whereas its competitors quote four up to five-figure rates in USD just for these three items listed above. Nevertheless, they lose power at further stages of the competition by offering staggeringly impracticable tariffs for the rest of Tmaxx and CargoMax FI in times of Saas way of marketing compared to SELECT. When it comes down to applying SWOT analysis to TLE and their product line, despite the odds favouring the company initially, it

drastically turns against them at the next steps. The impartial and deterministic findings regarding the strength of TLE are;

1. It is the first web-based ERP for the maritime industry in Turkey. This is a firm reference that carries a reliable image in addition to being a trendsetting, a leading brand name holdership.
2. Benefits of using an open licensed, solid, robust and effective DB as PostgreSQL and a Linux-based free operating system as CentOS in Tmaxx and Cargomax FI. These assets lucratively provide a "smart move" favour to TLE against its competitors.
3. It covers both operational and financial tasks with two harmonic products as Tmaxx for shipping, marketing, pricing, CRM, documentation and CargoMax Fi for finance, accounting, electronic invoicing, archiving duties.
4. It is an expert system that responds to the maritime industry's basic needs and defines a certain amount of operational documentation flows.
5. Existing clientele approves that the product receives attention, a considerably sufficient demand that forces the company to set new goals such as opening a branch in Germany in 2021.

Based on this outlook, Tmaxx and CargoMaxx offer a safe and sound corporate image that can shoulder heavy duties for long years for Turkish maritime customers. Howbeit, TLE and its products have weak points that create challenges for the company to overcome, namely;

1. Confusing branding strategy, which is dispersed through several different incorporation names such as XINERJI Technology, TLE Software Solutions A.S.

and VERA Tech Services Ltd that sets a blurry image at the sight of potential customers on which one is which. The same confusing attitude is maintained by TLE while branding their products as Tmaxx TMS for shipping tools and CargoMax FI for fiscal screens. When observed, custom behaviours of maritime industry software customers in the Turkish market, particularly decision-makers at managerial positions, pay the highest attention to branding features by measuring how reliable the product and the company behind it. A well-known brand name is simply a game-setting asset in the IT industry, especially for the SCM segment. Shipping corporations are unable to jump from an ERP to another every year. Changing software is almost a lifetime decision for most companies. Just to compare it with SOFT, as a market leader company and the main competitor for the rest of the players, it provides an excellent example for a simple benchmark by naming their product as SOFT either. There is a lack of brand identity observed of the company that is nearly two decades old.

2. As mentioned above, SOFT and SELECT are expert systems in the maritime industry, providing IT solutions for shipping companies by blending the demand with their sector centric experiences as it is their core capital. At the same time, TLE is a software company that acts in several different RD fields, and each requires a remarkable amount of experience, know-how and dedication. It positions TLE distantly to where it must be to gain more market space rather than losing it in the SCM sphere. It should be clear that any software company can code certain types of programs based on demand from their customers but only experienced and

dedicated experts provide tailored solutions referencing their unique know-how assets.

3. Tmaxx and CargoMax Fi combined, the most expensive web-based software solution in Turkey, up to date with five-figure quotations in Usd. On the other hand, it is one of the least capable products based on the number of modules. There is an absolute absence of vital modules such as railway cargo operations, multimodal transport, customs brokerage, oversize transportation. This fact might be a managerial flaw or a lack of market knowledge (in close relation with point 2) while pricing the product high by offering less than others. With this measure, it is the least feasible alternative in the league of web-based IT platforms for the maritime industry in Turkey that has a lack of presence and positive reverberance.

There are following opportunities and threats for TLE as follows;

1. The company aims to expand its activities abroad by establishing a subsidiary office in Hamburg in 2021 that may trigger more sales in Germany. It also tags TLE as the first company that incorporates internationally.
2. TLE is the only IT solution provider proposing tailored big data analyses for its customers, comparing all the other opponents active in the same league. As big data becomes more critical every day, it also becomes necessary to have practical tools that interpret actual company data into meaningful analyses, which may turn or evolve into effective decisions. This is an opportunity for TLE to gain more customers.
3. The same proposal discussed above turns into a curse when a company mixes two different concepts: "I can do it" with "I am already doing it". A possibility to offer

data visualisation, clustering, or charting, offering descriptive, predictive, or prescriptive solutions using conventional statistics tools, does not mean that a company is an experienced business intelligence and AI modelling entity specialising in that unique field of software research and development segment. This fact is visibly valid for TLE as a threat.

Based on the above study, TLE is the third and one of the most creative IT companies which produce ERP solutions for the SCM industry in Turkey. They are close to becoming the marginal leader of the market but stuck in between the market's ruling leader and the marginal leader. Tmaxx TMS, as the first web-based maritime software deployed and used online since 2005 by over 70 small and medium-sized shipping companies in Turkey, has strong potential to evolve into a market leader position by a progressive re-branding strategy that may lead the company into a pole position in this race.

Therewithal, it looks like TLE is at the crossroads of making a drastic strategical realignment to position its products into a more effective, reachable and useable state. While it fully works on the web and runs on open license DB and serverside operating system, it does not create a notable price difference. Despite its high price tag, no provision compensates the price with adequate tech tools to attract customers seeking a turnkey solution for their SCM service lines integrated end to end. To move out of this limbo, the company must re-design the modules and enrich its products by adding more features, tools. The SaaS method is an applicable and responsive tactic that benefits both service suppliers and customers in one go. It might be one of the instruments that will change TLE's success trend upwards.

2.2.4 DOA Software Engineering

DOA Information Technologies A.S. is the youngest corporation among the companies mentioned previously, founded in 2007 in Istanbul. DOA has already designed and delivered big-sized projects such as ZerLog application for KoçZer platform, ERP infrastructure for Borsuan Logistics, PowerTrans app for fuel transportation between Iraq and Turkey, all IT products and software solutions for a courier service company Surat Kargo. Through these valuable and differentiating experiences, DOA has decided to design software named LOJISOFT for freight forwarders, shipping and logistics companies that aim to provide which others could not. According to DOA, they have set 8 goals to make this project real as follows;

1. LOJISOFT must be reachable anywhere that has an internet connection
2. It must have utmost security features to protect client's data
3. Low price scale for the software
4. Low to none hardware investment to acquire the program
5. The improved user experience by high-end coding methods
6. Unlimited storage capacity offered to customers
7. Limitless file compatibility with MS Office and alternatives
8. Fast and solution-oriented support department for customers

One of the disadvantages of DOA is that they were the last comer of the market. As a result, they either had to settle with their then market share or put out a product that surpasses the competitors' flexibility, creativity, and feasibility. However, after two years of intensive benchmarking and a detailed study over LOJISOFT, it is possible to acknowledge that DOA has delivered nearly as best product as all contemporary maritime

software alternatives should have, considering product design simplicity and accuracy versatility, reliability and integrity.

LOJISOFT is a web-based ERP solution capable of answering the needs of maritime companies, transport firms dealing with multimodal and intermodal carriages, and logistics enterprises operating on Milk-Run projects and reverse logistics. Existing modules of LOJISOFT are ;

1. Fleet Management and Service Module
2. Domestic Transport Module
3. International Road Freight Module
4. Rail Freight Module
5. Sea Freight and Liner Module
6. Air Cargo Module
7. Warehouse Management Module
8. Customs Bonded Warehouse Management Module
9. Contract Logistics Module
10. Salesforce Module
11. Container Terminal Module
12. Finance Module

LOJISOFT has been built upon MongoDB, which is relatively new, free of charge, open-sourced and a stable non-relational database infrastructure used by Uber, Lyft, Accenture, Delivery Hero, Stack, LaunchDarkly. MongoDB is capable of handling high pressure on database queries for web platforms with a heavy bilateral flow. That is why it is popular among e-business companies, with millions of unique visitors interacting with

their business every day. E-Shops, web-based B2B, C2C platforms, delivery, courier, postal service companies, airlines, shipping and transport companies benefit from having MongoDB keeping the dataflow safe in the background. MongoDB is a database for today's applications and enables its users to leverage data and technology to maximize competitive advantage, accelerates time-to-value, reduces the risk for mission-critical deployments, dramatically lowers the total cost of ownership. According to the MongoDB manual, users can build applications that are barely possible with traditional relational databases. MongoDB's document data model makes it easy to build on since it has inherent support for unstructured data and does not require costly and time-consuming migrations when application requirements change (Krishnan, Elayidom, & Santhanakrishnan, 2016).

Figure 12

Lojisoft Sea Freight Screen

Note. From Lojisoft Company Brochure, October 2020

LOJISOFT uses Microsoft's C# 5.0 coding language for the back-end linking variables between MongoDB and front-end, JavaScript to carry the flag onto the front-end, Css3 HTML 5 to shape the web-based interface. It is designed on Visual Studio 2012, which is a code editor supported by Microsoft Company. C# applications are working on

.Net Framework, v4,5, and the web interface uses ASP .Net MVC (Model View Controller). MVC is a design pattern or a bridge used to decouple user interface, data and application logic. It is a software architecture concept considered as an architectural pattern in software engineering. It has three components as Model, View and Controller (Sarker & Apu, 2014). It gives designers enough headroom for creating dynamic interfaces based on different languages, IP geographies, user-defined time, date, content intervals reflected on interfaces directly corresponding with the application's back-end.

One of the advanced tools that LOJISOFT provides is the route optimization module that primitively solves travelling salesman problems for its customers. *Route planning* is a serious challenge that needs to be figured out by A.I.-supported intelligent systems such as LOJISOFT. Courier companies, food distributors, pharma logistics entities, which operate an enormous number of vehicles with multi stops, need effective route planning. LOJISOFT integrates with Google, Bing and Yandex maps and offers effective route alternatives that save up to 25% on fuel charges per month for active users while increasing lead times. Although LOJISOFT is not an A.I. application based on learning algorithms, it is integrated with third-party tools such as Yandex or Google while proposing optimized solutions to its customers.

LOJISOFT is one of the most feasible and reachable ERP solutions for maritime companies in Turkey. It has quite a few strengths as follows;

1. Four figures of the product price in USD for the sea, air, road, finance modules combined sets LOJISOFT is the cheapest alternative to start with. It is also the cheapest alternative to maintain with. LOJISOFT charges only three figures in USD per month for cloud storage, data back up and service fee.

2. It is a turnkey solution with over a dozen modules that successfully answers the needs of small or medium-sized shipping companies. It is the second company in rank compared to the other three above, regarding the variety of modules offered on one program.
3. Based on our two decades of study, examination, testing of all these software alternatives indicated above; it is experienced that LOJISOFT is the quickest to implement at new customers and fastest to get deployed and executed in less than eight working days while the nearest competitor asks for two weeks for getting their product ready to function correctly.
4. Multilingual operations were handled accurately thanks to MongoDB. The program has been designed parametrically, making using different languages simpler and cheaper than competitor systems.
5. DOA does not ask for development fees when a customer asks for further extensions or plug-ins in addition to what LOJISOFT offers as long as that feature is applicable for the whole structure.

LOJISOFT might be on the right track, but as well as all the other alternative platforms, it has some points which need to be improved, such as;

1. Despite its affordable pricing strategy, LOJISOFT is still far from offering Saas model of sales plans. A genuine Saas product does/should not ask for upfront payments from customers except its simple membership fees.
2. SOFT has a robust accounting system that makes them a market leader. International account reconciliations need a unique accounting system capable of invoice by invoice account settling, multi-currency transfers between accounts, a

proper ABC analysis and reporting between the creditor and debtor accounts, receivables, and payables ageing reports and integrations with banking systems. LOJISOFT has a primitive version of a bookkeeping application rather than having a competent account program. It is one of the main weaknesses the software has. Also, the LOJISOFT booking system cannot reconcile the accounts by closing paid invoices with associated payments received from customers. It is one of the most visible flaws that the module needs to improve immediately. LOJISOFT finance module cannot transfer different currency types between different accounts by converting these currencies into any other currency type; this fundamental feature, by the way, exists on SOFT and OPTIMUS. Briefly, LOJISOFT's finance module needs a revolutionary change to 'carpe diem'.

3. DOA, as a young company, is still gaining experience in the SCM industry. At the same time, its two main competitors, SOFT and SELECT, have over 25 years of experience and know-how solely in the transportation market. Coding is the architectural part of the process, while "know-how" comes from their interaction with freight forwarders, shipping companies, maritime experts, customs brokers, logistics specialists. Knowing how to code and relating these codes with a database platform is required, but not enough assets to create software that delivers proper, industry-specific IT solutions. In this perspective, LOJISOFT has got a lot to achieve to utilize simple tasks which are available on SOFT, OPTIMUS and TMaxx, such as single-window operations. One data must be used at all departments as long as those departments have the authorization access to the data. When creating an M B/L (Master Bill of Loading), the columns such as the shipper,

consignee, notify party, destination port agent details must be pulled from the data which was already submitted into the system based on the SI (Shipper's Instructions) automatically, and M B/L instructions from the freight forwarder to the shipping line agent must be automatically generated. This feature is not available in LOJISOFT or can be added to the program after the customer's request.

4. LOJISOFT follows the path of its predecessors and promotes the program by modules. At the same time, the contemporary logic of software engineering should remove such boundaries and build up a digital and responsive habitat capable of shapeshifting by events, queries, and demands without being stuck with such modularizations. It is observed that there are overlapping modules on LOJISOFT, such as the warehouse management module and customs bonded warehouse management module; both are the same operations with minor differences that do not require to be split and sold in two different individual packs. That policy has changed long ago in the world and must also change in Turkey.

When it comes to the opportunities side, LOJISOFT has particular head starts;

1. It is an easy product to sell in the Turkish market, price-wise. Decision-makers mind their budget limitations when they shop. This fact, beyond doubt, works perfectly for LOJISOFT.
2. Turkish Airlines, as flag carrier airline of Turkey, is among references of DOA company. Despite their relatively young age, DOA owns a success story that is reasonably supported by small to medium shipping companies and few big-sized conglomerates.

3. *Software* is a product that can not be imagined without supportive services. Once a transport company purchases an ERP, it becomes a permanent and almost daily relationship between the customer and IT company that lasts almost a lifetime. Besides the product's capabilities, price and technical details, support quality, service fees, and service speed are decisive factors when choosing software. Based on our studies, LOJISOFT has the fastest response times for inquiries, demands, and customer feedback-related errors. This is their opportunity for actively promoting in the market as many others who are using rival programs suffer from after-sales support services. We have submitted 71 tickets during two years for testing the company's response times. They were either support-related questions or error feedbacks noticed in the program. Out of that 71, 69% of our tickets responded and solved within a day, 17% of our tickets took less than five working days to be closed with an answer, and 14% took longer than a week.
4. DOA does not charge any extra fee for integration requests. LOJISOFT works fine with several third-party platforms: accounting systems, electronic government infrastructure for invoices, archive and tax, customs, air and sea-related booking, and tracking platforms. Their approach is simple goes as "If a new integration request comes along, it would be my asset to sell LOJISOFT easily to a next potential customer." This prudent merchant behaviour is one of the opportunities of DOA Technologies.

Last but not least, LOJISOFT has the following threats which may harm their success;

1. The program itself is one aspect of the project, while the hardware is another when it is provided as a turnkey cloud-based solution. In this model of sales method, the I.T. company also acts as a contractor who holds responsibilities of data storage, hosting, server management, backup management and security, 100% up-time monitoring continuously. It means that DOA compiles their customers in shared servers that host *N* amount of customers at once, all together in the same server. This method lets them cut down hardware investments for their account and bring a cheaper ERP alternative onto the table; on the other side, a crowded server means lag, latency and high ping times. Ping is a technical scale unit that measures seconds when a tiny information package goes and comes back between a client computer and a server computer. Partly, the speed of the package making a roundtrip is correlated to the internet speed of both client and server, and partly it depends on how versatile and relatively 'empty' that assigned server is. Based on our studies, LOJISOFT has difficulties keeping up with low ping times, especially on active days of the week, that are Mondays, Wednesdays and Fridays. These lags, known as frozen screens, are caused mainly by overloaded servers that have difficulties responding to heavy data requests from the customers or route them to less occupied servers. If DOA does not invest in new servers hosted in risk-free locations with high internet speed, other alternatives can steal part of their customers.
2. In connection with slow ping times of locally hosted servers of DOA, the company has another obstacle as they do not have multiple hosting locations abroad, particularly in Europe but only in Turkey. While local users had hardships connecting to LOJISOFT from time to time, it will be imperative for the company

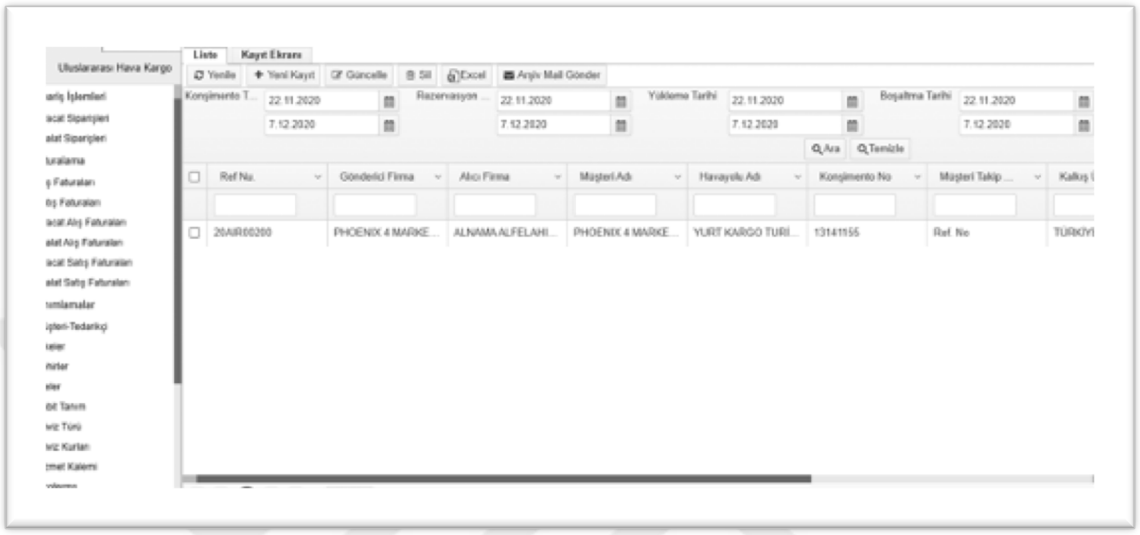
to have one or more hosting locations out of Turkey to reach potential international customers.

3. LOJISOFT has crowded and unoptimized screens that need to be reorganized. Screen designs are what users see and decide about any software. End users do not have to/ can not know the depth of the software, and they come to conclusions whether the software is good or bad based on the simplicity of the screen flow. Simplicity is a challenging task, and it is undoubtedly a crucial hurdle to solve. That is why LOJISOFT needs to design their screens as more simple, more dynamic and effective. Otherwise, existing screen designs will be their weak spot where competitors may/will aim and hit on.

LOJISOFT does not have an accounting module but a simple finance module that barely handles essential duties. SOFT and SELECT offer their in-house accounting programs as well as integration possibilities with third-party platforms. TLE offers a substantial finance screen, but LOJISOFT does not provide the same. The finance module we studied nearly for two years is insufficient for a mid-sized freight forwarding company. We have worked with the freight company to study on LOJISOFT had to abandon their finance module, which they had paid for and purchased another accounting software. This is one of their main threats that any company like SOFT may eliminate DOA in the race of accounting and finance platforms.

Figure 13

Lojisoft Air Cargo Screen



Note. From Lojisoft Company Brochure, October 2020

To summarise this section, LOJISOFT is one of the brightest and good products in the market that delivers a reliable and convincing solution package including all operational modules, rich integration services function easier than its rivals. It is the cheapest software alternative of its segment up to date. LOJISOFT has an attractive appeal compared to the other three main competitors thanks to its assets shown on the strength part of our SWOT analysis; anyhow, threats are coming through, from both sides internationally and locally. LOJISOFT is the nearest product to what and how an ERP should be nowadays. Although LOJISOFT does not apply the Saas system yet, it skillfully substitutes it with its pricing strategy. International e-commerce effects are expected to have a significant impact on logistics systems, including distribution processes and solutions (Olah, Popp, & Zoltan, 2017). This fact strongly underlines the importance of cloud or web-based SaaS systems for software developers such as LOJISOFT.

2.2.5 The Other Minor Software Alternatives

As the SCM market in Turkey grew over the years, the bloom of software alternatives has sparked off into the maritime industry one by one. Each of those alternative IT platforms has its odds and benefits that stand out differently from the industrial focal point, technological infrastructure, database management approach, pricing methodology and versatility. Although the four programs which were indicated above cover the largest share of the market and they are capable of responding majority of needs, these which will be named underneath are candidates that also have strong potential to become marginal market leaders by solving niche problems and offering their solutions at reasonable conditions to the maritime industry in Turkey.

One of the challenges or curses for established market leaders in the IT industry is the product over the trust that slows them down while adapting their products into new developments or technologies. The IT industry is the locomotive of the change as we know it. This industry's very own role is to act like a revolutionist, which pulls the rest of the world through. In such ecosystems, it is difficult to foresee the tools of the future and mechanism of tomorrow from today, especially in these days of fast transition of change that moves the software industry from SaaS to SaaG (Software as a Gateway) which fundamentally renovates the custom traditions. We will be seeing that SaaG products will not be sold but allocated to customers. Such platforms allow for collaboration and the fusion of financial and physical supply chain processes across trade communities by offering different software modules (Hentschel, Farkas, & Haas, 2019).

In return, SaaG platforms will be permitted to interact with user data, and they interpret that big data structures into prescribing solutions which will be the source of

sustainable income. But, unfortunately, while the world evolves into more innovative trade models in the software business, some companies either neglect or entirely miss the point that the change is not an obstacle but a sheer opportunity that all IT companies have as an asset. In this respect, our dissertation will glance at the other minor software alternatives in the market to strengthen our hypothesis.

Vericom is an Istanbul located, medium-sized software company with a self-titled web-based transport management software (TMS) that works on .Net with the support of Dapper ORM. Dapper ORM (Object Relationship Manager) is an open-source tool designed by the Stackoverflow team to increase the effectiveness and efficiency of communication between the user's inputs and the database structure, with relatively more minor code and more available automation to download on Github. *Dapper ORM* is a 'turbo' tool that speeds up known processes by pre-defining tasks, submitting described data automatically, or creating macros more simply. Vericom has 14 operational modules, including road, sea, air, rail cargo screens, CRM modules, fleet management and vendor management modules. Vericom products can be used as an installed product or as a SaaS tool upon demand. In addition to the above, Vericom is one of the first software companies which is active in the maritime industry in Turkey has signed a contract for integrating their product to TradeLens, which is a tool co-developed by shipping lines such as Cma Cgm, Msc, Hamburg Süd, Pacific International Lines, Apl, Anl, Cnc, Hapag Lloyd and Maersk Line group companies. In brief, Vericom is another dexterous software platform that can be available on the cloud, integrated with 1Ci services.

Winnak is an old and rooted software alternative for the transport industry, which Evren Computer Engineering A.S. developed in 1999. Over the years, Winnak had few upgrades, such as the sea freight module and accounting module. Winnak is one of the few IT platforms that offers its accounting program with full-scale integration capabilities. It is one of their key competencies to surpass their rivals in the race of gaining new customers and larger market shares. Any software alternative with a strong, tried, integrated and reliable accounting module gets the pole position in today's race which sets Winnak as a glory vulture of maritime, transport, SCM IT market. Winnak was designed for trucking companies, and as of today, it does not offer more than providing TMS systems mainly for hauliers as it is one of their constraints.

On the other hand, the software is not working on the cloud. It is an installed product with eight modules: international trucking, accounting, sea and air modules, domestic trucking, customs bonded warehouse management module, stock and payroll module. Winnak is used by hauliers as expected, and they have fewer SCM customers due to the lack of capabilities that Winnak could offer.

Siber Software is also a software solution provider for the transportation industry in Turkey, which has over two decades of history in the IT business (Appendix H). Their self-titled product is designed by aiming to solve trucking-related problems of hauliers in Turkey. The road freight module is placed in the centre of their portfolio, among other modules. This aspect positions Siber Software as among the average IT companies that do not create a significant difference in today's SCM world. It is, as Winnak an installed product that is sold as modules by modules on demand. It has three figures of the sales price in USD, and with this fact, it is possible to classify Siber Software as a package

program seller entity for small and medium-sized trucking companies that own up to 12 trucks. It is observed that Siber Software has robust reporting features, and the program is capable of creating over twenty different types of reports, mostly related to trucking and accounting jobs. Such software is an affordable, simple to use and manageable tool for those who run a small trucking company and want to make a one-time payment for the program.

LJK is a web-based TMS that runs on MS SQL DB that offers an internal e-mail system that allows users to correspond within the software without requiring a 3rd party e-mail program. This feature alone is one of the most diverse and creative solutions offered with a TMS platform comparing its opponent products. LJK is a lower-tier version of LOJISOFT in almost all aspects, including its pricing strategy. As a sales method, the product is sold as a SaaS platform with monthly subscription fees measured by the number of users. LJK has a standard dashboard on the web-based TMS, ERP, or CMS products with an activity menu on the left-hand side of the screen. At the same time, optional and also operational buttons are placed up above the dashboard. The dashboard is fully customizable, and it shows active figures of users' operational tasks, shipments, e-mails also daily exchange rates. LJK is a simple freight forwarding software with potential at sight. It has road, sea, air cargo and current accounts modules that are enough to run a small freight forwarding company in a narrow circle without dealing with supply chains, customs brokerage, container sales. From this point of view, LJK has a lot to improve to become a complete turnkey solution as ERP for the SCM industry. Although it has an easy screen flow and a unique design, unfortunately, it falls short of delivering a solid and comprehensive TMS infrastructure for the maritime industry companies in Turkey.

Neolojistik is a road freight software that runs on the cloud with unlimited user rights (license), while other TMS alternatives do not offer the same. In this aspect, it is their differentiated approach that attracts attention. The program has Saas type of sales policy with four different packages and support service fees that do not exceed three figures in USD. In addition to this, Neolojistik has so little to offer. It is barely a TMS, more likely, an applet that runs on the web designed for haulier companies willing to test the concept and capabilities of the web-based ERP systems for good. With their existing features and abilities, Neolojistik is far from being an alternative ERP for the platforms mentioned above anyhow; it is shown in this dissertation just for showing the variety of offers in the market.

Demsoft Transportation Program (DTP) is installed software, sold as a package program designed by Delphi and runs on MS Access DB. DTP is the technology of the '90s, but it still sells in Turkey. It is added into this thesis for disclosing the variety of transportation software programs. DTP is sold for 300 USD for unlimited users. It commits that it can handle domestic and international transportation operations, accounting-related duties, pre-alerts, customer relations and staff management in a nutshell. These are one-third of what SOFT offers, but DTM does that at a fraction of the cost compared to the pricing strategy of SOFT. DTP is an exciting example of the elasticity of price and benefit correlation while choosing an ERP for shipping companies.

Turkish SCM market became one of the biggest as of the '00s, and it attracted the attention of international investors who are willing to get into the market and have a piece of share from it. **1C**, a Russian software company founded in 1991, is one of those that aimed to pay attention to the maritime industry in Turkey to propose their product titled

as **1Ci** that is also their corporate name in Turkey. 1Ci is more than a TMS system. It is an SAP-like platform that delivers all the tools, whether for development or as ready-made turnkey solutions for the end-users. 1Ci brings their DB structure named Infobase that is fully capable of collaborating with all other DB platforms such as MS SQL Server, IBM DB2, PostgreSQL, or Oracle DB. 1Ci is a coding habitat for people who are willing to create and use object-oriented, modular, containerized software solutions for their very own business areas. 1Ci can work locally as an installed product, cloud-based, or on mobile devices at one kick start. It is an open-source product that opens the doors for SCM companies that employ in-house software developers for their advanced, unique and custom needs. It has been designed for quick integration with almost all known and reputable third-party DB or ERP infrastructures. More than 1500 different software products, tools, applications, or applets have been designed on 1Ci by independent software developers, and this amount is continuously counting up. The product comes in two different packages, one for small and medium-sized enterprises called "1C: Drive"; one for big-sized companies, named "1C: ERP". As 1Ci entered the Turkish market, they began promoting their modules for the transportation industry actively.

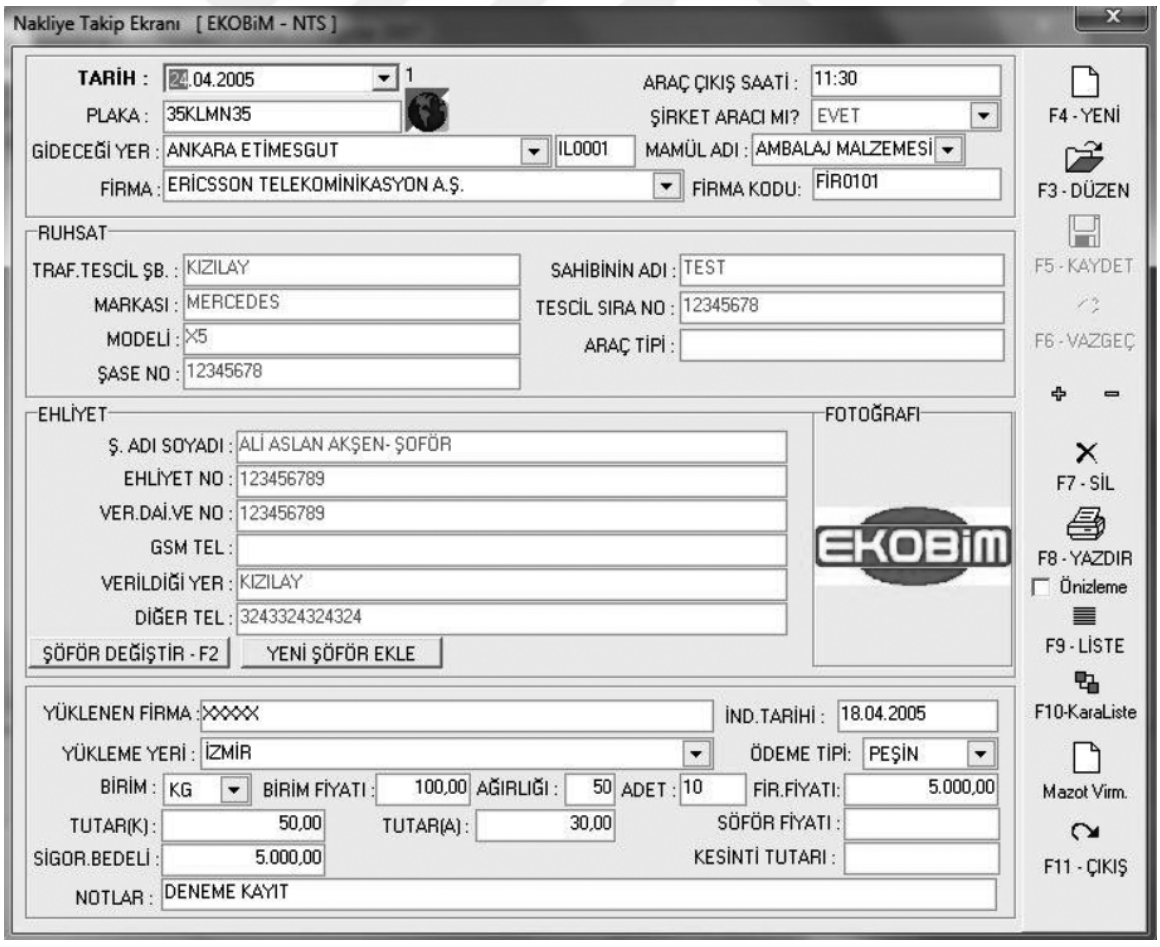
On the one hand, 1Ci as a newcomer will have to put out an extraordinary effort to convince the Turkish freight market that 1Ci Drive is the right tool to choose for 3PL operations, accounting, customs brokerage, warehouse management tasks; on the other hand, 1Ci as a company that is actively used in 95 countries with over 1.5 millions of users may achieve these goals in no time. Anyhow, the current outlook shows that 1Ci Drive, a transportation package that is a plug-in enclosed to their ERP modules, needs a particular work over to sell it to maritime companies in Turkey. This fact also shows that high-tailing,

particularly in the software business and especially while releasing a new product, may turn a hit project into a miss experience. Today, 1Ci Drive, a transportation program, pretentiously commits to overhauling freight companies' existing operational flow with an epochal approach, which falls far from the expected effect. Therefore, 1Ci Drive, as a TMS solution, is classified along with the minor software alternatives in this dissertation.

Ekobim is a software company from Izmir that produces various types of package programs sold through their sales agents in Turkey.

Figure 14

Ekobim Trucking Module



Note. From (www.ekobim.com.tr, 2021)

It is one of those "We can code anything you ask for." companies with accounting, call centre, transportation, school administration, auto service, retail industry, and more products that respond to nearly two dozen different industries. At first glance, the diversity of products that Ekobim offers might bring a "lack of expertise" to potential buyers. However, every one of these programs requires a significant amount of know-how to deliver accurate solutions. Although this image partly identifies Ekobim as one of the basic tier programs sold in the market, the company has over two decades of software engineering background that would disperse the fog in front of this image. Just like SOFT, Ekobim's TMS package has evolved from its accounting program. The whole hogger approach in the software industry takes or considers accounting programs as a collateral element for their sales targets, and they allocate other expansions next to or around that core where hosts accounting modules as their main products.

On the other hand, the innovative software platforms startup from the "know-how" station, the principal capital for supplying industry dedicated expert systems. Based on this perception, Ekobim is just another package program that is sold as is, as an installed program works only on MS Windows operating systems, it comes with its rigid limitations and inflexibilities, but it does have an affordable pricing scale, simple screen flow, no onerous hardware requirements and no expensive third-party licensing fees. In summary and a conclusion, Ekobim has its unique market segment among those minor players indicated above. That segment dully exists to deliver similar products that may not bring innovation to the table, but they solve several traditional tasks that came all along historically.

2.3 Benchmarking of ERP Platforms

In this section, the study will apply benchmark tools to top-tier platforms indicated above, namely SOFT, SELECT, XINERJI and LOJISOFT, to improve this dissertation's depth and innovation performance. It is a prerequisite to meet this ambitious objective by benchmarking these platforms in between and drawing an accomplished picture to express its logical angle. At first, these four platforms will be benchmarked between each other and in the following steps, minor software platforms will be benchmarked within themselves. At last, the same benchmarking will be applied between top-tier and minor products using the same parameters. The first benchmark will be applied to their technical capabilities, and the second one will measure their brand visibility, flexibility, customer support.

Table 5

Benchmark of Top Tier Platforms

	Programs			
Criteria	SOFT	SELECT	XINERJI	LOJISOFT
Database Platform	Progress	MS SQL	PostgreDB	MongoDB
Coding Language	C++	C++	C++	C#
SaaS	0	1	0	1
Web Based	0	1	1	1
Free Training	0	0	0	1
Multilingual	1	1	1	1
Multi Alphabet	0	1	0	1
Integrations	1	1	1	1
International Sales	0	0	1	1
International Offices	0	0	1	0
Open Source	0	0	0	0
Total	2	5	5	7

Note : 0 represents absence of the fact and 1 represents the opposite (Source: Interviews One-on-One With the ERP Suppliers & Appendix F & G)

To interpret this table accurately, it is vital to acknowledge that no ultimately advanced solution surpasses the other by all means and expectations in the market. Each platform has more robust features than the other, and all of those shown above have the unique know-how that they use while solving specific problems. This dissertation aims to display those features transparently for finding common ground to discuss how these features can be aligned or blended as effectively as balanced as possible in one product environment. According to the above table, LOJISOFT scores higher marks by hosting more extensive features while others do not. However, that ranking does not say that one particular software platform is better than the other single-handedly.

Table 6

Benchmark of Top Tier Platforms

			Programs	
Criteria	SOFT	SELECT	XINERJI	LOJISOFT
Ping Time / Lag	1	4	2	3
Price Level	4	2	3	1
Support Speed	4	2	1	3
Flexibility	4	3	2	1
Module Quantity	1	2	4	3
Customer Quantity	1	2	4	3
Brand Visibility	1	2	4	3
Total	16	17	20	17

Note. Ranking 1: Best 2: Good 3: Average 4: Weak (Source:developers.google.com)

Despite its high price level, inflexibility and slow support service, SOFT has the leading role on the above comparison by marking the best score. SOFT has the most potent online brand visibility based on Google ranks while it has 19500 unique references,

SELECT has 3240, LOJISOFT has 2440, and XINERJI has 2080. It does matter for a software company to have strong brand visibility. It is considered a reliable source of reputation once the company is acknowledged or recognized by many online resources attributing to its name. SOFT is also far ahead of its rivals by the number of modules it has. Although many SOFT modules are similar products that can be compiled and offered in a lesser amount of packages without decreasing the capability of the overall product line, SOFT has a significant advantage as it responds to almost every single need of SCM customers by a module or an integration as an expert system.

Table 7

Ping Ratio and Lag Test Results

	Programs		
Criteria	SELECT	XINERJI	LOJISOFT
First Contenful Paint (FCP)	1,3 secs	12,5 secs	2,5 secs
Speed Index	2,7 secs	16,4 secs	4,8 secs
Largest Contentful Paint	5,5 secs	16 secs	9,5 secs
Time to Interactive	10 secs	23 secs	7,2 secs
Total Blocking Time	1890 ms	1740 ms	120 ms
Cumulative Layout Shift	1334	0,005	0,0
Overall Result	39	6	61
Ranking	2	3	1

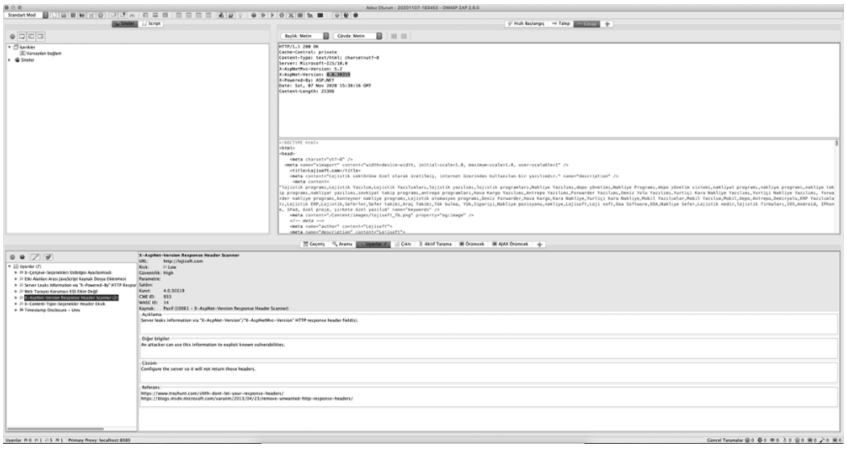
Note. From PageSpeed Insights (developers.google.com)

Ping is the time measurement unit of the data package sent between two computers describing how fast or slow the communication is relayed. Lag represents direct latency caused by numerous reasons that slow down the response times of computers. Ping Ratio and Lag Test Result table show five parameters benchmarked by PageSpeed Insights online tools to clarify which participating programs work faster on the cloud. Naturally, SOFT is

excluded as it has no products deployed on the cloud. First Contentful Paint (FCP) measures the time expended from navigation to the page when the first bit of content is rendered from the server to the browser. It is the first milestone to show that a page is starting to load. SELECT has a pole position in terms of FCP criteria. Speed Index shows how quickly the platform's content becomes visible to users, with lower scores indicating better performance. SELECT wins that race too. Largest Contentful Paint (LCP) is an indicator that must be less than 2.5 seconds as a world standard. Any web platform or a cloud-based ERP that has 2.5 seconds to 4.0 seconds needs improvement, and any platform with more than 4.0 seconds of LCP is in poor condition. Interpretation of this figure tells us that too many users are compiled, compressed, and gathered in the same server location, causing striking lag. XINERJI is severely in lousy condition when its LCP results are observed. Time to Interactive criteria gives us a view of when the users find the web-based ERP solution ready to function with all applets up. It simply measures how swiftly a page becomes interactive.

Figure 15

Owasp ZAP Penetration Test Screen



Note. From (https://owasp.org/www-project-zap/, 2021)

According to the Speed Score results of these three competing platforms, LOJISOFT has the best impact while XINERJI comes last. Notwithstanding, LOJISOFT's score is also average since the PageSpeed Insight benchmarking classifies 91-100 as a good score. This benchmark shows us one of the aspects, among many others, that there are numerous parameters when it comes to design, coding, testing, deploy and promoting software. It is not enough to put out a versatile, solid system, obviously, but also it must be accessible, up and running, and be ready to handle heavy data queries. Furthermore, it must be secure and resistant against digital penetrations or attacks for the sake of keeping customer assets untouchable. If the software is vulnerable to those attacks and far from mitigating server loads by applying necessary methodologies, it will be a loss for both customers and the IT company. When it comes to the vulnerability of cloud-based TMS platforms, benchmarking tools evolve into exploits, sniffers, scanners and crawlers, which measure all possible open ports, security flaws and coding backdoors that may cause bad experiences on attacks from the internet.

Table 8

Owasp Vulnerability Test Results

Made by OWASP ZAP 2.9.0.

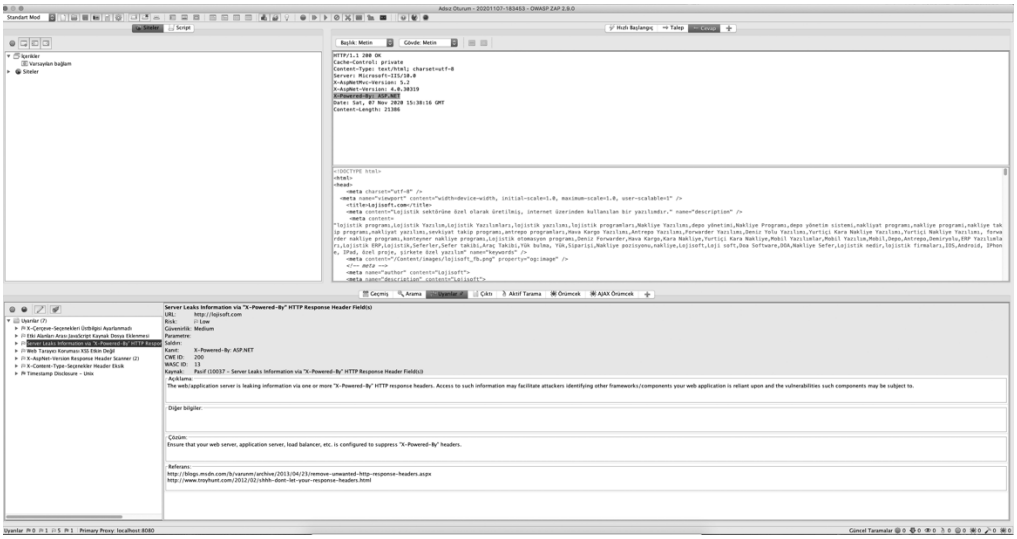
	Programs		
Criteria	SELECT	XINERJI	LOJISOFT
Information Leakage	1	1	1
Web Browser XSS Protection	1	1	1
ASP.Net Version Disclosure	1	1	1
Content Type Visibility	1	1	1
Timestamp Reveal	1	1	1
Ranking	-	-	-

Note : 0 represents absence of the fact and 1 represents the opposite

OWASP ZAP is an operating system free penetration tool capable of checking security gaps of web platforms by applying complete scans of available ports (sniffing) and code checking (ClickJacking) methods. As a result of our benchmarking test, none of these participating contenders has passed the security test. Without diving too deep into programming, it is possible to indicate that all these three platforms have soft spots for a possible attack. LOJISOFT system is open for Clickjacking attacks. There are no Anti-CSRF tokens were found in HTML submission forms on the XINERJI website. This flaw can be fixed by changing existing libraries and frameworks with reliable ones such as OWASP CSRFGuard. A cookie has been set without the 'SameSite' attribute, which means that the cookies can be sent due to a "Cross-site" request on SELECT's web address. Therefore, SELECT must be ensured that the SameSite attribute is set to either "lax" or ideally "strict" for all cookies.

Figure 16

Owasp DDOS Attack Results Screen



Note. From (https://owasp.org/www-project-zap/, 2021)

Both LOJISOFT and XINERJI have third-party JavaScript lines that cause a possible risk in case of that code is not cross-checked, if it is from a secure source or not. Their web/application servers are leaking information via one or more "X-Powered-By" HTTP response headers for all these contenders. Access to such information may facilitate attackers identifying other frameworks or components on the web application is reliant upon and the vulnerabilities such features may be subject to. As a result, developers must be ensured that their application servers and load balancers are configured to suppress "X-Powered-By" headers. None of these platforms has web browser protection. The XSS or "X-XSS-Protection" HTTP response header is turned off. To close that door for security measures for good, the XSS filter must be set to "1" for the server's response method. LOJISOFT's web platform discloses ASPNet Version information on headers. An attacker can use this information to exploit known vulnerabilities. The server must be configured so it will not return those headers. There are several more flaws in line to add to the benchmark results, which may shift the axis of this dissertation into computer engineering rather than keeping it in maritime, transportation and logistics circle boundaries. Thus, it is necessary to clarify and summarize that the result of the security benchmark of these platforms showed the weak points, which must be revised and repaired urgently for the sake of their customers' data security.

While cloud-based products are open for online threats, SOFT-like products that function locally are a safe zone. This may look like one of the advantages of running an ERP in a closed circuit that runs locally on servers with no or strictly limited internet connection. But, on the other hand, for multinational and hyperlocal companies, it is a technological obstacle. Therefore, a contemporary TMS must be web-based and secure

structures that protect its customers' data assets while providing all that simplicity and versatility the maritime industry seeks.

Table 9

Benchmark of Tier Two Platforms

	Programs							
Criteria	Vericom	Winnak	Siber	Ljk	Neolojistik	Dtp	1Ci	Ekobim
Database Platform	Multi*	MS SQL	MS SQL	MS SQL	MS SQL	MS Access	Multi *	Multi *
Coding Language	C#, ASP	C#	Delphi	C#	C#, ASP	Delphi	C, Java	Delphi
SaaS	0	0	0	1	1	0	0	0
Web Based	1	0	0	1	1	1	0	0
Free Training	0	0	0	1	1	1	0	0
Multilingual	1	0	1	1	0	0	1	1
Multi Alphabet	1	0	1	1	0	0	1	0
Integrations	1	1	1	0	0	1	1	1
International Sales	0	0	0	0	0	0	1	0
International Offices	0	0	0	0	0	0	1	0
Open Source	1	0	0	0	0	0	1	0
Total	5	1	3	5	3	3	6	2

Note : 0 represents absence of the fact and 1 represents the opposite

Note. From Company Brochures, Websites, Interview with ERP Suppliers

THE Multi DB option represents the fact that the particular software company can set their program working with any DB structure their customers prefer. The feature is a lucrative gain for those willing to assign several DB models for the ERP system. Among these ERP systems above, only 1Ci quantizes their commitment as follows;

There are 12 software companies benchmarked in this study, and just four of them provide SaaS systems to their customers, while seven offer web-based, cloud computing oriented ERP systems. To bring a broader vision to this dissertation, we must look beyond the horizon. According to Gartner's recent study, the vertical SaaS market had 114 billion USD in revenue in 2014. Customer, industry, sub-segment-specific SaaS products have already taken the lead in the world IT industries. Vertical SaaS products target specific niche segments of particular sectors and provide their customers with a complete digital habitat. SaaS is also evolving into PaaS (Platform as a Service), an advanced SaaS model.

After a particular stage, SaaS providers shift their focal points from customer acquisition to client retention by allowing them to add new components, plug-ins, or applets to their IT structure. In this respect, it is possible to acknowledge that 1Ci is the only PaaS vendor in the list, which provides an open-source platform for all the parties using the 1Ci environment to develop their modules subsequentially.

Table 10

1Ci Drive Advantages Set Table

Criteria	Ratio
Profit Growt	14%
Output Increase	29%
Turnover Increase	25%
Order Processing Increase	85%
Operational Cost Reduction	20%
Reduction on Accounts Receivables	19%
Reduction on Cost of Production	8%
Reduction on Warehouse Inventory	20%

Note. From 1Ci Drive, Presentation (Appendix B)

On-premises applications are still dominating the Turkish maritime market, but they lose both market share and customer attention at an incredible speed. Ones that resist this change either will perish permanently or will have to shift their platforms into cloud-compatible, web-based ERP systems sooner or later. The logic behind of SaaS system ensures flexible payment options, scalability, continuous updates at no cost, smooth, secure and straightforward accessibility, efficient collaboration with third-party platforms. At the system level, scalability means that a system can sustain performance when the data size, the number of users, the number of jobs, etc., continue to increase. At the inter-enterprise

level, it has the additional requirement that the information infrastructure must accommodate different types and growing numbers of participating enterprises and enterprise resources without compromising reliability, adaptability, flexibility and availability (Su, Lam, & Lodha, 2005). The architecture design and approaches are taken to implement these e-services to ensure that the other requirements at the inter-enterprise level will also be met.

Even if figures diverge somewhat, the many forecasts conducted on SaaS industry trends 2020 demonstrate an apparent reality: *the SaaS market will get bigger and bigger*. Indeed, according to Bloomberg, cloud platforms, business services, and applications (SaaS) will all grow at a 9% CAGR (Compound Annual Growth Rate) between 2019 and 2023 and worth $60.36 billion. A Betterbuys report reveals that the specific expenditure in the U.S. SaaS Industry is forecasted to reach $55 billion by 2026. Also, according to Gartner, the global public cloud service market is projected to grow significantly in 2020 and beyond. These figures clearly show us that the trends are emerging towards web-based ERP systems, particularly for the SCM industry. Because of this, it is also possible for the customers to expand their ERP system with either more virtual machines to increase the capacity or extend the data storage to enable more data to be stored. This fact provides the possibility for the companies to increase or decrease the system depending on the business. This change is perfect for new and fast-growing companies because they can adapt the system to the business without buying and installing new hardware. The use of the pay-what-you-use model makes this an excellent thing because a company never needs unused hardware (Snellman, 2017). Therefore, it is evident that the trends will evolve in favour of the cloud-based ERP alternatives.

2.4 Comparison of Two ERP Systems at Company A

It is fundamentally necessary to benchmark two software platforms, particularly an ERP that works on a local computer network and another one that works on the cloud, to observe the benefits or inefficiencies of these systems. On the other hand, it is not easy to have access to categorized company data in the shipping and freight forwarding industry that shows -to some degree, classified operational information that tends to be kept out of sight by those companies. Establishing a valuable set of KPIs depends on the subject company's objectives and is highly related to specific business contexts, strategies, processes, and systems (Gonçalves, Dias, & Machado, 2014). Therefore, it was challenging to convince the company that the data would be used solely for research purposes, and specific information segments would be excluded from the acquired dataset. (Appendix A: Data Usage Permit).

It has taken ten working days (two calendar weeks) of labour that has been spent at the company "A" for collecting, clustering, categorising and validating the data through two separate ERP programmes working on two different server systems. As a result, there were 42 KPIs compiled in each table. The KPIs have been selected by focusing on the core activity of company A, their shipping operations (sea, land, air transportation), sales and marketing flow, profit margins, ERP related training durations, training costs and their customer relation related performance indicators. These selected key performance indicators were also representing the intersecting set of data that both scrutinised ERP programs have commonly taken place in this statistical analysis. In addition to the above, any residual data that has no add-value or relation to this research's nature is considered excess data and removed from the study (i.e. human resources, accounting, personnel's

opinion on the ERP alternatives, hardware capacity and inventory of the staff). We have applied DeLone & McLean's I/S Success Model and The Gable et al. Model to define the performance indicators analysed in this chapter. The KPIs were grouped under four titles while classifying their presence in this research.

The KPIs have been grouped under four subtitles as;

- **Financial Indicators KPI Group 1**: Turnover, profits, fees, costs.
- **Operational Indicators KPI Group 2**: Quantity of shipments, shipping documents, new orders, lost-acquired-reclaimed customers.
- **Technological Indicators KPI Group 3**: Integrations, training & maintenance durations, errors, crash reports, third-party apps, time to make quotations.
- **Human Performance Indicators KPI Group 4**: Sales and marketing reports, screen-time, complaint tickets, training time, acquired, reclaimed, lost customers.

Each of these two models collaboratively influenced our statistical comparison to define, group, and visualize both KPIs and the outcome of the tests. For example, according to DeLone & McLean I/S Success Model, there are six criteria to observe the success ratio of an ERP which are;

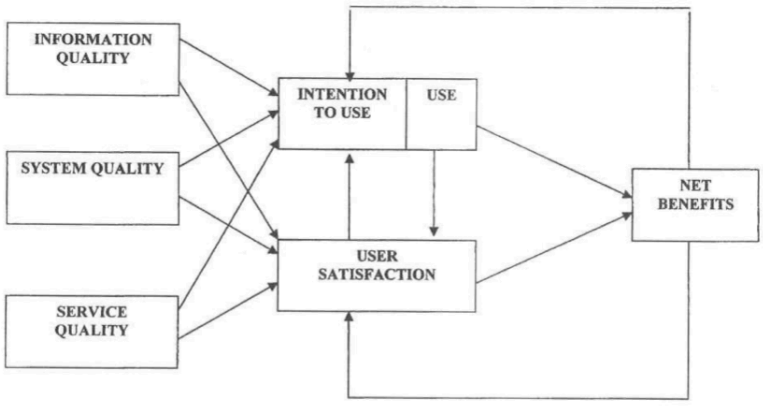
- **System Quality**: Technological Key Performance Indicators
- **Information Quality**: Human Performance Indicators, Technological KPIs
- **User Satisfaction (The use)**: Human Performance Indicators
- **Individual Impact**: Human Performance Indicators
- **Organisational Impact**: Fiscal and Operational Indicators (Kronbichler, Ostermann, & Staudinger, 2010).

According to DeLane & McLean's I/S Success Model, ***system quality*** was one of the KPIs while measuring and benchmarking an ERP's efficiency. The following criteria were forming a detailed and supportive sub-text of system quality as follows;

- **Adaptability**: Integration Demanded, Quantity of Integrations, Integrated 3rd Party Applications
- **Availability**: Crash Reports
- **Reliability**: Active CALs, Visit Reports, Acquired & Reclaimed Customers
- **Response Time**: Amount of Complaint Tickets,
- **Usability**: Average Screen Time, Visit Reports Submitted (DeLone & McLean, 2003).

Figure 17

Delone & McLean I/S Success Model



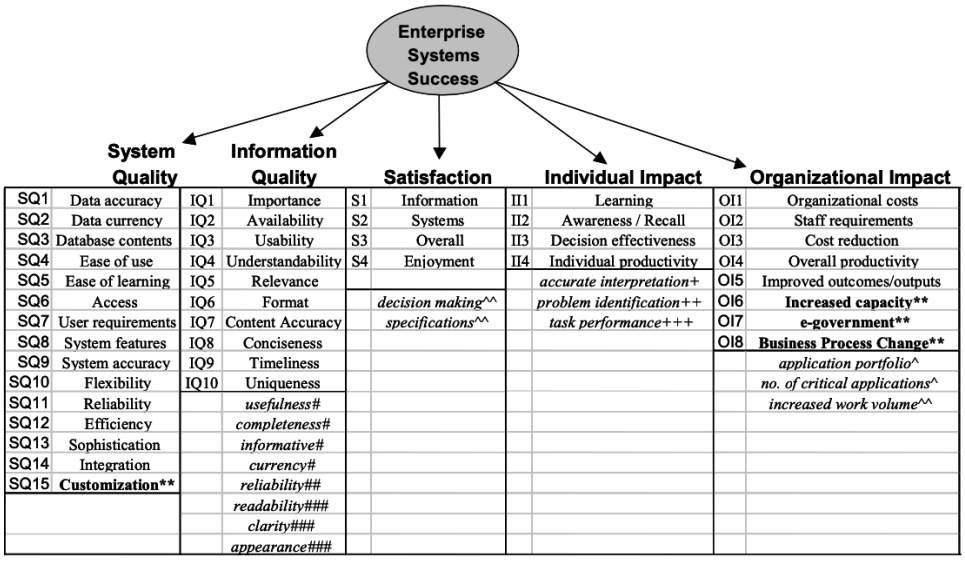
The DeLone & McLean IS Success Model seems to remain the most popular, comprehensive framework for IS success measurement. Therefore, it is ascribed to and influenced in this section of the dissertation while selecting KPIs from the company "A" dataset. Over the past three decades, evaluating the value and success of IT systems for organizations has been a recurring issue, and various assessment approaches have surfaced.

For example, one stream of research focuses on attitudinal, perceptual, and subjective measures, while another utilizes financial and objective parameters (Ifinedo, 2006).

Therefore, using another ERP success measurement and criteria evaluation method that cooperates with DeLone & McLean's model was necessary for this chapter. The Gable et al. model can be used for measures at a specific time as a snapshot of the organisation's experience. According to Gable and colleagues, success factors that help researchers measure the organisation's ERP efficiency level should be classified and aggregated in two clusters: workgroup impact and vendor/consultant related output. Workgroup Impact is rendered by active users' increased or decreased capacity that are compiled in our study as the group of criteria such as sales-related KPIs, screen time, the accuracy of documentation, operational effectiveness and vendor/consultant related output covers KPIs, such as third party application integrations, errors, maintenance fees, complaint tickets.

Figure 18

The Gable et al. Model KPI Structure



Note. From (Gable, Sedera, & Chan, 2003).

The model proposed by Guy G. Gable, Darshana Sedera and Taizan Chan can be considered an advanced version of DeLone & McLean's research (Gable, Sedera, & Chan, 2003). While preventing selected criteria from overlapping and misguiding the test results, the Gable et al. Model draws a futuristic approach by measuring the results (impacts) on individuals and the organisation for the present and the future. Therefore, our study also aims to forecast the future by analysing the trends. The relational connection of used KPIs was also compiled and displayed in Appendix C. In addition to the above, the selected KPIs were intersecting datasets of both ERP programs evaluated and compared in this section. Therefore, it was a practical approach to club these 42 KPIs for an accurate comparison.

The company "A" is a participant freight forwarder corporation with over 20 years of experience in container shipping, air cargo and truck transportation services, located in Istanbul, Turkey. Company A used these two different ERP platforms taking place in our benchmark over the years. Our case study will reveal the substantial, meaningful relations, if there are any, between these two ERP platforms as each has significant differences technologically and cost-wise. Company "A" employs 18 white-shirts personnel, excluding co-founder directors. Eight staff works at sea freight, container shipping operations department; two staff works at air cargo department, four staff works at trucking department who control, plan and manage groupage and full truckloads, two staff works at sales and marketing division, and two staff works at book-keeping department. Among those eight people who work at the sea freight department, seven deal with export shipments from Turkey, and one deals with import and transit shipments to/via Turkey. As we may observe, containerized shipping trade is Company "A" 's core business compared to their other activities. Company "A" is a limited liability entity that holds IATA

(International Air Transportation Association) license, enabling the company to handle air cargo shipments to and from Turkey (Appendix D). The company also acts as a freight forwarder that does not own freight trucks; instead, they chart such vehicles for a round-trip basis or long term. Therefore, the company also has a TIO Certificate that The Ministry of Transportation and Communication mandates on freight forwarding companies in Turkey(Appendix E). Thanks to this certificate, the company has legitimately acted as a non-vehicle owner freight operator company in Turkey (Asgard Transport Llc, 2020).

We have applied to IBM's SPSS program to interpret these data collected from company A. The data was acquired from the company directly by visiting them at their workplace and studying the raw data for five working days. The first table gives us an insight into ERP1 used by the company between 2010 to 2014, and the second table shows us the details of ERP2 that was in use between 2015 to 2019. The benchmark data has been segmented into three measurement units as Usd currency, as quantity and as minutes for 41 different criteria as subjects of the comparison study. The ERP1 is software that runs locally as an installed program.

The primary DB is stored on a server, and CALs connect to the mainframe as clients. It does not have access for third-party applicants unless otherwise is permitted by company A. ERP1 does not require an internet connection to function except a typical WAN structure which allows CALs to log in through a LAN. ERP2 is a web-based platform that needs an internet connection for accessing it. ERP2 is not an installed product; it does not require any applets or plug-ins to be installed for using it. It runs on a cloud environment and is accessible by web browsers. ERP1 does not provide DB protection or a backup service.

Company A protects its data and monitors the daily backup process performed by its personnel.

ERP1 is an older software than ERP2, and cost-wise, it has a higher sales price. ERP1 is using Progress DB, and ERP2 is using MS SQL DB. As a result, the start-up cost of ERP1 is higher than ERP2. ERP1 requires two servers in-house, one dedicated for the program's core and one for hosting the DB. In addition to this, ERP1 runs on Microsoft Server operating system only. The client is asked to purchase Microsoft's Server Operating system twice, one for the server that runs the program and the other for the server that hosts the DB files. ERP2 runs on a virtual server environment without asking clients to invest in hardware items such as servers or additional operating system license fees. In this respect, it is relatively simple to kickstart the ERP2 project for maritime companies willing to switch their old ERP or have a brand new one from zero ground.

ERP1 has a higher amount of modules than ERP2, and it has more comprehensive skills to cover the basic needs of shipping companies. Most importantly, ERP1 has its integrated accounting module that comes with the program, while ERP2 works with third-party accounting programs. On the other hand, ERP2 shows signs of openness and more flexibility for third-party integration possibilities. ERP1 has a policy that they produce all needed and supply their customers with their licensed products. ERP1 needs two to three weeks to get the program customized and running correctly for each new client, while ERP1 needs a week to set it all up and get ready, including custom-designed documents. On the other hand, as it is their preference in business, company A has only air cargo parcel exports; that is why there is an equal number of air cargo exports and MAWBs (Master Airway Bill).

Table 11 - *ERP1 Dataset (A Locally Installed Program)*

COMPANY A	UNIT	2010	2011	2012	2013	2014
Turnover (Mil)	Usd	3,5	3,8	4,2	5,1	5,3
Net Profits (Mil)	Usd	0,32	0,34	0,39	0,46	0,49
Sea Shipments (TEUs)	Quantity	2342,0	2520,0	2711,0	3296,0	3427,0
Air Shipments (Parcel)	Quantity	132,0	244,0	296,0	371,0	404,0
Road Shipments (Truck)	Quantity	721,0	826,0	899,0	927,0	1012,0
Sea B/L Issued	Quantity	834,0	681,0	777,0	1089,0	911,0
Air B/L Issued	Quantity	132,0	244,0	296,0	371,0	404,0
Road Cmr Issued	Quantity	721,0	826,0	899,0	927,0	1012,0
Freight Invoice Issued - Sea	Quantity	2006,0	2114,0	2645,0	3010,0	3127,0
Freight Invoice Issued - Air	Quantity	132,0	244,0	296,0	371,0	404,0
Freight Invoice Issued - Road	Quantity	701,0	808,0	890,0	894,0	997,0
Error(s) Reported	Quantity	44,0	52,0	31,0	27,0	24,0
Integration Demanded	Quantity	0,0	0,0	1,0	0,0	1,0
Annual Maintenance Fees	Usd	2382,0	4248,0	5310,0	6018,0	7788,0
Av. Profit Per Shipment	Usd	100,2	94,7	99.84	100,1	101,2
Av. Profit Per Shipment Sea	Usd	92,2	90,8	104,0	105,0	93,2
Av. Profit Per Shipment Air	Usd	110,1	97,7	98,8	97,1	91,3
Av. Profit Per Shipment Road	Usd	98,2	95,6	96,7	98,2	119,1
Time for Submitting a B/L	Minute	5	5	5	6	6
Average Amount of Reports	Quantity	4	4	5	5	6
Active CALs	Quantity	10	13	13	15	16
Program Crash Reports / Annual	Quantity	3	2	0	0	1
Training Time	Minute	40	52	55	68	78
Training Time per CAL	Minute	4	4	4,23	4,53	4,87
Training Costs	Usd	1200	1560	1650	2040	2340
Training Costs per CAL	Usd	120	120	126,92	136	146,25
Freight Quotations Made	Quantity	2576	2747	2741	3179	3893
Freight Quotes. Made Sea	Quantity	1104	1310	1098	1561	2080
Freight Quotes. Made Air	Quantity	410	328	366	307	384
Freight Quotes. Made Road	Quantity	1062	1109	1277	1311	1154
Average Time to Make Offers	Quantity	7	7	8	8	7
Visit Reports Submitted	Quantity	378	432	842	1040	1092
Acquired Orders After Quotes	Quantity	695	906	1014	1208	1479
Lost Customers	Quantity	27	24	18	32	19
Acquired Customers	Quantity	32	22	27	28	33
Reclaimed Customers	Quantity	4	0	2	1	1
Quantity of International Partners	Quantity	9	11	12	15	14
Quantity of Domestic Partners	Quantity	17	22	26	35	33
Amount of Integrations	Quantity	0	0	0	1	1
Integrated 3rd Party Apps	Quantity	0	0	0	1	1
Average Screen Time per CAL per Day	Minute	178	181	202	216	209
Amount of Complaint Tickets (CALs)	Quantity	32	27	38	41	45

NBote. From Company A Data - Appendix A

As seen above, ERP1 was used for five years at company A. Company A had a 3,5 million Usd turnover in the first year when ERP1 was set in use. When it was replaced by ERP2 in 2014, company A had 3427 TEU (Twenty Feet Equivalent Unit) sea shipments, 404 air cargo parcels and 1012 truckloads per annum. The data table shows that 1089 Bill of Ladings were issued for 3296 TEUs in 2013. Therefore, it can be interpreted that an average B/L had 3.02 TEUs assigned to it as it is possible to ship multiple containers under one B/L coverage.

The table shows that company A marketing department has sent 1561 freight quotations to local and international customers and gained 3296 TEUs out of these efforts. Comparing that ratio, the trucking department has half of that efficiency which the sea freight department had in 2013, and they have sent 1311 freight quotations and gained only 927 shipments as a result. We can also observe that company A continuously increased their international partners from 9 to 14 in those five years. International partners are considered big-scale customers in the maritime business.

They provide shipment volumes as both service buyers and sellers at the same time. It is possible to observe that due to several upgrades and changes in ERP1, submitting a BL and the average time of sending a quotation have increased by one minute per record. In the maritime industry, particularly in the freight forwarding business, response punctuality on the customer's demands means a big win. Whoever sends the offers first makes a significant and positive impression on the customer's side. Punctuality is equal to expertise in a specific type of service or geographical area served. Thus, the average time spent for a quotation is a measured parameter at maritime companies.

Table 12 - *ERP2 Dataset (A Web Based Program)*

COMPANY A	UNIT	2015	2016	2017	2018	2019
Turnover (Mil)	Usd	5,9	6,4	6,8	7,2	8,1
Net Profits (Mil)	Usd	0,58	0,63	0,65	0,64	0,77
Sea Shipments (TEUs)	Quantity	3948,0	4314,0	4608,0	4983,0	4764,0
Air Shipments (Parcel)	Quantity	425,0	471,0	518,0	615,0	552,0
Road Shipments (Truck)	Quantity	1107,0	1184,0	1213,0	1340,0	1205,0
Sea B/L Issued	Quantity	842,0	922,0	1221,0	1422,0	1385,0
Air B/L Issued	Quantity	425,0	471,0	518,0	615,0	552,0
Road Cmr Issued	Quantity	1107,0	1184,0	1213,0	1340,0	1205,0
Freight Invoice Issued - Sea	Quantity	3801,0	3926,0	4107,0	4048,0	4513,0
Freight Invoice Issued - Air	Quantity	425,0	471,0	518,0	615,0	552,0
Freight Invoice Issued - Road	Quantity	1096,0	1091,0	1175,0	1213,0	1106,0
Error(s) Reported	Quantity	29,0	16,0	10,0	14,0	9,0
Integration Demanded	Quantity	2,0	0,0	0,0	1,0	1,0
Annual Maintenance Fees	Usd	1416,0	1289,0	1154,0	1080,0	928,0
Av. Profit Per Shipment	Usd	105,8	105,5	102,5	92,2	118,1
Av. Profit Per Shipment Sea	Usd	111,3	106,1	101,5	94,6	124,8
Av. Profit Per Shipment Air	Usd	102,0	107,2	98,4	87,9	108,8
Av. Profit Per Shipment Road	Usd	104,2	103,3	107,7	94,0	120,7
Time for Submitting a B/L	Minute	5	5	4	4	3
Average Amount of Reports	Quantity	6	6	7	8	9
Active CALs	Quantity	15	16	16	19	22
Program Crash Reports / Annual	Quantity	3	0	1	0	2
Training Time	Minute	120	72	64	86	96
Training Time per CAL	Minute	8	4,5	4	4,52	4,36
Training Costs	Usd	1200	720	640	860	960
Training Costs per CAL	Usd	80	45	40	45,26	43,63
Freight Quotations Made	Quantity	3925	3841	4190	3433	4211
Freight Quotes. Made Sea	Quantity	2810	2706	2971	2522	2885
Freight Quotes. Made Air	Quantity	505	248	303	201	286
Freight Quotes. Made Road	Quantity	610	887	916	710	1040
Average Time to Make Offers	Quantity	5	5	5	5	4
Visit Reports Submitted	Quantity	921	1183	1320	1408	1560
Acquired Orders After Quotes	Quantity	1570	1728	1718	1510	1588
Lost Customers	Quantity	23	14	25	16	12
Acquired Customers	Quantity	21	7	32	29	31
Reclaimed Customers	Quantity	2	0	3	4	5
Quantity of International Partners	Quantity	18	18	19	19	19
Quantity of Domestic Partners	Quantity	29	42	44	45	44
Amount of Integrations	Quantity	2	0	0	3	4
Integrated 3rd Party Apps	Quantity	2	0	0	3	5
Average Screen Time per CAL per Day	Minute	217	234	242	252	268
Amount of Complaint Tickets (CALs)	Quantity	8	11	5	7	7

Note. From Company A Data - Appendix A

At this step, to take our study up to a more concrete scale and have it materialized, it is necessary to propose a simple hypothesis as follows;

- H0: ERP2 is not significantly better than ERP1, and ERP2 does not bring a remarkable dynamism to company A.
- H1(A): ERP2 is significantly better than ERP1, and ERP2 brings more dynamism to company A

We have applied a normality test for all the variables which have taken place in the tables. The test was conducted to determine whether to use parametric or non-parametric inferential tests to examine variables and interpret the results. As the first step, it is checked if the variables were normally distributed. The following variables; integration demanded, annual maintenance fees, program crash reports, training time per CAL, training costs per CAL, acquired (new) customers, amount of integrations and integrated third-party apps were not normally distributed ($p < .05$). On the other hand, the rest of the variables were normally distributed ($p > .05$). For those normally distributed variables, an independent t-Test (a parametric test) was applied to examine them. In contrast, a Mann-Whitney u-test (non-parametric test) was conducted for those variables that were not normally distributed.

Table 13 *Results of Different Statistical Analyzes - 1/2*

Variables	Mean Rank		Mann-Whitney U	Wilcoxon W	Chi-Square	P-value	Correlation Coefficient Category of ERP	P-value
Turnover Mil	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Net Profits Mil	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Sea Shipments TEUs	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Air Shipments Parcel	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Road Shipments Truck	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						

Table 14 - *Results of Different Statistical Analyzes - 2/2*

Variables	Mean Rank		Mann-Whitney U	Wilcoxon W	Chi-Square	P-value	Correlation Coefficient Category of ERP	P-value
Sea B/L Issued	ERP1	3.6	3.000	18.000	3.938	**0.047**	0.661	**0.037**
	ERP2	7.4						
Air B/L Issued	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Road Cmr Issued	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Freight Invoice Issued Sea	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Freight Invoice Issued Air	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Freight Invoice Issued Road	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Errors Reported	ERP1	7.6	2.000	17.000	4.811	**0.028**	-0.731	**0.016**
	ERP2	3.4						
Integration Demanded	ERP1	4.4	7.000	22.000	1.729	0.189	0.438	0.205
	ERP2	6.6						
Annual Maintenance Fees	ERP1	8	.000	15.000	6.818	**0.009**	-0.870	**0.001**
	ERP2	3						
Av Profit Per Shipment	ERP1	4	5.000	20.000	2.455	0.117	0.522	0.122
	ERP2	7						
Av Profit Per Shipment Sea	ERP1	3.8	4.000	19.000	3.153	0.076	0.592	0.071
	ERP2	7.2						
Av Profit Per Shipment Air	ERP1	5	10.000	25.000	.273	0.602	0.174	0.631
	ERP2	6						
Av Profit Per Shipment Road	ERP1	4.6	8.000	23.000	.889	0.346	0.314	0.376
	ERP2	6.4						
Time for Submitting a BL	ERP1	7.4	3.000	18.000	4.544	**0.033**	-0.711	**0.021**
	ERP2	3.6						
Average Amount of Reports	ERP1	3.2	1.000	16.000	5.989	**0.014**	0.816	**0.004**
	ERP2	7.8						
Active CALs	ERP1	3.5	2.500	17.500	4.528	**0.033**	0.709	**0.022**
	ERP2	7.5						
Program Crash Reports Annual	ERP1	5.5	12.500	27.500	.000	1.000	0.00	1.00
	ERP2	5.5						
Training Time	ERP1	3.6	3.000	18.000	3.938	**0.047**	0.661	**0.037**
	ERP2	7.4						
Training Time per CAL	ERP1	5	10.000	25.000	.280	0.597	0.176	0.626
	ERP2	6						
Training Costs	ERP1	7.9	.500	15.500	6.322	**0.012**	-0.838	**0.002**
	ERP2	3.1						
Training Costs per CAL	ERP1	8	.000	15.000	6.860	**0.009**	-0.873	**0.001**
	ERP2	3						
Freight Quotations Made	ERP1	3.4	2.000	17.000	4.811	**0.028**	0.731	**0.016**
	ERP2	7.6						
Freight Quotes Made Sea	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Freight Quotes Made Air	ERP1	7	5.000	20.000	2.455	0.117	-0.522	0.122
	ERP2	4						
Freight Quotes Made Road	ERP1	8	.000	15.000	6.818	**0.009**	-0.870	**0.001**
	ERP2	3						
Average Time to Make Offers	ERP1	3.4	.000	15.000	7.500	**0.006**	-0.913	**0.000**
	ERP2	7.6						
Visit Reports Submitted	ERP1	3	2.000	17.000	4.811	**0.028**	0.731	**0.016**
	ERP2	8						
Acquired Orders After Quotes	ERP1	7	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	4						
Lost Customers	ERP1	6.1	5.000	20.000	2.455	0.117	-0.522	0.122
	ERP2	4.9						
Acquired Customers	ERP1	6.1	9.500	24.500	.395	0.530	-0.210	0.561
	ERP2	4.9						
Reclaimed Customers	ERP1	4.5	7.500	22.500	1.118	0.290	0.352	0.318
	ERP2	6.5						
Quantity of International Partners	ERP1	3	.000	15.000	7.031	**0.008**	0.884	**0.001**
	ERP2	8						
Quantity of Domestic Partners	ERP1	3.4	2.000	17.000	4.840	**0.028**	0.733	**0.016**
	ERP2	7.6						
Amount of Integrations	ERP1	4.4	7.000	22.000	1.513	0.219	0.410	0.239
	ERP2	6.6						
Integrated 3rd Party Apps	ERP1	4.4	7.000	22.000	1.513	0.219	0.410	0.239
	ERP2	6.6						
Average Screen Time per CAL per Day	ERP1	3	.000	15.000	6.818	**0.009**	0.870	**0.001**
	ERP2	8						
Amount of Complaint Tickets CALs	ERP1	8	.000	15.000	6.860	**0.009**	-0.873	**0.001**
	ERP2	3						

From Table 9 and 10, it can be concluded that ERP2 reported the highest median on In Mann-Whitney U test, Turnover Mil (USD), Net Profits Mil(USD), Sea Shipments TEUs (Qty), Air Shipments Parcel (Qty), Road Shipments Truck(Qty), Air B/L Issued(Qty), Road Cmr Issued(Qty), Freight Invoice Issued Sea(Qty), Freight Invoice Issued Air(Qty), Freight Invoice Issued Road(Qty), Freight Quotes Made Sea(Qty), Visit Reports Submitted(Qty), Quantity of International Partners (Qty), Average Screen Time per CAL per Day(Min), indicating that profits in EPR2 may be based on this variables much.

Tables 9 and 10 also show a correlation test indicating a correlation between different variables with ERP type. The findings suggested that there is a positive correlation of Turnover Mill(USD), Net profits Mil(USD), Sea shipments TEUs (Qty), Air shipments parcel (Qty), Road shipments truck (Qty), Sea B/L issued (Qty), Air B/L issued (Qty), Road Cmr issued (Qty), Freight Invoice Issued Sea (Qty), Freight Invoice Issued Air (Qty), Freight Invoice Issued Road (Qty), Average Amount of Reports (Qty), Active CALs (Qty), Training Time (Min), Freight Quotations Made (Qty), Freight Quotations Made Sea (Qty), Visit Reports Submitted (Qty), Acquired Orders after Quotes (Qty), Quantity of International Partners (Qty), Quantity of Domestic Partners (Qty) and Average Screen Time per CAL per Day (Min) with ERP type. This can be anticipated that as these variables will increase, the ERP type will improve accordingly.

As the dependent variable (ERP type) is categorical and we need to compare the variables with the ERP type, we need to perform the **Mann-Whitney U** test. This test is used to compare the number of times a score from one sample is ranked higher than a score from another sample. **Mean rank** is used to show which type of ERP is higher. The high

mean rank of ERP indicates mean value of the variable is higher. **Wilcoxon W** is used to compare two variables, and the value indicates the smaller value of rank totals. **A Chi-square test** is used to see the correlation between variables. A value of chi-square suggests the difference between actual data and expected data. A higher value indicates much difference. **Spearman Correlation test:** Spearman correlation measures the strength and direction of association of two variables. Here this test was done to see the linear relationship of variables with ERP type and which variables will improve the ERP in the future. **ERP** is categorized in ERP1 and ERP2 to apply the Spearman correlation test. This category of variables is done to see their type of correlation (positive or negative) with other variables.

The test revealed a significant difference for Turnover Mil (USD), Net Profits Mil(USD), Sea Shipments TEUs (Qty), Air Shipments Parcel (Qty), Road Shipments Truck(Qty), Air B/L Issued(Qty), Road Cmr Issued(Qty), Freight Invoice Issued Sea(Qty), Freight Invoice Issued Air(Qty), Freight Invoice Issued Road(Qty), Annual Maintenance Fees(USD), Freight Quotes Made Sea(Qty), Freight Quotes Made Road(Qty), Acquired Orders After Quotes(Qty), Average Screen Time per CAL per Day(Min) (U =0, Z=-2.611, p=0.009 with large effect r=0.83), for Sea B/L Issued(Qty) (U=3, Z=-1.984, p=0.047 with large effect, r=0.63), for Error reported(Qty)(U=2, Z=-2.193, p=0.028 , r=0.69), for Time for Submitting a B/L(Min) (U=3, Z=-2.132, p=0.033, r=0.67), for average amount of reports(Qty) (U=1, Z=-2.447, p=0.014, r=0.77), Active CALs(Qty) (U=2.5, Z=-2.128, p=0.033, r=0.67), for training time(Min) (U=3, Z=-1.984, p=0.047, r=0.63), for Training Cost(USD) (U=0.5, Z=-2.514, p=0.012, r=0.79, for Training Costs per CAL(USD) and Amount of Complaint Tickets CALs(Qty) (U=0, Z=-2.619, p=0.009, r=0.82), for Freight

Quotations Made(Qty) and Visit Reports Submitted(Qty) (U=2, Z=-2.193, p=0.028, r=0.69) , for Average Time to Make Offers(Qty)(U=0, Z=-2.739, p=0.006, r=0.86), for Quantity of International Partners (Qty) (U=0, Z=-2.652, p=0.008, r=0.84) and for Quantity of Domestic Partners (Qty) (U=2, Z=-2.2, p=0.028, r=0.696).

Integration Demanded(Qty), Av Profit Per Shipment(USD), Av Profit Per Shipment Sea (USD), Av Profit Per Shipment Air (USD), Av Profit Per Shipment Road (USD), Program Crash Reports Annual (Qty), Training Time per CAL(Min), Freight Quotes Made Air (Qty), Lost Customers(Qty), Acquired Customers(Qty), Reclaimed Customers(Qty), Amount of Integrations(Qty) and Integrated 3rd Party Apps (Qty) did not show a significant difference ($p<0.05$).

Turnover Mil (USD), Net Profits Mil(USD), Sea Shipments TEUs (Qty), Air Shipments Parcel (Qty), Road Shipments Truck(Qty), Sea B/L Issued(Qty), Air B/L Issued(Qty), Road Cmr Issued(Qty), Freight Invoice Issued Sea(Qty), Freight Invoice Issued Air(Qty), Freight Invoice Issued Road(Qty), Freight Quotes Made Sea(Qty), Acquired Orders After Quotes(Qty), Average Screen Time per CAL per Day(Min), the average amount of reports(Qty), Active CALs(Qty), Training time(Min), Freight Quotations Made(Qty), Visit Reports Submitted(Qty), Quantity of International Partners (Qty) and Quantity of Domestic Partners(Qty) are lower in ERP1 than ERP2 as the mean rank is higher in ERP2. Error reported(Qty), Annual Maintenance Fees(USD), Time for Submitting a B/L(Min), Training Cost(USD), Training Costs per CAL(USD) Freight Quotes Made Road(Qty), Average Time to Make Offers(Qty) and Amount of Complaint Tickets CALs(Qty) are higher in ERP1 than ERP2.

Table 15

Test Stats Table

	MW U	Wilcoxon W	Z	Asymp. Sig. (2-tailed)	Exact Sig. [2*(1-tailed Sig.)]
Turnover Mil	.000	15.000	-2.611	.009	.008[b]
Net Profits Mil	.000	15.000	-2.611	.009	.008[b]
Sea Shipments TEUs	.000	15.000	-2.611	.009	.008[b]
Air Shipments Parcel	.000	15.000	-2.611	.009	.008[b]
Road Shipments Truck	.000	15.000	-2.611	.009	.008[b]
Sea BL Issued	3.000	18.000	-1.984	.047	.056[b]
Air BL Issued	.000	15.000	-2.611	.009	.008[b]
Road Cmr Issued	.000	15.000	-2.611	.009	.008[b]
Freight Invoice Issued Sea	.000	15.000	-2.611	.009	.008[b]
Freight Invoice Issued Air	.000	15.000	-2.611	.009	.008[b]
Freight Invoice Issued Road	.000	15.000	-2.611	.009	.008[b]
Errors Reported	2.000	17.000	-2.193	.028	.032[b]
Integration Demanded	7.000	22.000	-1.315	.189	.310[b]
Annual Maintenance Fees	.000	15.000	-2.611	.009	.008[b]
Av Profit Per Shipment	5.000	20.000	-1.567	.117	.151[b]
Av Profit Per Shipment Sea	4.000	19.000	-1.776	.076	.095[b]
Av Profit Per Shipment Air	10.000	25.000	-.522	.602	.690[b]
Av Profit Per Shipment Road	8.000	23.000	-.943	.346	.421[b]
Time for Submitting a BL	3.000	18.000	-2.132	.033	.056[b]
Average Amount of Reports	1.000	16.000	-2.447	.014	.016[b]
Active CALs	2.500	17.500	-2.128	.033	.032[b]
Program Crash Reports Annual	12.500	27.500	.000	1.000	1.000[b]
Training Time	3.000	18.000	-1.984	.047	.056[b]
Training Time per CAL	10.000	25.000	-.529	.597	.690[b]
Training Costs	.500	15.500	-2.514	.012	.008[b]
Training Costs per CAL	.000	15.000	-2.619	.009	.008[b]
Freight Quotations Made	2.000	17.000	-2.193	.028	.032[b]
Freight Quotes Made Sea	.000	15.000	-2.611	.009	.008[b]
Freight Quotes Made Air	5.000	20.000	-1.567	.117	.151[b]
Freight Quotes Made Road	.000	15.000	-2.611	.009	.008[b]
Average Time to Make Offers	.000	15.000	-2.739	.006	.008[b]
Visit Reports Submitted	2.000	17.000	-2.193	.028	.032[b]
Acquired Orders After Quotes	.000	15.000	-2.611	.009	.008[b]
Lost Customers	5.000	20.000	-1.567	.117	.151[b]
Acquired Customers	9.500	24.500	-.629	.530	.548[b]
Reclaimed Customers	7.500	22.500	-1.057	.290	.310[b]
Quantity of International Partners	.000	15.000	-2.652	.008	.008[b]
Quantity of Domestic Partners	2.000	17.000	-2.200	.028	.032[b]
Amount of Integrations	7.000	22.000	-1.230	.219	.310[b]
Integrated 3rd Party Apps	7.000	22.000	-1.230	.219	.310[b]
Av. Screen Time per CAL/Day	.000	15.000	-2.611	.009	.008[b]
Amt. of Complaint Tickets CALs	.000	15.000	-2.619	.009	.008[b]

a. Grouping Variable: Category of ERP

b. Not corrected for ties.

The Kruskal-Wallis test, also called "one-way ANOVA [Analysis of Variances]", is a non-parametric method used in this benchmark to determine if there are statistically significant differences between ERP1 and ERP2 datasets shown above. The Kruskal Wallis H test showed that there is a significant difference in Turnover Mil (USD), Net Profits Mil(USD), Sea Shipments TEUs (Qty), Air Shipments Parcel (Qty), Road Shipments Truck(Qty), Sea B/L Issued, Air B/L Issued(Qty), Road Cmr Issued(Qty), Freight Invoice Issued Sea(Qty), Freight Invoice Issued Air(Qty), Freight Invoice Issued Road(Qty), Freight Quotes Made Sea(Qty), Acquired Orders After Quotes(Qty), Average Screen Time per CAL per Day(Min), the average amount of reports(Qty), Active CALs(Qty), training time(Min), Freight Quotations Made(Qty), Visit Reports Submitted(Qty), Quantity of International Partners (Qty), Quantity of Domestic Partners, Error reported(Qty), Annual Maintenance Fees(USD), Time for Submitting a B/L(Min), Training Cost(USD), Freight Quotes Made Road(Qty), Average Time to Make Offers(Qty) and Amount of Complaint Tickets CALs(Qty) among the two groups of ERP (ERP1, n=5 and ERP2, n=5).

After the analysis, the mean rank, Turnover Mil (USD), Net Profits Mil(USD), Sea Shipments TEUs (Qty), Air Shipments Parcel (Qty), Road Shipments Truck(Qty), Sea B/L Issued, Air B/L Issued(Qty), Road Cmr Issued(Qty), Freight Invoice Issued Sea(Qty), Freight Invoice Issued Air(Qty), Freight Invoice Issued Road(Qty), Freight Quotes Made Sea(Qty), Acquired Orders After Quotes(Qty), Average Screen Time per CAL per Day(Min), the average amount of reports(Qty), Active CALs(Qty), training time(Min), Freight Quotations Made(Qty), Visit Reports Submitted(Qty), Quantity of International Partners (Qty) and Quantity of Domestic Partners are lower in ERP1 than ERP2 and Error reported(Qty), Annual Maintenance Fees(USD), Time for Submitting a B/L(Min), Training

Cost(USD), Freight Quotes Made Road(Qty), Average Time to Make Offers(Qty) and Amount of Complaint Tickets CALs(Qty) are higher in ERP1 than ERP2.

Table 16

Test Stats Table

Test Statistics[a,b]

	Chi-Square	df	Asymp.
Turnover Mil	6.818	1	.009
Net Profits Mil	6.818	1	.009
Sea Shipments TEUs	6.818	1	.009
Air Shipments Parcel	6.818	1	.009
Road Shipments Truck	6.818	1	.009
Sea BL Issued	3.938	1	.047
Air BL Issued	6.818	1	.009
Road Cmr Issued	6.818	1	.009
Freight Invoice Issued Sea	6.818	1	.009
Freight Invoice Issued Air	6.818	1	.009
Freight Invoice Issued Road	6.818	1	.009
Errors Reported	4.811	1	.028
Integration Demanded	1.729	1	.189
Annual Maintenance Fees	6.818	1	.009
Av Profit Per Shipment	2.455	1	.117
Av Profit Per Shipment Sea	3.153	1	.076
Av Profit Per Shipment Air	.273	1	.602
Av Profit Per Shipment Road	.889	1	.346
Time for Submitting a BL	4.544	1	.033
Average Amount of Reports	5.989	1	.014
Active CALs	4.528	1	.033
Program Crash Reports Annual	.000	1	1.000
Training Time	3.938	1	.047
Training Time per CAL	.280	1	.597
Training Costs	6.322	1	.012
Training Costs per CAL	6.860	1	.009
Freight Quotations Made	4.811	1	.028
Freight Quotes Made Sea	6.818	1	.009
Freight Quotes Made Air	2.455	1	.117
Freight Quotes Made Road	6.818	1	.009
Average Time to Make Offers	7.500	1	.006
Visit Reports Submitted	4.811	1	.028
Acquired Orders After Quotes	6.818	1	.009
Lost Customers	2.455	1	.117
Acquired Customers	.395	1	.530
Reclaimed Customers	1.118	1	.290
Quantity of International Partners	7.031	1	.008
Quantity of Domestic Partners	4.840	1	.028
Amount of Integrations	1.513	1	.219
Integrated 3rd Party Apps	1.513	1	.219
Average Screen Time per CAL per Day	6.818	1	.009
Amount of Complaint Tickets CALs	6.860	1	.009

a. Kruskal Wallis Test
b. Grouping Variable: Category of ERP

t-Tests are used in order to compare the means of two datasets which are used in hypothesis testing to determine whether two groups are different from one another. All the variables had p-value higher than 0.05 except Annual Maintenance Fees(USD) (p-value: 0.035), Quantity of International Partners(Qty) (p-value: 0.037), Amount of Integrations(Qty) (p-value: 0.026), and Amount of Complaint Tickets CALs(Qty) (p-value: 0.032) that means null hypothesis accept and assumed equal variance. In the case of Annual Maintenance Fees(USD), Quantity of International Partners(Qty), Amount of Integrations(Qty) and Amount of Complaint Tickets CALs(Qty), null hypothesis are rejected that means variances are not equal.

In t-Test, the p-value for Turnover Mil (USD), Net Profits Mil(USD), Sea Shipments TEUs (Qty), Air Shipments Parcel (Qty), Road Shipments Truck(Qty), Air B/L Issued(Qty), Road Cmr Issued(Qty), Freight Invoice Issued Sea(Qty), Freight Invoice Issued Air(Qty), Freight Invoice Issued Road(Qty), Freight Quotes Made Sea(Qty), Acquired Orders After Quotes(Qty), Average Screen Time per CAL per Day(Min), the average amount of reports(Qty), Active CALs(Qty), training time(Min), Freight Quotations Made(Qty), Visit Reports Submitted(Qty), Quantity of International Partners (Qty), Quantity of Domestic Partners(Qty), Error reported(Qty), Annual Maintenance Fees(USD), Time for Submitting a B/L(Min), Training Cost(USD), Freight Quotes Made Road(Qty), Average Time to Make Offers(Qty) and Amount of Complaint Tickets CALs(Qty) and Training Costs per CAL(USD) are less than 0.05 that means the mean score between the groups are significantly different.

There is no significant difference in mean score between groups for Sea B/L Issued(Qty), Integration Demanded(Qty), Av Profit Per Shipment(USD), Av Profit Per

Shipment Sea (USD), Av Profit Per Shipment Air (USD), Av Profit Per Shipment Road (USD), Program Crash Reports Annual (Qty), Training Time per CAL(Min), Freight Quotes Made Air (Qty), Lost Customers(Qty), Acquired Customers(Qty), Reclaimed Customers(Qty), Amount of Integrations(Qty) and Integrated 3rd Party Apps (Qty).

Table 17

The Independent Sample Test Table 1/3

		Levene's Test for Equality of Variances		t-Test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Turnover Mil	Equal variances assumed	.026	.877	-4.858	8	.001	-250.000	.51459	-368.664	-131.336
	Equal variances not assumed			-4.858	7.978	.001	-250.000	.51459	-368.722	-131.278
Net Profits Mil	Equal variances assumed	.290	.605	-5.575	8	.001	-.25400	.04556	-.35907	-.14893
	Equal variances not assumed			-5.575	7.980	.001	-.25400	.04556	-.35911	-.14889
Sea Shipments TEUs	Equal variances assumed	.575	.470	-5.942	8	.000	-166.420.000	28.008.195	-231.007.014	-101.832.986
	Equal variances not assumed			-5.942	7.776	.000	-166.420.000	28.008.195	-231.332.820	-101.507.180
Air Shipments Parcel	Equal variances assumed	.695	.429	-3.887	8	.005	-22.680.000	5.834.295	-36.133.909	-9.226.091
	Equal variances not assumed			-3.887	7.032	.006	-22.680.000	5.834.295	-36.463.360	-8.896.640
Road Shipments truck	Equal variances assumed	.622	.453	-5.386	8	.001	-33.280.000	6.179.191	-47.529.240	-19.030.760
	Equal variances not assumed			-5.386	7.490	.001	-33.280.000	6.179.191	-47.699.910	-18.860.090
Sea B/L Issued	Equal variances assumed	3.485	.099	-2.190	8	.060	-30.000.000	13.700.007	-61.592.273	1.592.273
	Equal variances not assumed			-2.190	6.422	.068	-30.000.000	13.700.007	-62.996.445	2.996.445
Air B/L Issued	Equal variances assumed	.695	.429	-3.887	8	.005	-22.680.000	5.834.295	-36.133.909	-9.226.091
	Equal variances not assumed			-3.887	7.032	.006	-22.680.000	5.834.295	-36.463.360	-8.896.640
Road Cmr Issued	Equal variances assumed	.622	.453	-5.386	8	.001	-33.280.000	6.179.191	-47.529.240	-19.030.760
	Equal variances not assumed			-5.386	7.490	.001	-33.280.000	6.179.191	-47.699.910	-18.860.090
Freight Invoice Issued Sea	Equal variances assumed	3.717	.090	-5.821	8	.000	-149.860.000	25.746.448	-209.231.416	-90.488.584
	Equal variances not assumed			-5.821	6.083	.001	-149.860.000	25.746.448	-212.650.780	-87.069.220
Freight Invoice Issued Air	Equal variances assumed	.695	.429	-3.887	8	.005	-22.680.000	5.834.295	-36.133.909	-9.226.091
	Equal variances not assumed			-3.887	7.032	.006	-22.680.000	5.834.295	-36.463.360	-8.896.640
Freight Invoice Issued Road	Equal variances assumed	1.692	.229	-5.047	8	.001	-27.820.000	5.512.023	-40.530.748	-15.109.252
	Equal variances not assumed			-5.047	5.852	.003	-27.820.000	5.512.023	-41.390.595	-14.249.405
Errors Reported	Equal variances assumed	2.127	.183	3.111	8	.014	2.000.000	642.806	517.686	3.482.314
	Equal variances not assumed			3.111	7.002	.017	2.000.000	642.806	480.091	3.519.909
Integration Demanded	Equal variances assumed	1.969	.198	-1.414	8	.195	-.60000	.42426	-157.835	.37835
	Equal variances not assumed			-1.414	6.113	.206	-.60000	.42426	-163.349	.43349
Annual Maintenance Fees	Equal variances assumed	6.391	.035	4.397	8	.002	397.580.000	90.429.619	189.048.925	606.111.075
	Equal variances not assumed			4.397	4.070	.011	397.580.000	90.429.619	148.197.042	646.962.958
Av Profit Per Shipment	Equal variances assumed	2.001	.195	-1.307	8	.228	-561.200	429.475	-1.551.571	429.171
	Equal variances not assumed			-1.307	4.615	.253	-561.200	429.475	-1.693.508	571.108
Av Profit Per Shipment Sea	Equal variances assumed	.599	.461	-1.786	8	.112	-1.062.000	594.510	-2.432.942	308.942
	Equal variances not assumed			-1.786	6.575	.120	-1.062.000	594.510	-2.486.416	362.416
Av Profit Per Shipment Air	Equal variances assumed	.336	.578	-.385	8	.710	-186.000	482.904	-1.299.578	927.578
	Equal variances not assumed			-.385	7.708	.711	-186.000	482.904	-1.306.953	934.953
Av Profit Per Shipment Road	Equal variances assumed	.013	.912	-.716	8	.495	-442.000	617.608	-1.866.207	982.207
	Equal variances not assumed			-.716	7.997	.495	-442.000	617.608	-1.866.314	982.314
Time for Submitting a BL	Equal variances assumed	.640	.447	2.683	8	.028	120.000	.44721	.16872	223.128
	Equal variances not assumed			2.683	6.897	.032	120.000	.44721	.13928	226.072

Table 18

The Independent Sample Test Table 2/3

		Levene's Test for Equality of Variances		t-Test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Average Amount of Reports	Equal variances assumed	1.493	.257	-3.464	8	.009	-240.000	.69282	-399.765	-.80235
	Equal variances not assumed			-3.464	6.817	.011	-240.000	.69282	-404.724	-.75276
Active CALs	Equal variances assumed	.612	.456	-2.547	8	.034	-420.000	164.924	-800.316	-.39684
	Equal variances not assumed			-2.547	7.629	.036	-420.000	164.924	-803.561	-.36439
Program Crash Reports Annual	Equal variances assumed	.000	1.000	.000	8	1.000	.00000	.82462	-190.158	190.158
	Equal variances not assumed			.000	8.000	1.000	.00000	.82462	-190.158	190.158
Training Time	Equal variances assumed	.580	.468	-2.455	8	.040	-2.900.000	1.181.186	-5.623.819	-176.181
	Equal variances not assumed			-2.455	6.998	.044	-2.900.000	1.181.186	-5.693.239	-106.761
Training Time per CAL	Equal variances assumed	3.666	.092	-.993	8	.350	-.75000	.75566	-249.256	.99256
	Equal variances not assumed			-.993	4.411	.372	-.75000	.75566	-277.317	127.317
Training Costs	Equal variances assumed	2.745	.136	3.999	8	.004	88.200.000	22.054.478	37.342.283	139.057.717
	Equal variances not assumed			3.999	5.858	.007	88.200.000	22.054.478	33.917.001	142.482.999
Training Costs per CAL	Equal variances assumed	.280	.611	8.854	8	.000	7.905.600	892.869	5.846.641	9.964.559
	Equal variances not assumed			8.854	7.078	.000	7.905.600	892.869	5.798.984	10.012.216
Freight Quotations Made	Equal variances assumed	1.441	.264	-3.220	8	.012	-89.280.000	27.727.899	-153.220.650	-25.339.350
	Equal variances not assumed			-3.220	6.510	.016	-89.280.000	27.727.899	-155.859.875	-22.700.125
Freight Quotes Made Sea	Equal variances assumed	2.980	.123	-6.779	8	.000	-134.820.000	19.887.157	-180.679.865	-88.960.135
	Equal variances not assumed			-6.779	5.392	.001	-134.820.000	19.887.157	-184.843.752	-84.796.248
Freight Quotes Made Air	Equal variances assumed	1.650	.235	.910	8	.389	5.040.000	5.536.479	-7.727.144	17.807.144
	Equal variances not assumed			.910	5.005	.404	5.040.000	5.536.479	-9.187.811	19.267.811
Freight Quotes Made Road	Equal variances assumed	1.674	.232	3.869	8	.005	35.000.000	9.046.778	14.138.092	55.861.908
	Equal variances not assumed			3.869	6.723	.007	35.000.000	9.046.778	13.427.908	56.572.092
Average Time to Make Offers	Equal variances assumed	1.524	.252	8.222	8	.000	260.000	.31623	187.078	332.922
	Equal variances not assumed			8.222	7.692	.000	260.000	.31623	186.567	333.433
Visit Reports Submitted	Equal variances assumed	1.631	.237	-2.822	8	.022	-52.160.000	18.486.022	-94.788.843	-9.531.157
	Equal variances not assumed			-2.822	7.285	.025	-52.160.000	18.486.022	-95.528.378	-8.791.622

Table 19

The Independent Sample Test Table 3/3

		Levene's Test for Equality of Variances		t-Test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Acquired Orders After Quotes	Equal variances assumed	4.087	.078	-4.010	8	.004	-56.240.000	14.024.514	-88.580.588	-23.899.412
	Equal variances not assumed			-4.010	4.818	.011	-56.240.000	14.024.514	-92.704.171	-19.775.829
Lost Customers	Equal variances assumed	.062	.810	1.651	8	.137	600.000	363.318	-237.813	1.437.813
	Equal variances not assumed			1.651	7.998	.137	600.000	363.318	-237.846	1.437.846
Acquired Customers	Equal variances assumed	3.196	.112	.869	8	.410	440.000	506.557	-728.123	1.608.123
	Equal variances not assumed			.869	5.373	.422	440.000	506.557	-835.391	1.715.391
Reclaimed Customers	Equal variances assumed	.278	.612	-1.095	8	.305	-120.000	109.545	-372.610	132.610
	Equal variances not assumed			-1.095	7.587	.307	-120.000	109.545	-375.024	135.024
Quantity of International Partners	Equal variances assumed	6.249	.037	-5.842	8	.000	-640.000	109.545	-892.610	-387.390
	Equal variances not assumed			-5.842	4.420	.003	-640.000	109.545	-933.081	-346.919
Quantity of Domestic Partners	Equal variances assumed	.245	.634	-3.159	8	.013	-1.420.000	449.444	-2.456.420	-383.580
	Equal variances not assumed			-3.159	7.896	.014	-1.420.000	449.444	-2.458.804	-381.196
Amount of Integrations	Equal variances assumed	7.432	.026	-1.673	8	.133	-140.000	.83666	-332.934	.52934
	Equal variances not assumed			-1.673	4.743	.158	-140.000	.83666	-358.616	.78616
Integrated 3rd Party Apps	Equal variances assumed	4.780	.060	-1.633	8	.141	-160.000	.97980	-385.941	.65941
	Equal variances not assumed			-1.633	4.531	.169	-160.000	.97980	-419.912	.99912
Average Screen Time per CAL per Day	Equal variances assumed	.002	.967	-3.974	8	.004	-4.540.000	1.142.366	-7.174.301	-1.905.699
	Equal variances not assumed			-3.974	7.884	.004	-4.540.000	1.142.366	-7.181.054	-1.898.946
Amount of Complaint Tickets CALs	Equal variances assumed	6.716	.032	8.658	8	.000	2.900.000	334.963	2.127.575	3.672.425
	Equal variances not assumed			8.658	4.742	.000	2.900.000	334.963	2.024.670	3.775.330

Since the study aims to define the correlation between two datasets representing ERP1 and ERP2, Spearman's Correlation Analysis (Rank Analysis or Rho) is applied and interpreted on the below-mentioned tables. It assists this research in determining the strength and direction of the relationship between our two ERP systems. Each interpretation is placed beneath the related tables.

Table 20

Correlation Table 1 - Mil. USD

			Category of ERP	Turnover Mil
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Turnover Mil	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Turnover Mill(USD) and ERP types

Table 21

Correlation Table 2 - Net Profits Mil. USD

			Category of ERP	Net Profits Mil
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Net Profits Mil	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Net profits Mil(USD) and ERP types. In the shipping business, an ERP is not directly affecting the profits, but it has a powerful effect on the quality of services. Therefore, freight forwarders must have vital ERP programs to respond to customer

questions. For example, suppose an ERP is better than the other at sending quotations, issuing the bill of lading documents, sending automatic pre-alerts or invoices. In that case, it can be interpreted as an indirect effect of the ERP on profitability.

Table 22

Correlation Table 3 - Sea Shipments TEUs

			Category of ERP	Sea Shipments TEUs
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Sea Shipments TEUs	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Sea shipments TEUs (Qty) and ERP types.

Table 23

Correlation Table 4 - Air Shipments Parcel

			Category of ERP	Air Shipments Parcel
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Air Shipments Parcel	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Air shipments parcel (Qty) and ERP types.

Table 24

Correlation Table 5 - Road Truck Shipments

			Category of ERP	Road Shipments Truck
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Road Shipments Truck	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Road shipments truck (Qty) and ERP types.

Table 25

Correlation Table 6 - Sea B/L Issued

			Category of ERP	Sea B/L Issued
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.661*
		Sig. (2-tailed)	.	.037
		N	10	10
	Sea B/L Issued	Correlation Coefficient	.661*	1.000
		Sig. (2-tailed)	.037	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Sea B/L issued (Qty) and ERP types.

Table 26 - *Correlation Table 7 - Air MAWB Issued*

			Category of ERP	Air B/L Issued
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Air B/L Issued	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Air B/L issued (Qty) and ERP types.

Table 27 - *Correlation Table 8 - Road Cmr Issued*

			Category of ERP	Road Cmr Issued
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Road Cmr Issued	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Road Cmr issued (Qty) and ERP types.

Table 28 - *Correlation Table 9 - Freight Invoice Issued Sea*

			Category of ERP	Freight Invoice Issued Sea
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Freight Invoice Issued Sea	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Freight Invoice Issued Sea (Qty) and ERP types.

Table 29 - *Correlation Table 10 - Freight Invoice Issued Air*

			Category of ERP	Freight Invoice Issued Air
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Freight Invoice Issued Air	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Freight Invoice Issued Air (Qty) and ERP types.

Table 30 - *Correlation Table 11 - Freight Invoice Issued Road*

			Category of ERP	Freight Invoice Issued Road
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Freight Invoice Issued Road	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists between Freight Invoice Issued Road (Qty) and ERP types.

Table 31 - *Correlation Table 12 - Erros Reported*

			Category of ERP	Errors Reported
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.731*
		Sig. (2-tailed)	.	.016
		N	10	10
	Errors Reported	Correlation Coefficient	-.731*	1.000
		Sig. (2-tailed)	.016	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect negative correlation exists between Errors reported (Qty) and ERP types

Table 32 - *Correlation Table 13 - Integration Demanded*

			Category of ERP	Integration Demanded
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.438
		Sig. (2-tailed)	.	.205
		N	10	10
	Integration Demanded	Correlation Coefficient	.438	1.000
		Sig. (2-tailed)	.205	.
		N	10	10

There is enough evidence to suggest that a small to moderate positive correlation exists insignificantly between Integration Demanded (Qty) and ERP types.

Table 33 - *Correlation Table 14 -Annual Maintenance Fees*

			Category of ERP	Annual Maintenance Fees
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Annual Maintenance Fees	Correlation Coefficient	-.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect negative correlation exists between Annual Maintenance Fees (USD) and ERP types.

Table 34 - *Correlation Table 15 - AverageProfit Per Shipment*

			Category of ERP	Av Profit Per Shipment
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.522
		Sig. (2-tailed)	.	.122
		N	10	10
	Av Profit Per Shipment	Correlation Coefficient	.522	1.000
		Sig. (2-tailed)	.122	.
		N	10	10

There is enough evidence to suggest that a moderate to perfect positive correlation exists insignificantly between Av. Profit Per Shipment (USD) and ERP types.

Table 35 - *Correlation Table 16 - Av. Profit Per Shipment Sea*

			Category of ERP	Av Profit Per Shipment Sea
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.592
		Sig. (2-tailed)	.	.071
		N	10	10
	Av Profit Per Shipment Sea	Correlation Coefficient	.592	1.000
		Sig. (2-tailed)	.071	.
		N	10	10

There is enough evidence to suggest that a moderate to perfect positive correlation exists insignificantly between Av. Profit Per Shipment Sea (USD) and ERP types.

Table 36 - *Correlation Table 17 - Av. Profit Per Shipment Air*

			Category of ERP	Av Profit Per Shipment Air
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.174
		Sig. (2-tailed)	.	.631
		N	10	10
	Av Profit Per Shipment Air	Correlation Coefficient	.174	1.000
		Sig. (2-tailed)	.631	.
		N	10	10

There is enough evidence to suggest that a small to moderate positive correlation exists insignificantly between Av. Profit Per Shipment Air (USD) and ERP types.

Table 37 - *Correlation Table 18 - Av. Profit Per Shipment Road*

			Category of ERP	Av Profit Per Shipment Road
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.314
		Sig. (2-tailed)	.	.376
		N	10	10
	Av. Profit Per Shipment Road	Correlation Coefficient	.314	1.000
		Sig. (2-tailed)	.376	.
		N	10	10

There is enough evidence to suggest that a small to moderate positive correlation exists insignificantly between Av. Profit Per Shipment Road (USD) and ERP types.

Table 38 - *Correlation Table 19 - Time For Submitting a B/L*

			Category of ERP	Time for Submitting a BL
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.711*
		Sig. (2-tailed)	.	.021
		N	10	10
	Time for Submitting a BL	Correlation Coefficient	-.711*	1.000
		Sig. (2-tailed)	.021	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect negative correlation exists significantly between Time for Submitting a BL (Min) and ERP types.

Table 39 - *Correlation Table 20 - Average Amount of Reports*

			Category of ERP	Average Amount of Reports
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.816**
		Sig. (2-tailed)	.	.004
		N	10	10
	Average Amount of Reports	Correlation Coefficient	.816**	1.000
		Sig. (2-tailed)	.004	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists significantly between Average Amount of Reports (Qty) and ERP types.

Table 40 - *Correlation Table 21 - Active CALs (Users)*

			Category of ERP	Active CALs
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.709*
		Sig. (2-tailed)	.	.022
		N	10	10
	Active CALs	Correlation Coefficient	.709*	1.000
		Sig. (2-tailed)	.022	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists significantly between Active CALs (Qty) and ERP types.

Table 41 - *Correlation Table 22 - Program Crash Reports Annual*

			Category of ERP	Program Crash Reports Annual
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.000
		Sig. (2-tailed)	.	1.000
		N	10	10
	Program Crash Reports Annual	Correlation Coefficient	.000	1.000
		Sig. (2-tailed)	1.000	.
		N	10	10

There is enough evidence to suggest that there is no correlation exists between Program Crash Reports Annual (Qty) and ERP types.

Table 42 - *Correlation Table 23 - Training Time (Total)*

			Category of ERP	Training Time
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.661*
		Sig. (2-tailed)	.	.037
		N	10	10
	Training Time	Correlation Coefficient	.661*	1.000
		Sig. (2-tailed)	.037	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists significantly between Training Time (Min) and ERP types.

Table 43 - *Correlation Table 24 - Training Time per CAL*

			Category of ERP	Training Time per CAL
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.176
		Sig. (2-tailed)	.	.626
		N	10	10
	Training Time per CAL	Correlation Coefficient	.176	1.000
		Sig. (2-tailed)	.626	.
		N	10	10

There is enough evidence to suggest that a small to moderate positive correlation exists insignificantly between Training Time per CAL (Min) and ERP types.

Table 44 - *Correlation Table 25 - Training Costs*

			Category of ERP	Training Costs
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.838**
		Sig. (2-tailed)	.	.002
		N	10	10
	Training Costs	Correlation Coefficient	-.838**	1.000
		Sig. (2-tailed)	.002	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect negative correlation exists significantly between Training Costs (USD) and ERP types.

Table 45 - *Correlation Table 26 - Training Costs per CAL*

			Category of ERP	Training Costs per CAL
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.873**
		Sig. (2-tailed)	.	.001
		N	10	10
	Training Costs per CAL	Correlation Coefficient	-.873**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect negative correlation exists significantly between Training Costs per CAL (USD) and ERP types.

Table 46 - *Correlation Table 27 - Freight Quotations Made*

			Category of ERP	Freight Quotations Made
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.731*
		Sig. (2-tailed)	.	.016
		N	10	10
	Freight Quotations Made	Correlation Coefficient	.731*	1.000
		Sig. (2-tailed)	.016	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists significantly between Freight Quotations Made (Qty) and ERP types

Table 47 - *Correlation Table 28 - Freight Quotations Made Sea*

			Category of ERP	Freight Quotes Made Sea
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Freight Quotes Made Sea	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists significantly between Freight Quotations Made Sea (Qty) and ERP types.

Table 48 - *Correlation Table 29 - Freight Quotations Made Air*

			Category of ERP	Freight Quotes Made Air
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.522
		Sig. (2-tailed)	.	.122
		N	10	10
	Freight Quotes Made Air	Correlation Coefficient	-.522	1.000
		Sig. (2-tailed)	.122	.
		N	10	10

There is enough evidence to suggest that a moderate to perfect negative correlation exists insignificantly between Freight Quotations Made Air (Qty) and ERP types.

Table 49 - *Correlation Table 30 - Freight Quotations Made Road*

			Category of ERP	Freight Quotes Made Road
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Freight Quotes Made Road	Correlation Coefficient	-.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect negative correlation exists significantly between Freight Quotations Made Road (Qty) and ERP types.

Table 50 - *Correlation Table 31 - Average Time to Make Offers*

			Category of ERP	Average Time to Make Offers
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.913**
		Sig. (2-tailed)	.	.000
		N	10	10
	Average Time to Make Offers	Correlation Coefficient	-.913**	1.000
		Sig. (2-tailed)	.000	.
		N	10	10

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

There is enough evidence to suggest that almost perfect negative correlation exists significantly between Average Time to make offers (Qty) and ERP types.

Table 51 - *Correlation Table 32 - Visit Reports Submitted*

			Category of ERP	Visit Reports Submitted
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.731*
		Sig. (2-tailed)	.	.016
		N	10	10
	Visit Reports Submitted	Correlation Coefficient	.731*	1.000
		Sig. (2-tailed)	.016	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists significantly between Visit Reports Submitted (Qty) and ERP type.

Table 52 - *Correlation Table 33 - Acquired Orders After Quotations*

			Category of ERP	Acquired Orders After Quotes
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Acquired Orders After Quotes	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists significantly between Acquired Orders After Quotes (Qty) and ERP types.

Table 53 - *Correlation Table 34 - Lost Customers*

			Category of ERP	Lost Customers
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.522
		Sig. (2-tailed)	.	.122
		N	10	10
	Lost Customers	Correlation Coefficient	-.522	1.000
		Sig. (2-tailed)	.122	.
		N	10	10

There is enough evidence to suggest that a moderate to perfect negative correlation exists insignificantly between Lost Customers (Qty) and ERP types.

Table 54 - *Correlation Table 35 - Acquired (New) Customers*

			Category of ERP	Acquired Customers
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	-.210
		Sig. (2-tailed)	.	.561
		N	10	10
	Acquired Customers	Correlation Coefficient	-.210	1.000
		Sig. (2-tailed)	.561	.
		N	10	10

There is enough evidence to suggest that a small to moderate negative correlation exists insignificantly between Acquired Customers(Qty) and ERP types.

Table 55 - *Correlation Table 36 - Reclaimed Customers*

			Category of ERP	Reclaimed Customers
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.352
		Sig. (2-tailed)	.	.318
		N	10	10
	Reclaimed Customers	Correlation Coefficient	.352	1.000
		Sig. (2-tailed)	.318	.
		N	10	10

There is enough evidence to suggest that a small to moderate positive correlation exists insignificantly between Reclaimed Customers (Qty) and ERP types.

Table 56 - *Correlation Table 37 - Quantity of International Partners*

			Category of ERP	Quantity of International Partners
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.884**
		Sig. (2-tailed)	.	.001
		N	10	10
	Quantity of International Partners	Correlation Coefficient	.884**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists significantly between Quantity of International Partners (Qty) and ERP types.

Table 57 - *Correlation Table 38 - Quantity of Domestic Partners*

			Category of ERP	Quantity of Domestic Partners
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.733*
		Sig. (2-tailed)	.	.016
		N	10	10
	Quantity of Domestic Partners	Correlation Coefficient	.733*	1.000
		Sig. (2-tailed)	.016	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect positive correlation exists significantly between Quantity of Domestic Partners (Qty) and ERP types.

Table 58 - *Correlation Table 39 - Amount of Integrations*

			Category of ERP	Amount of Integrations
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.410
		Sig. (2-tailed)	.	.239
		N	10	10
	Amount of Integrations	Correlation Coefficient	.410	1.000
		Sig. (2-tailed)	.239	.
		N	10	10

There is enough evidence to suggest that a small to moderate positive correlation exists insignificantly between Amounts of Integrations (Qty) and ERP types.

Table 59 - *Correlation Table 40 - Integrated 3rd Party Apps.*

			Category of ERP	Integrated 3rd Party Apps
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.410
		Sig. (2-tailed)	.	.239
		N	10	10
	Integrated 3rd Party Apps	Correlation Coefficient	.410	1.000
		Sig. (2-tailed)	.239	.
		N	10	10

There is enough evidence to suggest that a small to moderate positive correlation exists insignificantly between Integrated 3rd party Apps (Qty) and ERP type.

Table 60 - *Correlation Table 42 - Av.Screen Time CAL/Day*

			Category of ERP	Average Screen Time per CAL per Day
Spearman's rho	Category of ERP	Correlation Coefficient	1.000	.870**
		Sig. (2-tailed)	.	.001
		N	10	10
	Average Screen Time per CAL per Day	Correlation Coefficient	.870**	1.000
		Sig. (2-tailed)	.001	.
		N	10	10

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

There is enough evidence to suggest that a moderate to perfect negative correlation exists significantly between Amounts of Compliant Tickets CALs (Qty) and ERP types.

Table 61

Mean Values of Different Categories by ERP

Category	ERP 1	ERP 2	Mean Difference
Amount of Integrations	0.40	1.80	-1.40
Integrated 3rd Party Apps	0.40	2.00	-1.60
Integration Demanded	0.40	0.80	-0.40
Net Profits (Mil)	0.40	0.65	-0.25
Crash Reports / Annual	1.20	1.20	0.00
Reclaimed Customers	1.60	2.80	-1.20

Comparison of means for two ERP alternatives will allow us to see the differentiated elements in both of these groups. As we observe, there are more integrated apps available for ERP2 than ERP1, while ERP2 is used in higher profit times. Although it is difficult to interpret this figure as ERP2 is the cause of more profits, there is a visible link between profitability and ERP2. Company A claims more customers by using ERP2 thanks to its practical cost evaluation and price quotation modules.

Figure 19

Bar Chart Comparison of ERPs

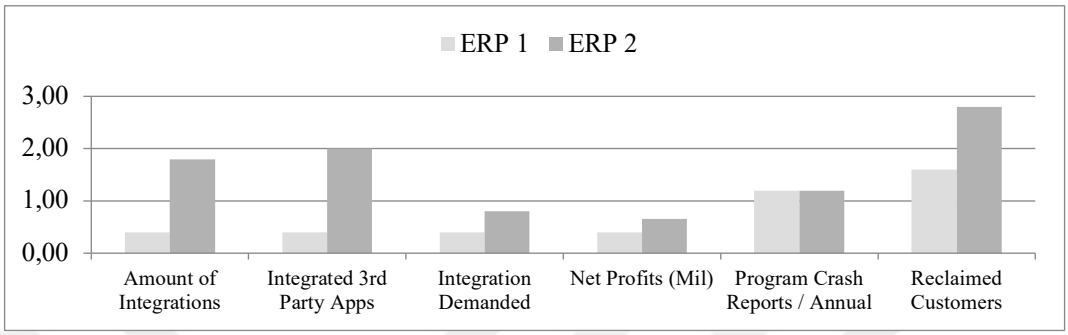


Table 54 shows the mean values for categories, amount of integrations, integrated 3rd party apps, integration demanded, net profits (Mil), program crash reports / annual, and reclaimed customers. Figure 12 shows that ERP 2 has better values compared to those in ERP 1.

ERP2 is a web-based platform that runs on a cloud environment, and ERP1 works on local servers by installing the GUI for each CAL's computer. We can observe that ERP2 has better results than ERP1, according to the figures in Table 1. Anyhow, it is not enough to come to any conclusion with just the test mentioned above, and the study needs to apply other tests such as t-Test and Mann-Whitney U Test on the independent samples for mean comparison between ERP1 and ERP2.

Table 62

Independent Sample t-Test Table

	t-Test				
	t	df	p-value	Significant?	Is ERP 2 better?
Amount of Integrations	-1.673	4.743	0.158	No	
Integrated 3rd Party Apps	-1.633	8	0.141	No	
Integration Demanded	-0.894	8	0.397	No	
Net Profits (Mil)	-5.575	8	0.001	Yes	Yes
Program Crash Reports / Annual	0.000	8	1.000	No	
Reclaimed Customers	-1.095	8	0.305	No	

Table 59 shows that only Net Profits had significantly better values for ERP2 compared to the other categories. There are no significant outcomes for other categories such as the number of integrations that the ERP "shakes hands" with, integration with third-party applications, or demand of company A for more software integrations. This is also not enough for us to acknowledge that ERP2 is a superior solution to ERP1.

Table 63

Mann Whitney U Test for Independent Samples

	Mann-Whitney U			
	MW- U	p-value	Significant?	Is ERP 2 better?
Amount of Integrations	7	0.219	No	
Integrated 3rd Party Apps	7	0.219	No	
Integration Demanded	9	0.419	No	
Net Profits (Mil)	0	0.009	Yes	Yes
Program Crash Reports / Annual	12,50	1.000	No	
Reclaimed Customers	7,50	0.290	No	

Pearson's correlation assists us when we have two quantitative variables such as above and we seek to find out if there is a linear relationship between those variables.

Table 64

Pearson's Correlation Results Data by Year

Category	Pearson Correlation	p-value	Significant?
Amount of Integrations	.696	.025	Yes
Integr. 3rd Party Apps	.696	.025	Yes
Integration Demanded	.315	.375	No
Net Profits (Mil)	.984	.000	Yes
Crash Reports / Annual	-.239	.506	No
Reclaimed Customers	.419	.228	No

Table 61 shows the correlation between the data values over the years. The results indicate that there is a significant positive correlation for the categories such as; the number of integrations, integrated 3rd party apps, and net profits (Mil).

Figure 20

Amount of Integrations

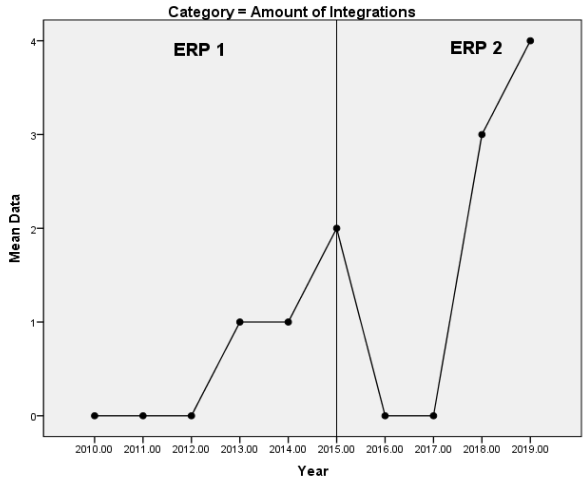


Figure 21

Integrated 3rd Party Apps.

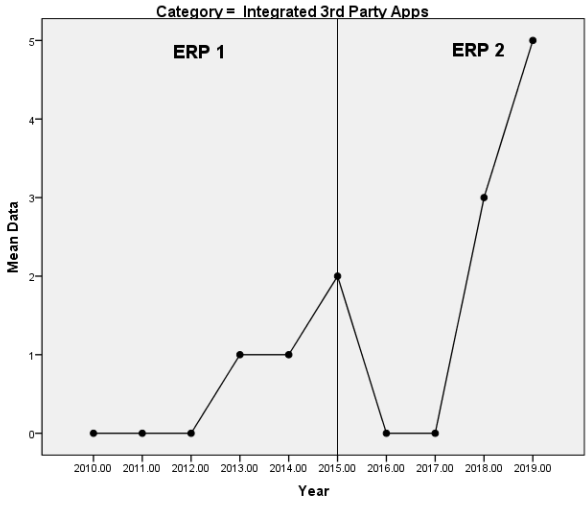
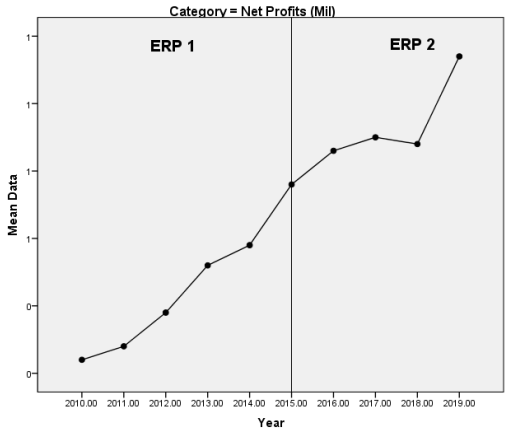


Figure 22

Net Profits (mil. USD)



Figures 16 and 17 show the improvement of values in categories such as; the number of integrations, integrated third-party apps, and net profits (Mil) over time. This indicates that ERP 2 methods are improving these categories. For example, in maritime logistics, the amount of integrations with third-party apps represents the company's interactivity to collaborate with more business partners and government departments electronically.

Table 65

Mean Values of Different Categories Compared by ERP

Category	ERP 1	ERP 2	Mean Difference
Training Time per CAL	4.33	5.08	-0.75
Turnover (Mil)	4.38	6.88	-2.50
Average Amount of Reports	4.80	7.20	-2.40
Time for Submitting a B/L	5.40	4.20	1.20
Average Time to Make Offers	7.40	4.80	2.60
Qty of International Partners	12.20	18.60	-6.40
Active CALs	13.40	17.60	-4.20

Figure 23

Bar Chart Comparison

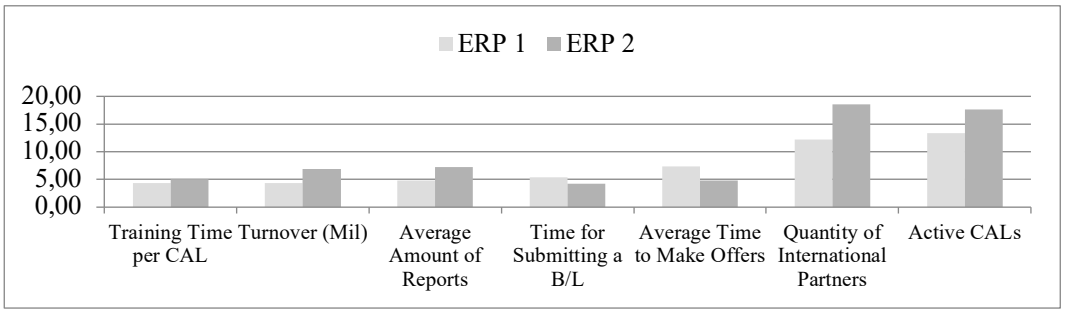


Table 62 shows the mean values for categories such as; training time per CAL, turnover (Mil), the average amount of reports generated by users, time for submitting a B/L, average time to make offers, quantity of international partners, and active CALs. For example, figure 3 shows that ERP 2 has better values compared to those in ERP 1. Mainly, the average time of making price quotations has been drastically decreased on ERP2. In logistics, faster response to customer demands is one of the keys to gaining new business. Also, the average amount of reports statistically shows that users are more engaged with ERP2 compared to ERP1 while they produce recent reports and study over these documents.

Table 66

t-Test for Mean Comparison Between ERP1 and ERP2

	t-Test			
	t	p-value	Significant?	Is ERP 2 better?
Active CALs	-2.547	0.034	Yes	Yes
Av. Amount of Reports	-3.464	0.009	Yes	Yes
Av. Time to Make Offers	8.222	0.000	Yes	Yes
Qty of Intl. Partners	-5.842	0.003	Yes	Yes
Time for Submitting a B/L	2.683	0.028	Yes	Yes
Training Time per CAL	-0.993	0.350	No	
Turnover (Mil)	-4.858	0.001	Yes	Yes

Table 67

Mann-Whitney U Test for Mean Comparison Between ERP1 and ERP2

	Mann-Whitney U			
	Mann-Whitney U	p-value	Significant?	Is ERP 2 better?
Active CALs	2,50	0.033	Yes	Yes
Average Amount of Reports	1	0.014	Yes	Yes
Average Time to Make Offers	0	0.006	Yes	Yes
Quantity of International Partners	0	0.008	Yes	Yes
Time for Submitting a B/L	3	0.033	Yes	Yes
Training Time per CAL	10	0.597	No	
Turnover (Mil)	0	0.009	Yes	Yes

Tables 63 and 64 show that the categories had better showings in ERP 2 than ERP 1 except for the Training Time per CAL. Training time requirement has always been a cost factor on the shoulders of companies. Any ERP solution that has a complex GUI automatically receives a negative response from the new users. It is a challenge to break the resistance of an ordinary worker's technological habits. Thus, simplicity is a game-changer when it comes to software interfaces, screen flow and menu transitions.

Table 68

Pearson Correlation Results Data by Year

Category	Pearson Correlation	p-value	Significant?
Active CALs	.926	.000	Yes
Average Amount of Reports	.966	.000	Yes
Average Time to Make Offers	-.848	.002	Yes
Quantity of International Partners	.950	.000	Yes
Time for Submitting a B/L	-.679	.031	Yes
Training Time per CAL	.135	.710	No
Turnover (Mil)	.995	.000	Yes

Table 65 shows the correlation between the data values over the years. The results indicate that there are significant correlations among the categories except for training time per CAL.

Figure 24

Active CALs per Year

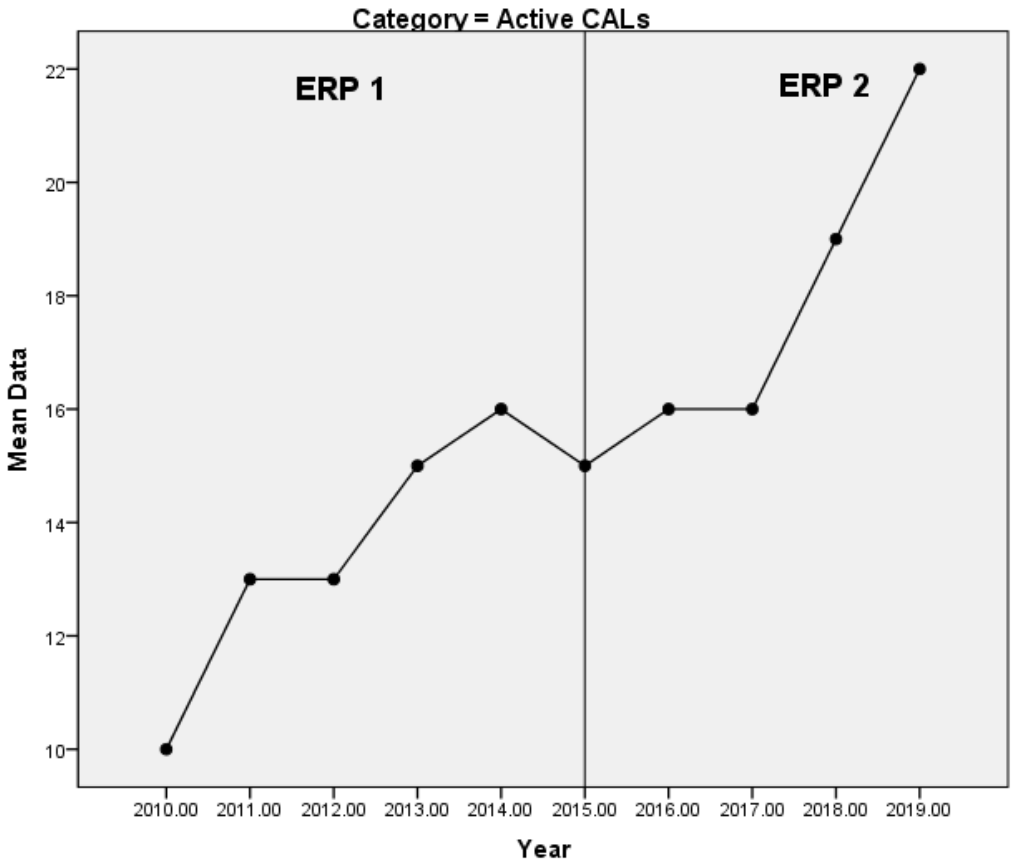


Figure 25

Average Amount of Reports Generated

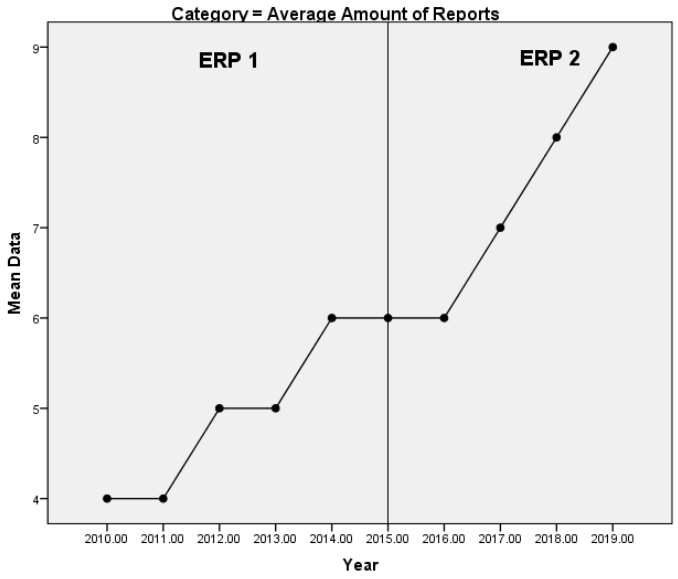


Figure 26

Quantity of International Partners

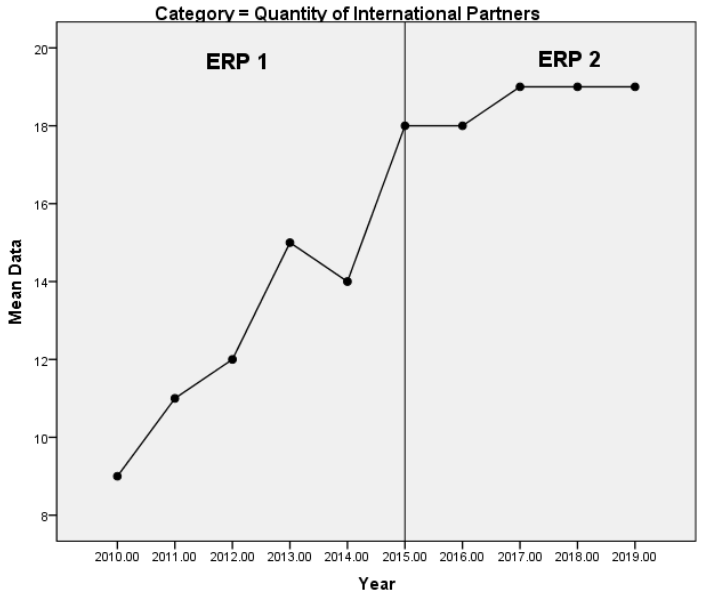


Figure 27

Time For Submitting a B/l (min)

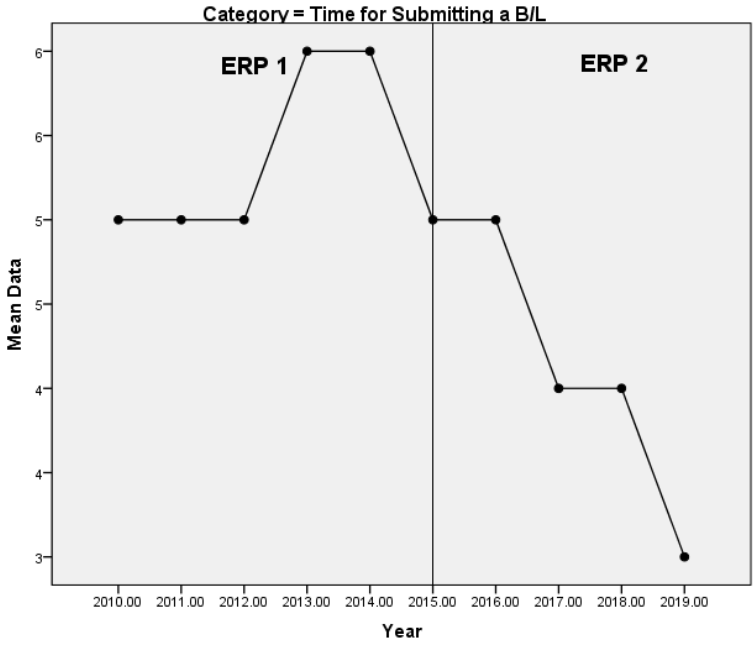


Figure 28

Turnover (mil. USD)

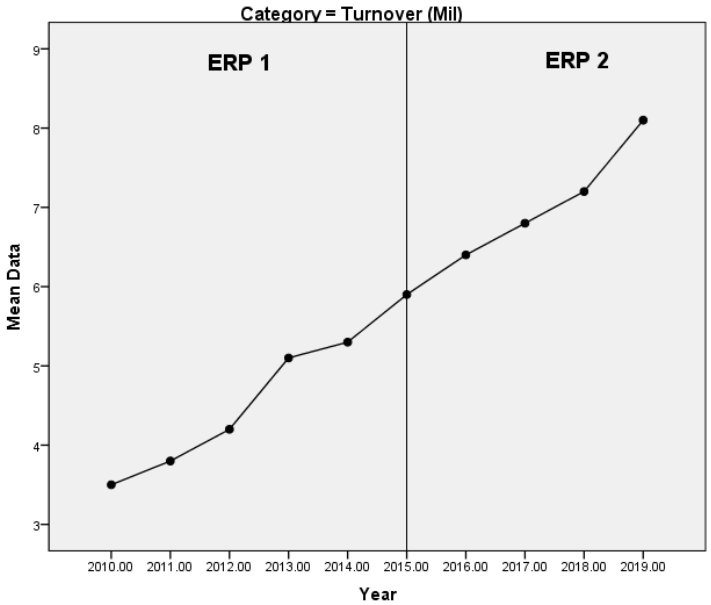


Figure 20 shows the improvement of values in categories of active CALs, the average amount of reports generated by CALs, the number of international partners and turnovers. There is also an improvement in the decrease of the average time to make offers and time for submitting a B/L when ERP 2 was implemented. One of the impactful results of this research was shown on the graph, indicating the time for submitting a B/L. ERP2 reduces it over the years.

BL instructions are received from the shippers and supplied freight forwarding companies to shipping lines, vessel owners, or NVOCCs. Freight forwarders act as gateways between the exporter and the shipping line when creating such documentation. Bill of Lading is the primary document of everyday operations of maritime companies. The time spent submitting it into their ERP and forwarding their version to shipping lines is one of the critical jobs that must be done accurately and swiftly.

Table 69

Mean Values of Different Categories Compared by ERP

Category	ERP 1	ERP 2	Mean Difference
Lost Customers	24.00	18.00	6.00
Quty of Domestic Partners	26.60	40.80	-14.20
Acquired Customers	28.40	24.00	4,40
Error(s) Reported	35.60	15.60	20.00
Complaint Tickets	36.60	7,60	29.00
Training Time	58.60	87.60	-29.00

Figure 29

Bar Chart for Comparison of ERP1 and ERP2

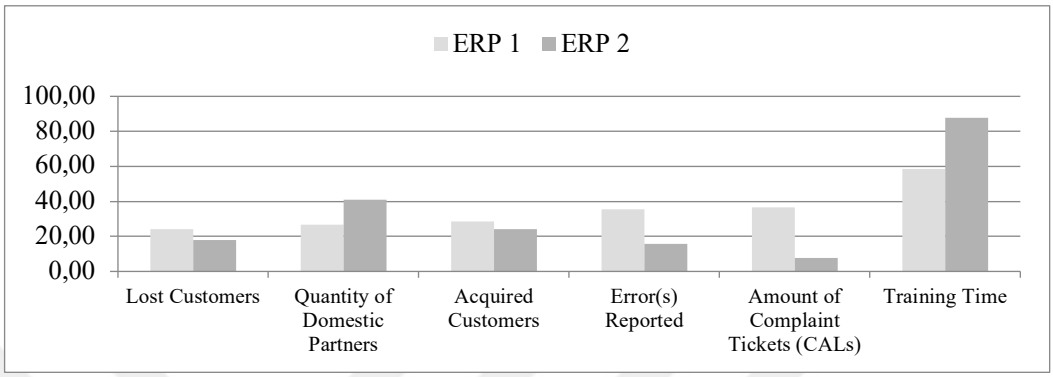


Table 66 shows the mean values for categories such as; lost customers, domestic partners, acquired customers, error(s), reported amount of complaint tickets (CALs), and training time. Figure 5 shows that ERP 2 has better values than ERP 1 except for the time spent on training and acquired customers. We can observe that CALs reported fewer errors, and fewer complaint tickets have been filed related to the software. The same chart shows that the training time for each CAL has been increased with ERP2, and it should be classified as both a positive and a negative impact on company A. On the one hand, it might create higher training costs and time spent on an ERP, but on the other hand, it may add significant gains in operational service quality.

Table 70

t-Test for Mean Comparison Between ERP1 and ERP2

	t-Test			
	t	p-value	Significant?	Is ERP 2 better?
Acquired Customers	0.869	0.410	No	
Amount of Complaint Tickets (CALs)	8.658	0.000	Yes	Yes
Error(s) Reported	3.111	0.014	Yes	Yes
Lost Customers	1.651	0.137	No	
Quantity of Domestic Partners	-3.159	0.013	Yes	Yes
Training Time	-2.455	0.040	Yes	Yes

Table 71

Mann-Whitney U Test for Mean Comparison Between ERP 1 and ERP 2

	Mann-Whitney U			
	Mann-Whitney U	p-value	Significant?	Is ERP 2 better?
Acquired Customers	9,50	0.530	No	
Amount of Complaint Tickets (CALs)	0	0.009	Yes	Yes
Error(s) Reported	2	0.028	Yes	Yes
Lost Customers	5	0.117	No	
Quantity of Domestic Partners	2	0.028	Yes	Yes
Training Time	3	0.047	Yes	Yes

The tests indicated in the above tables show that categories that had significantly better marks for ERP2. These values are; the quantity of domestic partners, error(s) reported, amount of complaint tickets (CALs).

Table 72

Pearson Correlation Results Data by Year

Category	Pearson Correlation	p-value	Significant?
Acquired Customers	-.023	.949	No
Amount of Complaint Tickets (CALs)	-.750	.013	Yes
Error(s) Reported	-.920	.000	Yes
Lost Customers	-.603	.065	No
Quantity of Domestic Partners	.933	.000	Yes
Training Time	.662	.037	Yes

Table 68 shows the Correlation between the data values over the Years. The results indicate that there are significant correlations among the categories quantity of domestic partners, error(s) reported, amount of complaint tickets (CALs).

Figure 30

The Amount of Complaint Tickets

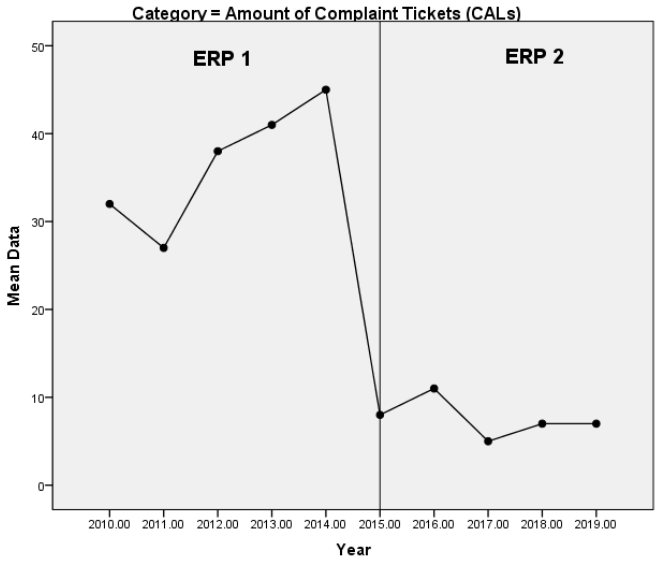


Figure 31

Reported Errors of Software(s)

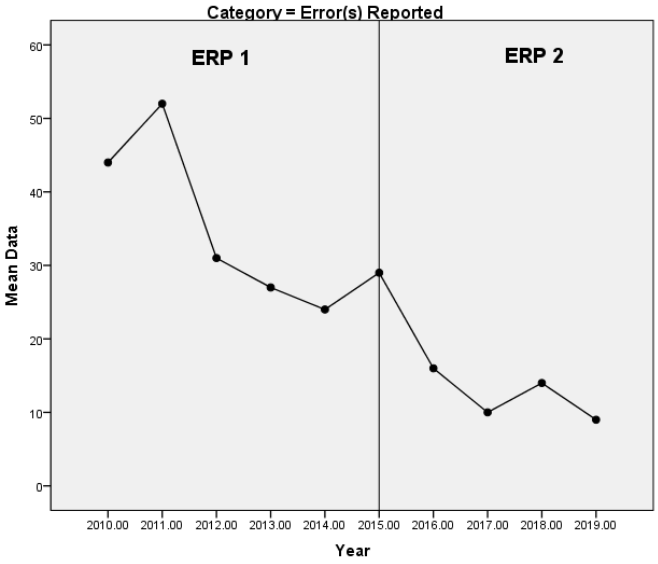


Figure 26 shows a visualization of the correlation coefficients in Table 69, which indicate that there is a significant decrease over time for the number of complaint tickets

(per CALs), and error(s) reported this means lesser incidences of these categories. Also, significant increases in the number of domestic partners are vital in maritime logistics.

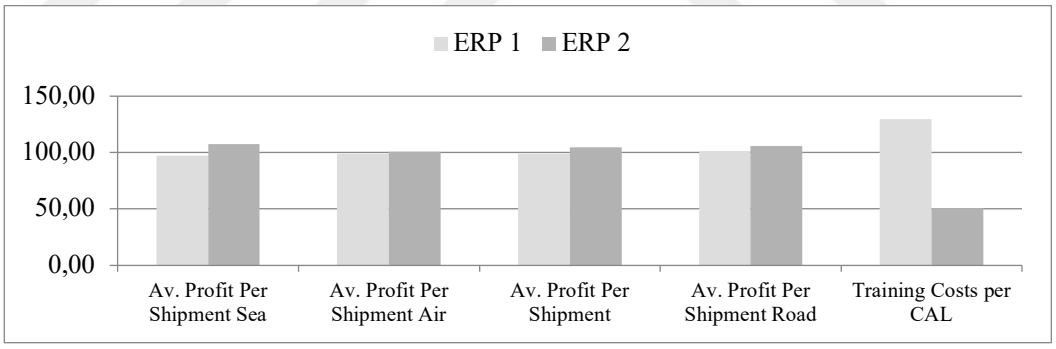
Table 73

Mean Values of Different Categories Compared by ERP

Category	ERP 1	ERP 2	Mean Difference
Av. Profit Per Shipment Sea	97.04	107.66	-10.62
Av. Profit Per Shipment Air	99.00	100.86	-1.86
Av. Profit Per Shipment	99.21	104.82	-5.61
Av. Profit Per Shipment Road	101.56	105.98	-4.42
Training Costs per CAL	129.83	50.78	79.06

Figure 32

Bar Chart Comparison



The table above shows the mean values for categories average profit per shipment sea, shipment air, per shipment road, and training costs per CAL. Figure 7 shows that ERP 2 has slightly better values than ERP 1 for the Average Profits, while Training Costs per CAL had higher prices on ERP 1 than ERP 2. Also, we can observe that despite the increased training times, training costs were surprisingly decreased. It is related to the pricing policy of ERP2's supplier in essence.

Table 74 - *t-Test Results*

	t-Test			
	t	p-value	Significant?	Is ERP 2 better?
Av. Profit Per Shipment	-1.307	0.228	No	
Av. Profit Per Shipment Air	-0.385	0.710	No	
Av. Profit Per Shipment Road	-0.716	0.495	No	
Av. Profit Per Shipment Sea	-1.786	0.112	No	
Training Costs per CAL	8.854	0.000	Yes	Yes

Table 75 - *Mann-Whitney U Test Results*

	Mann-Whitney U			
	Mann-Whitney U	p-value	Significant?	Is ERP 2 better?
Av. Profit Per Shipment	5	0.117	No	
Av. Profit Per Shipment Air	10	0.602	No	
Av. Profit Per Shipment Road	8	0.346	No	
Av. Profit Per Shipment Sea	4	0.076	No	
Training Costs per CAL	0	0.009	Yes	Yes

Table 71 and 72 show no significant differences in the Average Profit per Shipment Sea, Shipment Air, per Shipment, and per Shipment Road. This means ERP 1 and ERP 2 values are almost similar to each other. There is a significant difference in the Training Costs per CAL for ERP 1 and ERP 2.

Table 76 - *Pearson Correlation Results Data by Year*

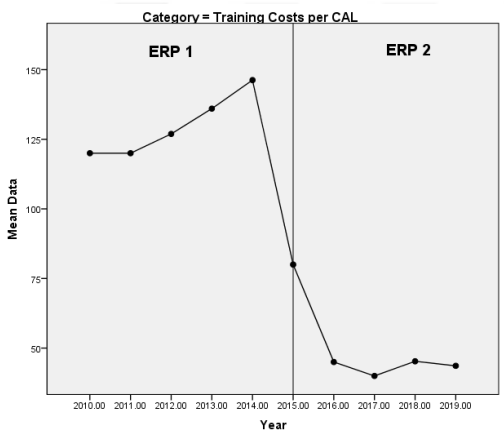
Category	Pearson Correlation	p-value	Significant?
Av. Profit Per Shp	.462	.178	No
Av. Profit Per Sh Air	-.104	.774	No
Av. Profit Per Sh Rd	.477	.164	No
Av. Profit Per Sh Sea	.576	.082	No
Training Costs/ CAL	-.832	.003	Yes

Table 73 shows the Correlation between the data values over the Years. The results

indicate that there are no significant correlations among the categories Average Profit per Shipment Sea, Shipment Air, per Shipment, and per Shipment Road. But there is a significant negative correlation in the Training Costs per CAL for ERP 1 and ERP 2. This means there is a significant decrease in the Training Costs per CAL over the years.

Figure 33

Training Costs per Year



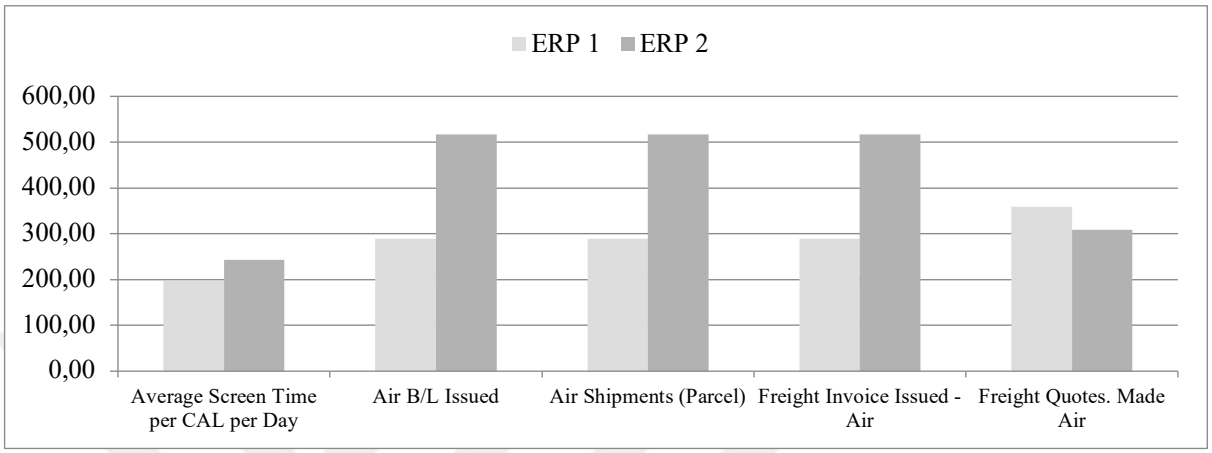
The above-mentioned figure shows the drastic decrease in the Training Costs per CAL over time since the introduction of ERP 2 at company A. Obviously, each of these ERP suppliers has different pricing policies for the training services they provide to their customers. Some IT companies take advantage of their customers by offering pricey training packages.

Table 77 - *Mean Values of Different Categories Compared by ERP*

Category	ERP 1	ERP 2	Mean Difference
Ave. Screening CAL/Day	197.20	242.60	-45.40
Air B/L Issued	289.40	516.20	-226.80
Air Shipments (Parcel)	289.40	516.20	-226.80
Freight Inv. Issued - Air	289.40	516.20	-226.80
Freight Quotes. Made Air	359.00	308.60	50.40

Figure 34

Bar Chart of Mean Values of different Categories Compared by ERP



The above table shows the mean values for categories such as; average screen time per CAL per day, air B/L issued, air shipments (parcel), freight invoice issued - air, and freight quotes made (air). The mean differences were higher for the air B/L issued, air shipments (parcel), and freight invoice issued (air) compared to the others. Figure 9 visualizes the results in Table 10. This shows the visual gap between ERP 1 and ERP 2 among the categories. Again, it is observed that more airway bills have been issued with fewer quotations, but more air shipments and more freight invoices were issued. Based on our interview with the company A partners and air cargo director, it was mentioned that they all think controlling cost house and making alternatives visible is the key for making a reasonable offer that brings the business.

Table 78 - *t-Test for Mean Comparison Between ERP1 and ERP2*

	t-Test			
	t	p-value	Significant?	Is ERP 2 better?
Air B/L Issued	-3.887	0.005	Yes	Yes
Air Shipments (Parcel)	-3.887	0.005	Yes	Yes
Av. Screen Time per CAL/Day	-3.974	0.004	Yes	Yes
Freight Invoice Issued - Air	-3.887	0.005	Yes	Yes
Freight Quotes. Made Air	0.910	0.389	No	

Table 79 - *Mann-Whitney U Test Results*

	Mann-Whitney U			
	Mann-Whitney U	p-value	Significant?	Is ERP 2 better?
Air B/L Issued	0	0.009	Yes	Yes
Air Shipments (Parcel)	0	0.009	Yes	Yes
Av. Screen Time per CAL/Day	0	0.009	Yes	Yes
Freight Invoice Issued - Air	0	0.009	Yes	Yes
Freight Quotes. Made Air	5	0.117	No	

Above mentioned tables show significant differences in the values for Average Screen Time per CAL per Day, Air B/L Issued, Air Shipments (Parcel), and Freight Invoice Issued – Air. This means that the ERP 2 values for these categories are significantly better than ERP 1.

Table 80 - *Pearson Correlation Results Data by Year*

Category	Pearson Correlation	p-value	Significant?
Air B/L Issued	.969	.000	Yes
Air Shipments (Parcel)	.969	.000	Yes
Av. Screening CAL/ Day	.980	.000	Yes
Freight Inv. Issued - Air	.969	.000	Yes
Freight Quotes. Made Air	-.503	.138	No

The table mentioned above shows the correlation between the data values over the years. The results are similar to Table 11, and wherein there are significant positive

correlations for the categories average screen Time per CAL per day, air B/L issued, air shipments (Parcel), and freight invoices issued – Air. This means that there is a significant increase in the values of these categories over time.

Figure 35

Air Parcels by Year Comparison Chart

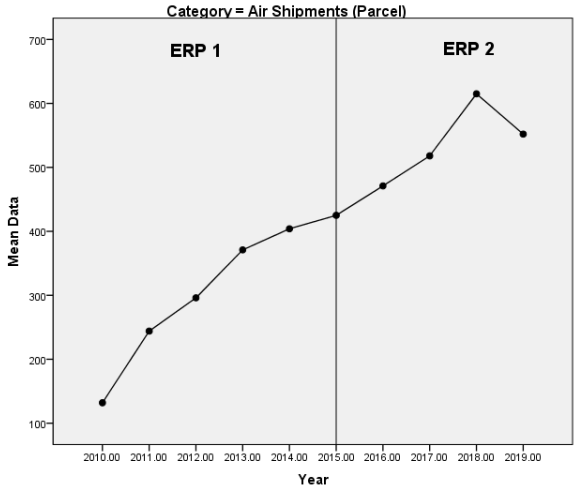


Figure 36

Bill of Ladings Issued

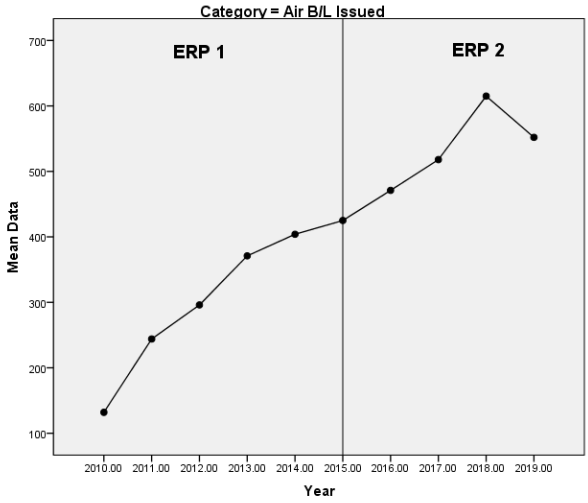


Figure 37

Average Screen Time per CAL

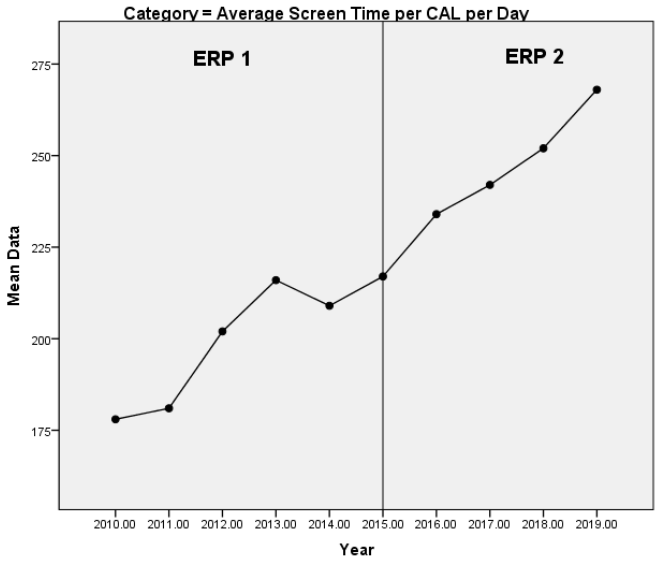


Figure 38

Issued Freight Invoices Air Dept.

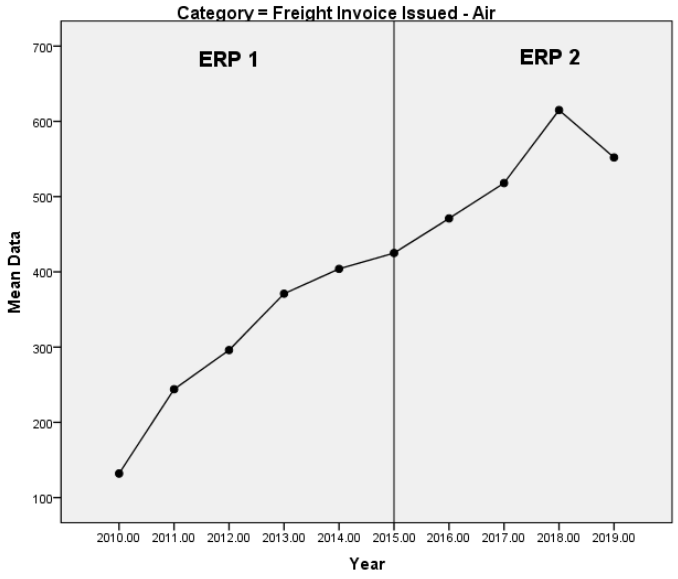


Figure 33 shows the drastic increase in the Average Screen Time per CAL per Day, Air B/L Issued, Air Shipments (Parcel), and Freight Invoice Issued – Air over time since the introduction of ERP 2. Screen time represents how keen the users are to engage with the ERP and how much they take it to the centre of daily tasks. As much as the ERP is used for all the operational, documentation related, financial jobs at the company, safety of company data, the value of the data they have and control of the overall business stream become standardized.

Table 81

Mean Values of Different Categories Compared by ERP

Category	ERP 1	ERP 2	Mean Difference
Visit Reps Submitted	756.80	1278.40	-521.60
Frgh Inv. Issd - Road	858.00	1136.20	-278.20
Sea B/L Issued	858.40	1158.40	-300.00
Road Cmr Issued	877.00	1209.80	-332.80
Road Shipments	877.00	1209.80	-332.80

Figure 39

Bar Chart of Mean Values of Different Categories Compared by ERP

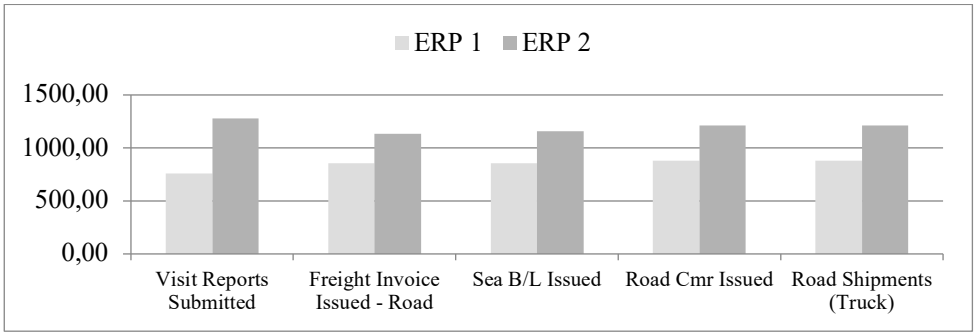


Figure 35 visualizes the results of Table 78. The results indicate an increase in the Visit Reports Submitted, Freight Invoice Issued – Road, Sea B/L Issued, Road Cmr Issued, and Road Shipments (Truck) for ERP 2.

Table 82 - *t-Test for Mean Comparison Between ERP 1 and ERP 2*

	t-Test			
	t	p-value	Significant?	Is ERP 2 better?
Freight Invoice Issued - Road	-5.047	0.001	Yes	Yes
Road Cmr Issued	-5.386	0.001	Yes	Yes
Road Shipments (Truck)	-5.386	0.001	Yes	Yes
Sea B/L Issued	-2.190	0.060	No	
Visit Reports Submitted	-2.822	0.022	Yes	Yes

Table 83 - *Mann-Whitney U Test for Mean Comparison Between ERP 1 and ERP 2*

	Mann-Whitney U			
	Mann-Whitney U	p-value	Significant?	Is ERP 2 better?
Freight Invoice Issued - Road	0	0.009	Yes	Yes
Road Cmr Issued	0	0.009	Yes	Yes
Road Shipments (Truck)	0	0.009	Yes	Yes
Sea B/L Issued	3	0.047	Yes	Yes
Visit Reports Submitted	2	0.028	Yes	Yes

Table 79 and 80 show significant differences in the values for the Visit Reports Submitted, Freight Invoice Issued – Road, Sea B/L Issued, Road Cmr Issued, and Road Shipments (Truck). There may be differences in the t-Test and Mann-Whitney U results for Sea B/L Issued but further investigation can be done on this in the next tables and figures.

Table 84

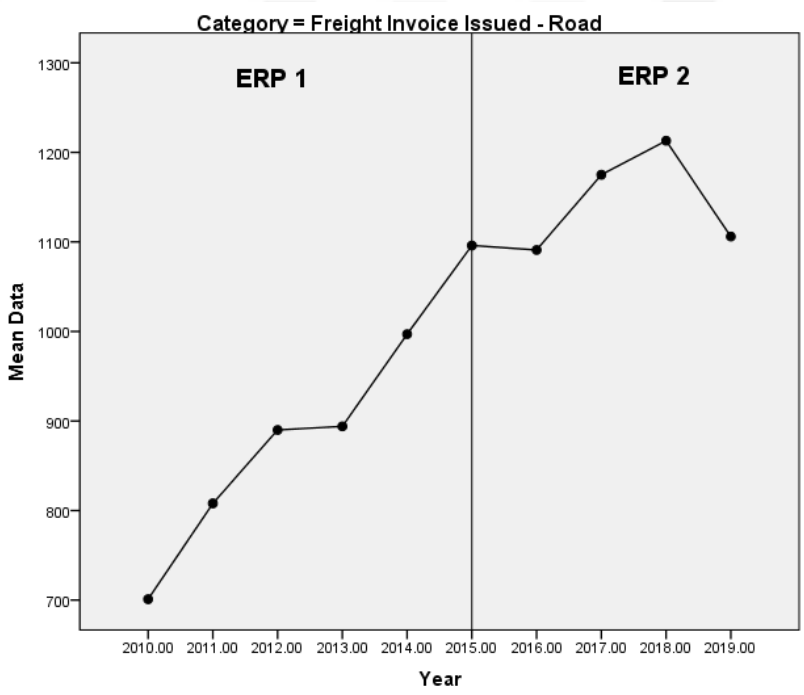
Pearson Correlation Results Data by Year

Category	Pearson Correlation	p-value	Significant?
Frgh Invo Issued - Road	.938	.000	Yes
Road Cmr Issued	.962	.000	Yes
Road Shipments (Truck)	.962	.000	Yes
Sea B/L Issued	.838	.002	Yes
Visit Reports Submitted	.948	.000	Yes

Table 81 shows the Correlation between the Data values over the Years. The results show there are significant positive correlations for the categories Visit Reports Submitted, Freight Invoice Issued – Road, Sea B/L Issued, Road Cmr Issued, and Road Shipments (Truck). This indicates a drastic increase in the values of the categories over time.

Figure 40

Freight Invoice Issued - Trucking Dept.



There is a visible fall down in the stats in 2018. The trucking department is affected by an economic crisis that mainly hit road freight operations and caused a decrease in the number of trucking shipments, issued CMRs and freight invoices. There is a similar slope in other modes of transportation. The amount of marine bill of ladings was decreased in 2018, too. The company continued to promote their business through active marketing activities, and the graphic of Visit Reports Submitted shows the continuous increase of data submitted in this department. This graphic can be interpreted as the marketing team's

positive tendency to use the ERP2 more for submitting their sales reports, customer meeting reports, and completing feedback notes.

Figure 41

Quantity of Issued Road CMRs

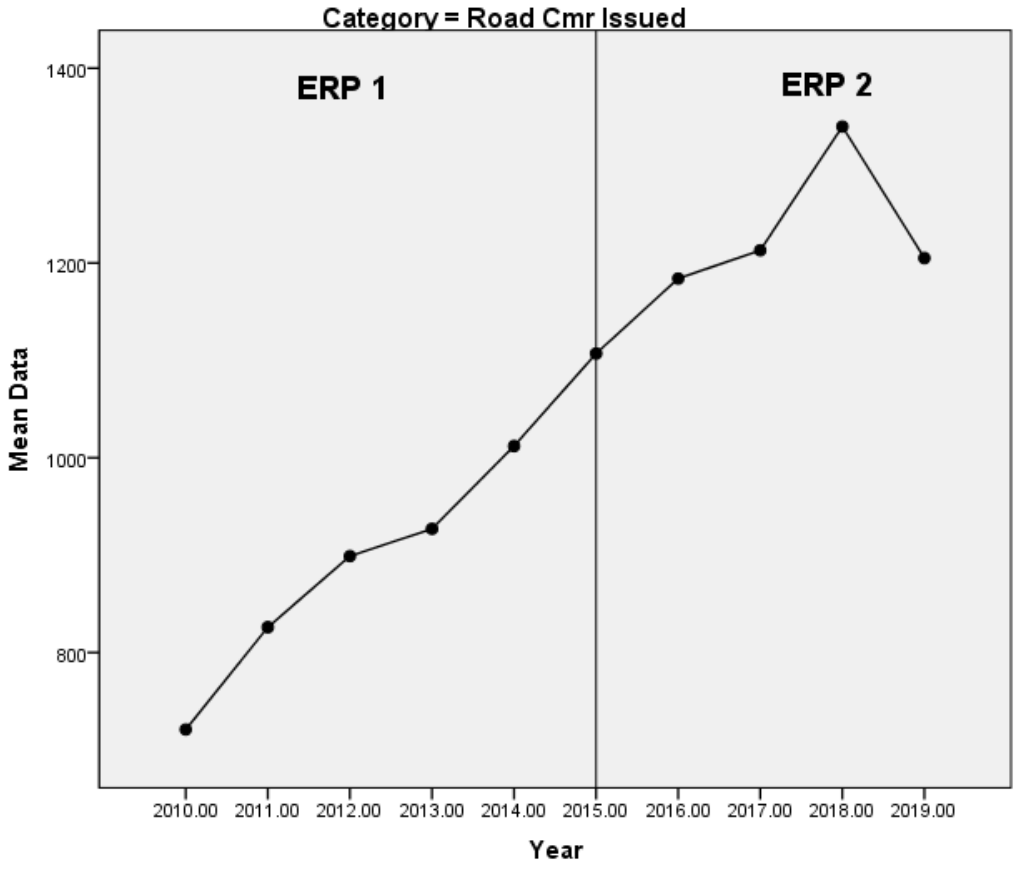


Figure 42

Quantity of Truck Loads

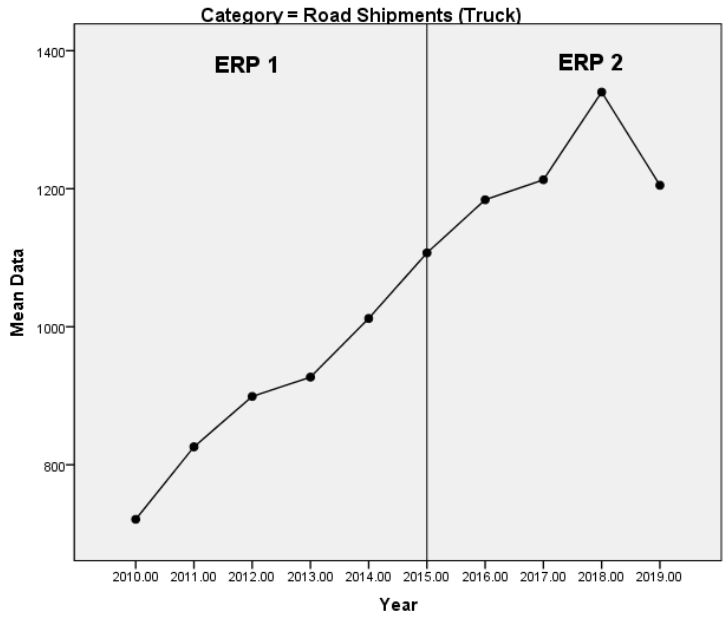


Figure 43

Quantity of Marine Bill of Ladings Issued

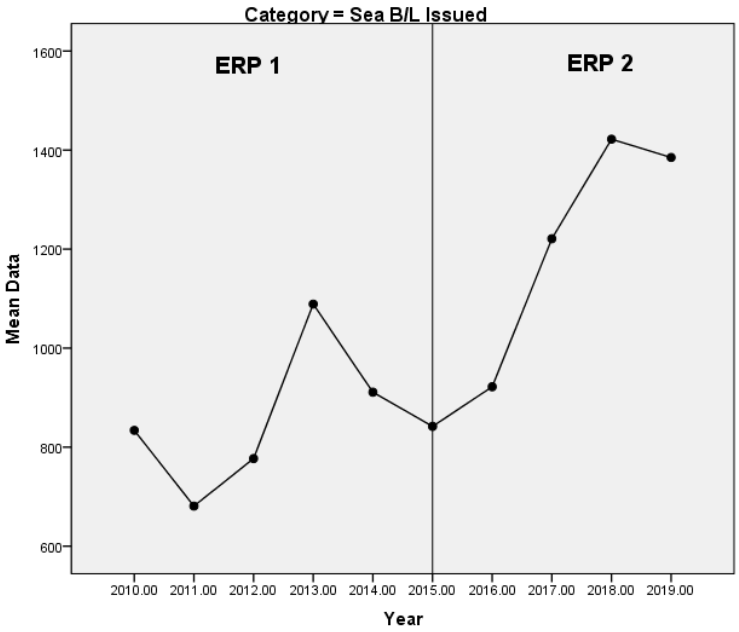


Figure 44

Customer Visit Reports Submitted into ERP

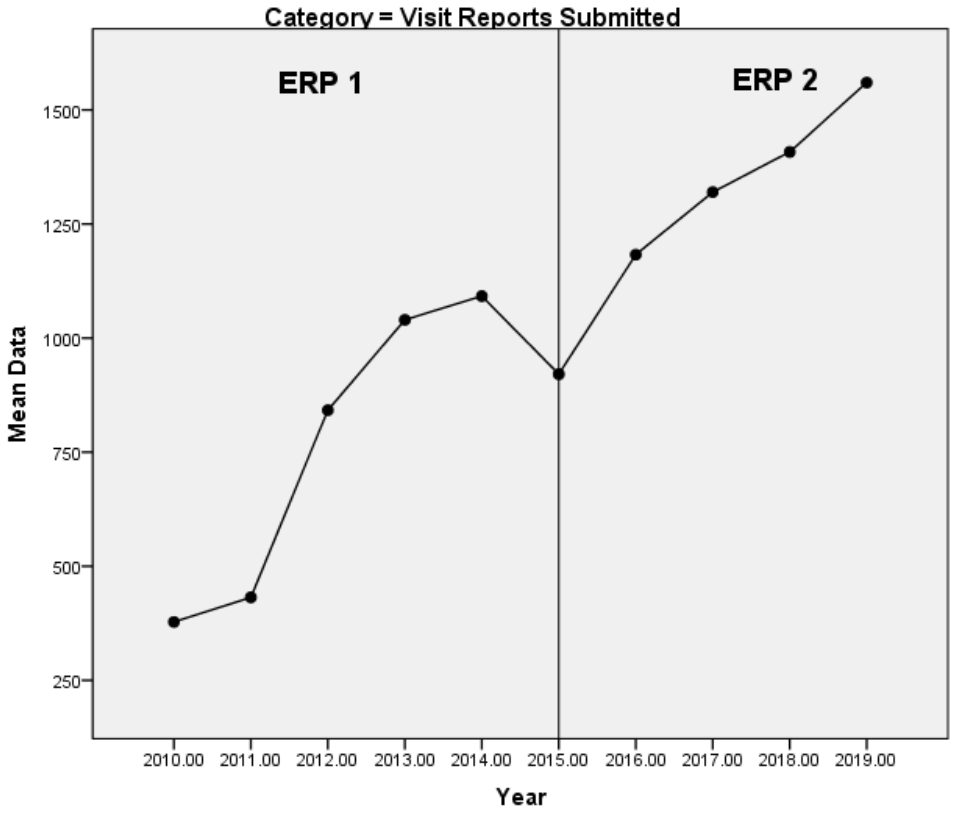


Figure 40 shows the drastic increase in the Visit Reports Submitted, Freight Invoice Issued – Road, Sea B/L Issued, Road Cmr Issued, and Road Shipments (Truck).

Table 85

Mean Values of Different Categories Compared by ERP

Category	ERP 1	ERP 2	Mean Difference
Acq. Orders After Quotes	1060.40	1622.80	-562.40
Frgh Quotes. Made Road	1182.60	832.60	350.00
Frgh Quotes. Made Sea	1430.60	2778.80	-1348.20
Training Costs	1758.00	876.00	882.00

Figure 45

Bar Chart of Mean Values of Different Categories Compared by ERP

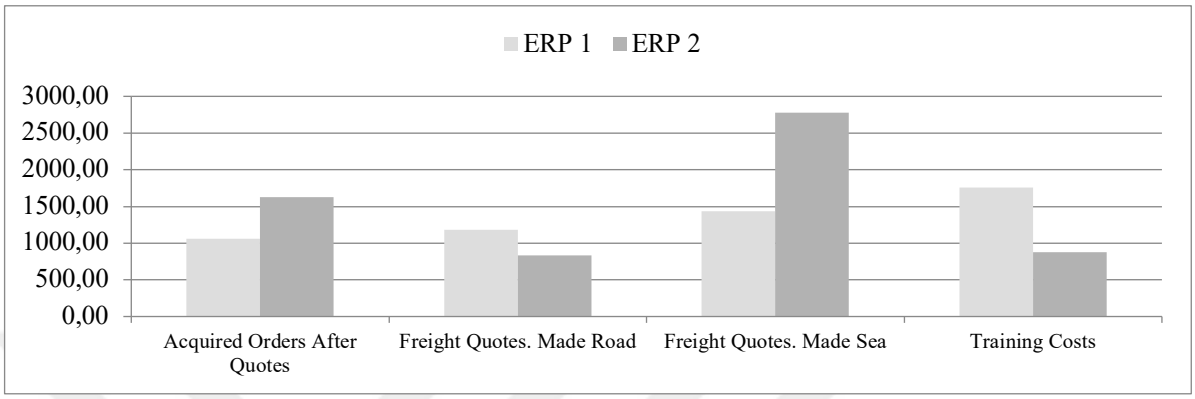


Figure 41 visualizes Table 82 for the values of the Acquired Orders After Quotes, Freight Quotes. Made Road, Freight Quotes. Made Sea and Training Costs. The results indicate that there is an increase in Acquired Orders After Quotes and Freight Quotes. Made Sea for ERP 2 while there is a decrease in Freight Quotes. Made Road and Training Costs. We observe that there is a big jump in sea freight quotations upwards while training costs decrease. There is a positive gap between the two software platforms regarding acquired orders after quotations have been made in favour of ERP2. During our interview with the company directors, we were told that company A had a business shift from trucking to sea and air shipments. It is pictured that company A has made fewer trucking offers in the same period that it has a significant increase in sea freight quotations.

Table 86 - *t-Test for Mean Comparison Between ERPs*

	t-Test			
	t	p-value	Significant?	Is ERP 2 better?
Acquired Orders After Quotes	-4.010	0.004	Yes	Yes
Freight Quotes. Made Road	3.869	0.005	Yes	Yes
Freight Quotes. Made Sea	-6.779	0.000	Yes	Yes
Training Costs	3.999	0.004	Yes	Yes

Table 87 - *Mann-Whitney U Test for Mean Comparison Between ERPs*

	Mann-Whitney U			
	Mann-Whitney U	p-value	Significant?	Is ERP 2 better?
Acquired Orders After Quotes	0	0.009	Yes	Yes
Freight Quotes. Made Road	0	0.009	Yes	Yes
Freight Quotes. Made Sea	0	0.009	Yes	Yes
Training Costs	0.5	0.012	Yes	Yes

Table 83 and 84 show significant differences in the values for the Acquired Orders After Quotes, Freight Quotes. Made Road, Freight Quotes. Made Sea, and Training Costs when compared as to ERP 1 and ERP 2.

Table 88

Pearson Correlation Results Data by Year

Category	Pearson Correlation	p-value	Significant?
Acq Orders After Quotes	.882	.001	Yes
Frgh Quotes Made Road	-.531	.114	No
Frgh Quotes. Made Sea	.907	.000	Yes
Training Costs	-.555	.096	No

Table 81 shows the results show there are significant positive correlations for the categories Acquired Orders After Quotes, and Freight Quotes. Made Sea while there are significant negative correlations for Freight Quotes. Made Road, and Training Costs. This means an increase in Acquired Orders After Quotes, and Freight Quotes. Made over Time as ERP 2 is introduced. While there is a decrease in the Freight Quotes. Made Road and Training Costs over time.

Figure 46

Acquired Shipping Orders by Years

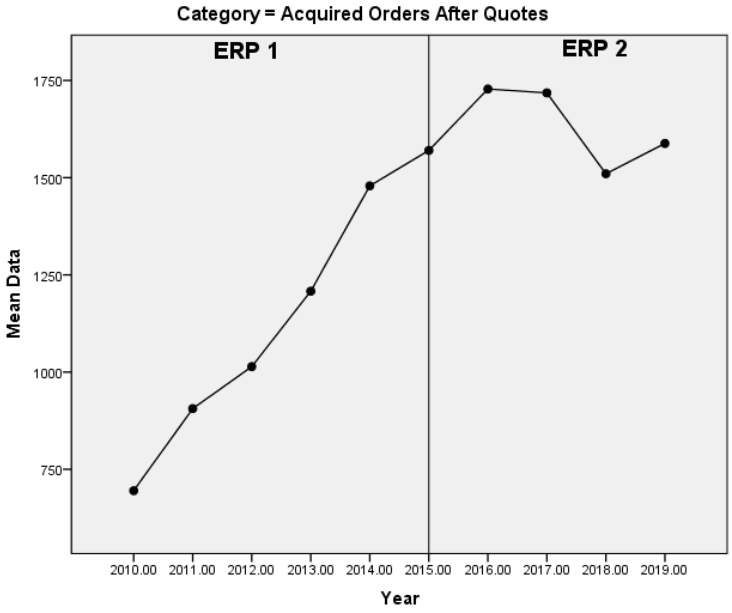


Figure 47

Sea Freight Quotations Made by the Years

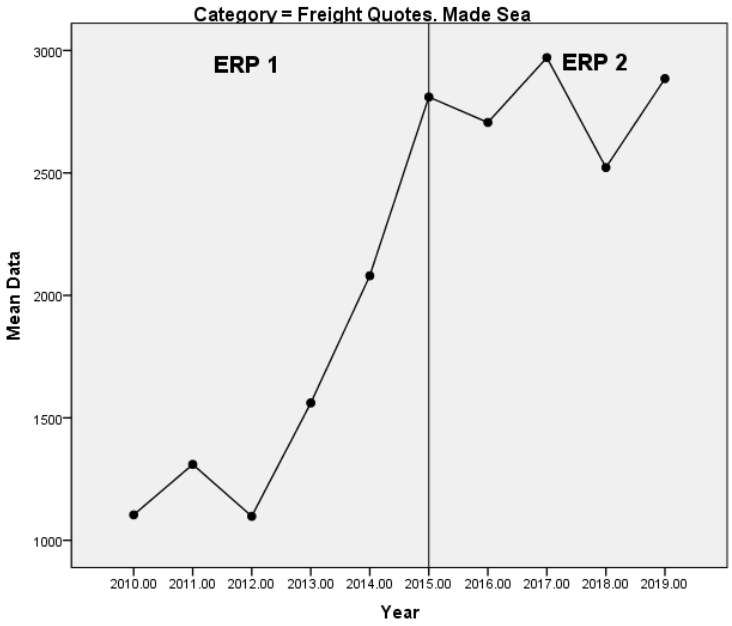


Figure 48

ERP Related Training Costs

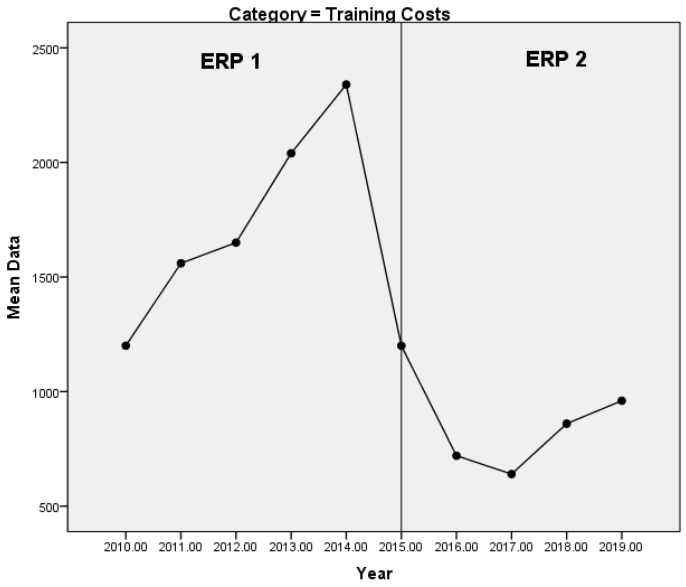


Figure 49

Road Freight Quotations Made

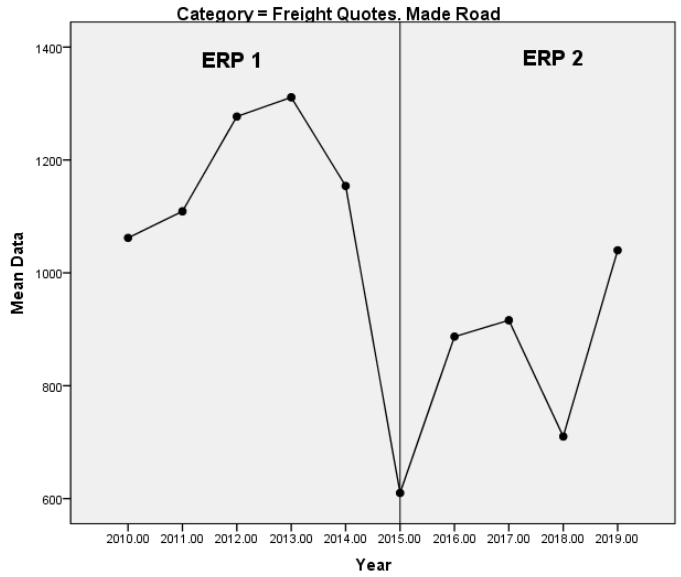


Figure 42 shows an increase in Acquired Orders After Quotes and Freight Quotes over Time as ERP 2 is introduced. At the same time, there is a decrease in the Road Freight

Quotes and Training Costs over time. One of the notable findings is that the training expenses decreased during the ERP2 era thanks to the IT supplier's customer satisfaction policy. Employing new staff and getting them engaged in the mainframe means additional costs. Suppose a team member uses the ERP more actively, submits more data into it, sends offers through the ERP, and tracks and applies A-B Analysis on customers, shipments, and operations. In that case, it brings dynamism and effectiveness into the company. On certain occasions, it is experienced that when an ERP is too challenging to use by the simple users, they develop a tendency to handle their daily jobs without submitting it into the ERP or do it infrequently and reluctantly. Decreased cost of training expenses opens the path, which is considered an obstacle for companies to create a budget for continuous IT training programs of their personnel. In this respect, it is possible to indicate that ERP2 is a better tool than ERP1 based on this variable.

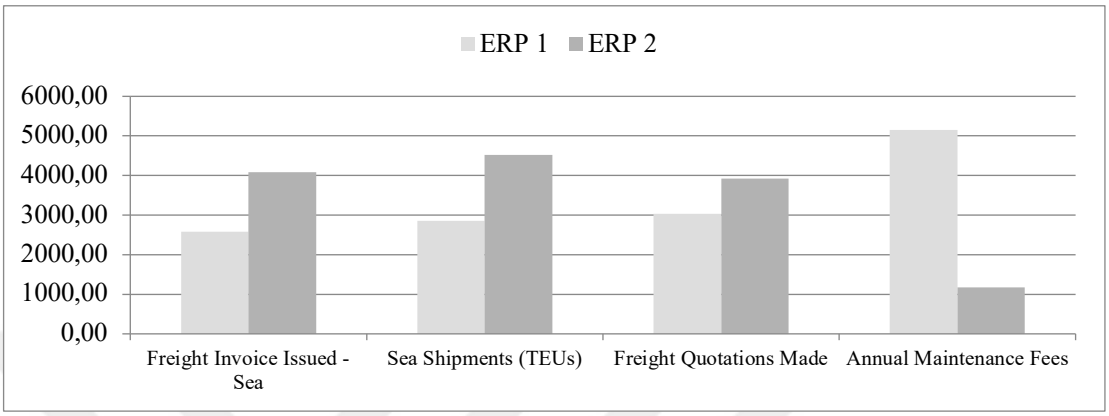
Table 89

Mean Values of Different Categories Compared by ERP

Category	ERP 1	ERP 2	Mean Difference
Frgh Invoice Issued - Sea	2580.40	4079.00	-1498.60
Sea Shipments (TEUs)	2859.20	4523.40	-1664.20
Freight Quotations Made	3027.20	3920.00	-892.80
Annual Maintenance Fees	5149.20	1173.40	3975.80

Figure 50

Bar Chart of Mean Values of Different Categories Compared by ERP



Quotations Made, and Annual Maintenance Fees. The figure indicates an increase in Freight Invoice Issued – Sea, Sea Shipments (TEUs), Freight Quotations Made for ERP 2 and a decrease in the Annual Maintenance Fees for ERP 2. Annual maintenance fees may become unbearable for maritime companies, particularly when they do not read the contracts before purchasing their ERP platforms. The yearly maintenance fee is an income "out of thin air" for the software companies. Like the telex release fee in the shipping business, the maintenance fee is an extra cost that a customer has to bear but gets nothing in return. The customer gets billed for all additional demands such as training, integration with third-party apps, innovation, or development in the ERP. So, lowering this 'unique' fee is a big win for the buyer.

Table 90

t-Test and Mann-Whitney U Test for Mean Comparison Between ERPs

	t-Test			
	t	p-value	Significant?	Is ERP 2 better?
Annual Maintenance Fees	4.397	0.011	Yes	Yes
Freight Invoice Issued - Sea	-5.821	0.000	Yes	Yes
Freight Quotations Made	-3.220	0.012	Yes	Yes
Sea Shipments (TEUs)	-5.942	0.000	Yes	Yes
	Mann-Whitney U			
	Mann-Whitney U	p-value	Significant?	Is ERP 2 better?
Annual Maintenance Fees	0	0.009	Yes	Yes
Freight Invoice Issued - Sea	0	0.009	Yes	Yes
Freight Quotations Made	2	0.028	Yes	Yes
Sea Shipments (TEUs)	0	0.009	Yes	Yes

Table 87 shows significant differences in the values for the categories Freight Invoice Issued – Sea, Sea Shipments (TEUs), Freight Quotations Made, and Annual Maintenance Fees Costs when compared as to ERP 1 and ERP 2.

Table 91

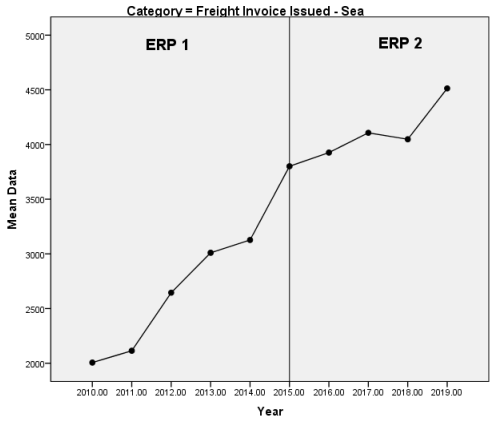
Pearson Correlation Results Data by Year

Category	Pearson Correlation	p-value	Significant?
Annual Maintenance Fees	-.564	.089	No
Freight Invoice Issued - Sea	.979	.000	Yes
Freight Quotations Made	.843	.002	Yes
Sea Shipments (TEUs)	.984	.000	Yes

Table 88 shows the Correlation between the Data values over the Years. The results show that there are significant positive correlations for the categories Freight Invoice Issued – Sea, Sea Shipments (TEUs), and Freight Quotations Made which indicate a drastic increase in their values over time as ERP 2 is introduced.

Figure 51

Sea Freight Invoices Issued



Company A explains that 2019 was a challenging year for all industries, including freight forwarding. Economic sanctions on Iran, political instability in Syria and Iraq, devaluation in the local currency, the domestic slowdown in a big portion of the industries have caused a decrease in transportation services by TEUs at the sea freight department. The TEU has fallen, but the company has enriched its services by add-on products such as cargo tally, survey, fumigation, lashing and still kept freight-related invoices increasing.

Figure 52

Freight Quotations Made (Overall)

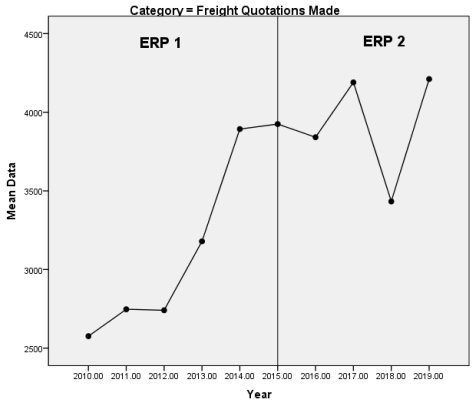
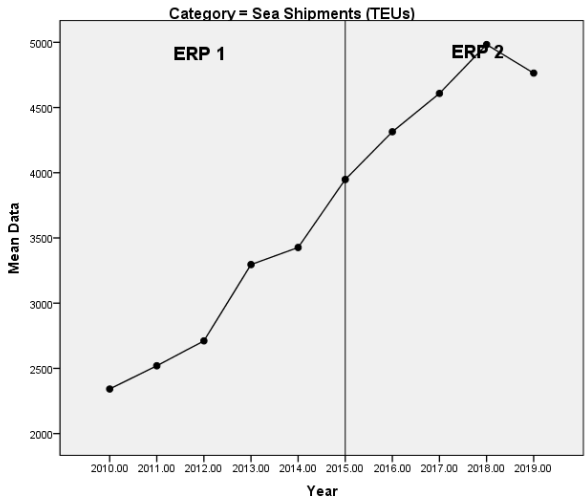


Figure 53

Container Shipments (TEUs)



Figures 48 and 49 show an increase in Freight Invoice Issued – Sea, Sea Shipments (TEUs), and Freight Quotations Made over Time as ERP 2 was introduced in 2015.

In conclusion, the Independent Samples t-Test is a parametric statistical tool favoured when the frequency count is more than 30. This is a more powerful tool to determine significant differences. Mann-Whitney U is a non-parametric equivalent of the t-Test, which is not bound by the frequency count rule; therefore, it can be used for quick statistical inferences. For this study, both of their results mirror each other except for the category Sea B/L Issued, but we can go for that since the differences are pretty minimal. Some categories are significantly higher for ERP 2 and others that are substantially lower for ERP 2.

The results were:

a. ERP 2 has reduced the following:
    1) **Time for Submitting a B/L**
    2) **Error(s) Reported**
    3) Freight Quotes. Made Road
    4) **Training Costs**
    5) **Annual Maintenance Fees**

6) **Average Time to Make Offers**
7) **Amount of Complaint Tickets (CALs)**
8) **Training Costs per CAL**

b. While it has increased the following:
1) Freight Quotes. Made Sea
2) Sea Shipments (TEUs)
3) Quantity of International Partners
4) Freight Invoice Issued - Sea
5) Net Profits (Mil)
6) Road Cmr Issued
7) Road Shipments (Truck)
8) Freight Invoice Issued - Road
9) Turnover (Mil)
10) **Acquired Orders After Quotes**
11) **Average Screen Time per CAL per Day**
12) Air B/L Issued
13) Air Shipments (Parcel)
14) Freight Invoice Issued - Air
15) **Average Amount of Reports**
16) Freight Quotations Made
17) Quantity of Domestic Partners
18) **Visit Reports Submitted**
19) Active CALs
20) Training Time
21) Sea B/L Issued

c. No significant improvements in the following:
1) Amount of Integrations
2) Integrated 3rd Party Apps
3) Integration Demanded
4) Program Crash Reports / Annual
5) Reclaimed Customers
6) Training Time per CAL
7) Acquired Customers
8) Lost Customers
9) Av. Profit Per Shipment
10) Av. Profit Per Shipment Air
11) Av. Profit Per Shipment Road
12) Av. Profit Per Shipment Sea
13) Freight Quotes. Made Air

Another way to look at the results is through the correlation table and line graphs. ERP 2 was introduced in 2015 therefore the expectations of improvements are

monitored over time. This means that the correlation test was done between the values of the categories by years.

The results were the following:

a. There was a significant decrease in the following areas:
    1) Error(s) Reported
    2) Average Time to Make Offers
    3) Training Costs per CAL
    4) Amount of Complaint Tickets (CALs)
    5) Time for Submitting a B/L
b. While there is a significant increase in the following:
    1) Training Time
    2) Integrated 3rd Party Apps
    3) Amount of Integrations
    4) Sea B/L Issued
    5) Freight Quotations Made
    6) Acquired Orders After Quotes
    7) Freight Quotes. Made Sea
    8) Active CALs
    9) Quantity of Domestic Partners
    10) Freight Invoice Issued - Road
    11) Visit Reports Submitted
    12) Quantity of International Partners
    13) Road Cmr Issued
    14) Road Shipments (Truck)
    15) Average Amount of Reports
    16) Air B/L Issued
    17) Air Shipments (Parcel)
    18) Freight Invoice Issued - Air
    19) Freight Invoice Issued - Sea
    20) Average Screen Time per CAL per Day
    21) Net Profits (Mil)
    22) Sea Shipments (TEUs)
    23) Turnover (Mil)
c. No significant correlation for the following:
    1) Integration Demanded
    2) Program Crash Reports / Annual
    3) Reclaimed Customers
    4) Training Time per CAL
    5) Acquired Customers
    6) Lost Customers
    7) Av. Profit Per Shipment
    8) Av. Profit Per Shipment Air
    9) Av. Profit Per Shipment Road

10) Av. Profit Per Shipment Sea
11) Freight Quotes. Made Air
12) Freight Quotes. Made Road
13) Training Costs
14) Annual Maintenance Fees

Overall, it shows us that ERP2 as a web-based platform that runs on MS SQL DB is a more effective and efficient tool than ERP1, which runs on Progress DB, is locally installed and comes with hardware investment requirements. As maritime logistics is changing almost day by day, so ERP solutions are. It is not enough to adapt to these conditions, but IT companies must shape the change and take a leading role. From this point of view, our benchmark has shown that ERP platforms that run on the cloud environment run on less expensive, less limiting, but more flexible database structures will have a brighter future than those run on local computers and that use relatively weak DB tool.

3. DEVELOPMENT PROCESS OF KSHAL INFRASTRUCTURE

This section is the kernel of our research that reveals the significant steps illuminating the software development process from blueprints to the final deployment stage. All the stages of the development process will be shown with the sound foundations of decisions while applying necessary steps into screens, into the DB and to the codes. For example, why do we design the screens in such a way? How has the pricing structure been built? How do we promote and sell the program? How do we handle customer feedback data through the software? How secure is the system? How economical to use such a system for companies? How effective is KSHAL as a web-based ERP alternative for the maritime industry? Some of these questions coming from our hypotheses will seek answers and solutions in this section.

On the other hand, this section aims to underline how necessary technological tools are in maritime, shipping, transportation, logistics, customs, and container sales business. Even though this dissertation walks on the software development path, it is a study blooming in the international trade and logistics field. On many occasions, the know-how of the core business comes first, then the software development. In this research, our experiment space is limited by the transportation, maritime and logistics spheres. The know-how which we have is coming from the same source. In other words, one of the roles that this dissertation holds is visualizing the process of how the maritime, shipping and transportation know-how can be shapeshifted into a digital product. As we observed and indicated in Section 2, the absence of experienced freight forwarders, maritime consultants at rival companies can be considered one of their weak points. No ERP software can be

brought into life better than having at least one consultant was set in a project consultancy position to guide the software development team.

Section 3 was segmented by 13 subtitles. Each section profoundly aims to enlighten a vital phase of the KSHAL project. The sections were arrayed in a logical sequence of how KSHAL was built, so we began with constructing the DB, which will be the powerhouse of the software. KSHAL is a balanced mixture of design and engineering; thus, it is prominent to reveal the designing part of the ERP. In Section 3.3, we tried to put the user experience part into the words of how and why it has been built up that way.

The container management module is one of the unique features that KSHAL provides. It utilizes and unravels the operational hardships of the container trading business. When a merchant who sells second hand and brand-new containers of all kinds at multiple depots in domestic and international markets faces several difficult consequences from calculating depot costs, demurrage incomes, leasing charges, need such a tool puts automation into business seamlessly. KSHAL fulfils these tasks at a fraction of a price. This aspect is rather a unique product that no other web-based platform had the same functionality in Turkey when this dissertation was scripted.

Every solution is there to answer an existing or a potential problem. This is the reason why KSHAL is there. It came into life for providing an economical, versatile, lightweight, dynamic, secure, fast and skilled software solution for maritime logistics companies. As the markets change, the shape and requirements of the business in SCM also do. By SaaG proposal, KSHAL will evolve into a pioneering sample of how the future of ERP solutions positions itself at the disposal of SCM companies.

3.1 Advantages of the Cloud and Web-Based Platforms

Software programs may have multiple habitats to become functional. It can be an installed product that works on local servers inside the company, which is the customer of that software. That option loads additional responsibilities to the shoulders of the customer. These servers must be kept at a secured place called a data storage room or a network room. The room must be dust-free and protected against possible natural disasters such as fire, water leakage, earthquakes and theft. The system is also required to be monitored by experts routinely and obliged to have a staff to intervene in possible hardware or connection problems that may halt the workflow. In the SCM sphere, the customer must decide how keen they are to keep that equipment in the company and spend funds running safe and sound.

Next to the above method, the customer may purchase servers by its funds, ask the software company to install the program into those servers but place it elsewhere. This method, called co-location, takes place at specific locations, particularly at hosting companies that hire customers for rack space for their servers. The customer pays for broadband, fast-speed, simultaneous internet connection, security, hardware maintenance, and backup services. In this option, the customer still has to deal with two separate entities: the software company and the other one is the hosting service provider. This option is more economical and feasible since several tasks are being outsourced to a hosting company. However, this option still keeps a few costs and tasks on the customer's account, which can be cut or reduced to more reasonable levels. This option, called "Dedicated Hosting" or "Co-Hosting, " is an option to choose when picking up a software installation place and a data-keeping location. Dedicated hosting, shared hosting, and co-location are different

variants of the same structure based on installing software only for one customer and keeping the servers at an agreed place.

The third method of keeping the software and all relevant data is cloud-based virtual private servers, shortly known as VPS. The cluster of servers compiled under the roof of a hosting company and work interlinked to create the cloud environment as we know it. The cloud technology does not only make data storage cheaper but also shifts the shape of the whole conventional hosting business into a digital ecosystem where on the one hand, software engineers build up new programs by the support of use on-demand infrastructures and, on the other hand, removes a significant amount of occupying jobs from the shoulders of the customers. As embedded in its definition, VPS is a digital platform where a customer does not own any hardware. It is a scalable, pay-per-use option where customers can start from simple service packages and upgrade their virtual private spaces up to any grade of requirements. The cloud company hosts the data, provides all the run times, infrastructure for our ERP to become functional, and allows the customer to customize the content of the service they buy. From this perspective, the cloud-based VPS option is a one-stop-shop for building up a new ERP.

From another point of view, all components that affect sustainability have the potential to be defined as constraints. So, besides the costs, technical requirements, staff-related constraints, a digital platform where we deploy, operate, execute and store our company data is also a critical constraint that may lead us into whether troubles or gains. Therefore, a sustainable and manageable technological infrastructure should be the sole goal of transportation companies. When we approach it from this perspective, it should be stated that cloud-based software is a dynamic, flexible and profitable infrastructure

alternative that allows companies to spread the high investment costs over time. Cloud enterprise resource planning (ERP) solutions allow organizations to support and coordinate key business processes by leveraging virtualization (Hustad, Sorheller, Jorgensen, & Vassillakopoulou, 2019).

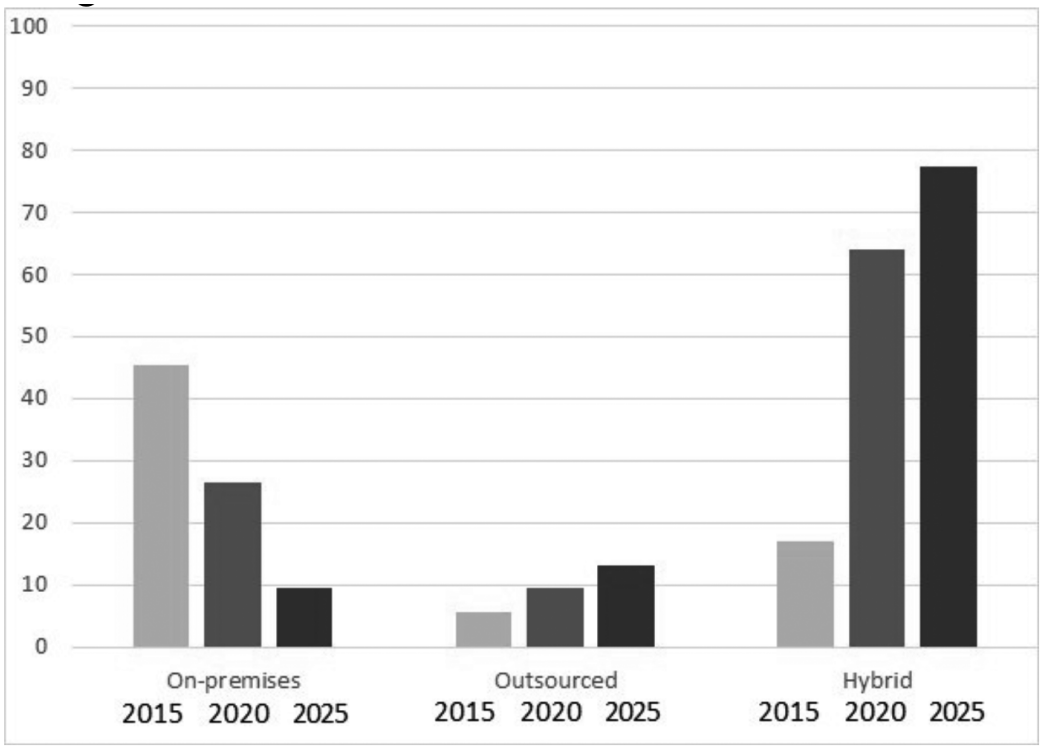
In this way, logistics companies can focus more comfortably on their business in capital use decisions and provide a competitive advantage by making their decision support systems investments relatively more efficiently. The process of switching organizations to the Cloud ERP system is increasing, especially small and medium private organizations and companies that do not want to make the I.T. department a large department and reduce the costs of the I.T. department because the company does not need to maintain the system (Hadidi, Al-Rashdan, Hadidi, & Soubhi, 2020).

Today, on-premise ERP products are still dominant comparing the cloud-based SaaS platforms. Anyhow, as conventional computing evolves, the speed of the internet emerges; also, industry-specific ERP service providers follow the trend and carry their solutions to the web faster than before. The on-premise environment was our natural habitat in the past due to several facts and constraints such as security, the speed of the internet, smaller e-markets and web-based consumption. Anyhow, we move forward to the cloud and SaaS environment through hybrid models every day. The research conducted by scholars from Universidade Nova de Lisboa, Portugal, in 2015 also prooves this movement visually. According to the paper titled "The ERP surge of hybrid models - an exploratory research into five and ten years forecast", European companies will move their ERP programmes from on-premise to hybrid environments (Ruivo, Rodrigues, & Oliveira,

2015). According to the research results, the move to ERP as SaaS is underway, and by 2025 only a minority of firms will stay with a single on-premises as shown below.

Figure 54

ERP model evolution, from today to 5 years, to 10 years.



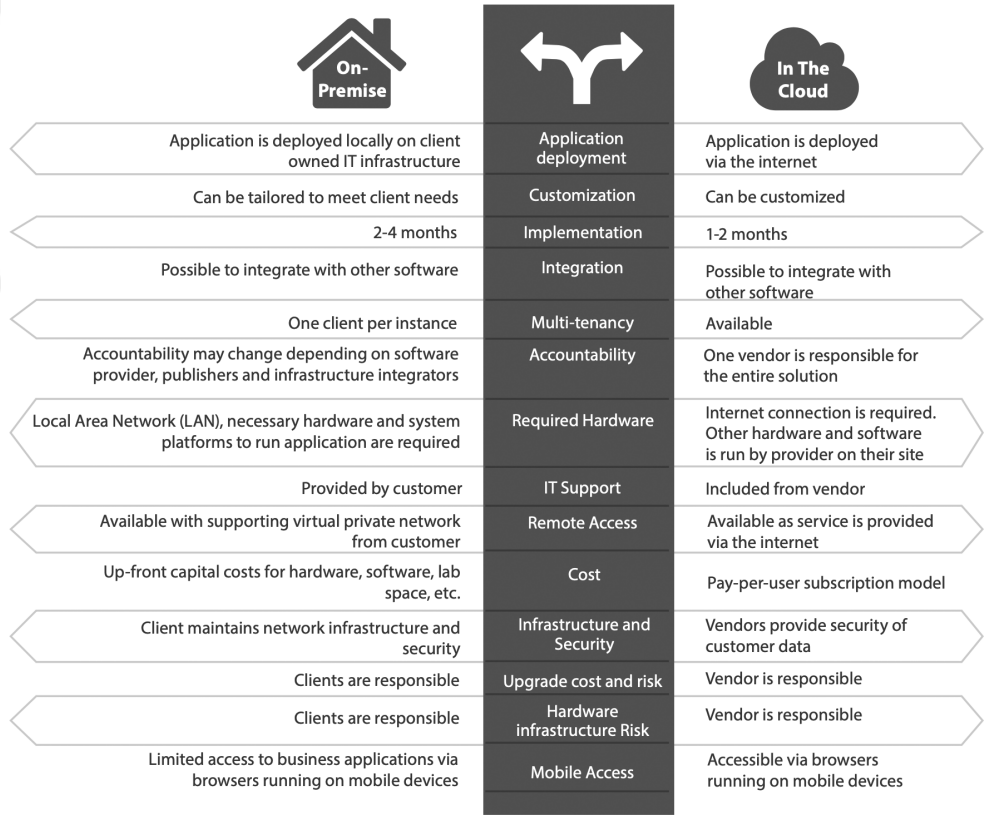
Note. From Ruivo, Rodrigues, Oliveira, 2015.

ERP systems have evolved from large monolithic packages installed on-premise to more flexibly deployed SaaS applications available in the cloud (Chao & Peng, 2014). As per our statistical findings in Section 2.4, there is a positive correlation between operational effectiveness and economic affordability in the comparison between two ERP systems as one of them works locally and the other is a web-based SaaS platform, to the advantage of the web-based ERP. Today, the benefits of developing an ERP on the cloud, supplying it as a system that works on the cloud, has more benefits than developing it in local computers

and supplying it as an installed program. In order to acknowledge the benefits of web-based platforms, we must indicate some factors in detail. When it comes to desktop-based ERP system design and production, consideration has to be given to the power of the machines that will be running. Sometimes a rollout of a needing new software program can require a complete hardware overhaul too. That is big spending.

Figure 55

On-Premise vs. In The Cloud Comparison Chart



Note. From www.vision33.com. August 2021

However, when cloud-based ERPs are used, they can be used from almost any device with a browser. The computing power is coming from the server, which cuts down on necessary on-site hardware requirements. According to Figure 55, it is visible that the

cloud-based ERP solutions are -comparing on-premise software-, easier to customize, integrate, implement; they are more affordable and accessible by companies.

Web-based ERP systems used to be finite in functionality. Nonetheless, advances in technology, security, and broadband internet have markedly increased the potential scope of web-based ERP systems. Moreover, network computers provide those ERP-driven businesses a way to leverage the emerging Web technologies, such as Java, Intranet, and Extranet applications (Yen, Chou, & Chang, 2002).

Today, there are web-based business bookkeeping systems, freight forwarding programs, web-based office options, and more. Web-based ERP solutions supply some significant advantages over native, customer-based, installed software. A web-based ERP is an application that is accessed via WWW. Web-based supply chain applications promise to provide information sharing capabilities that will enhance the participating organizations' information capabilities and business benefits (Smith, Duchessi, & Gil-Garcia, 2012).

The term web-based is usually used to describe programs that run in a web browser. It can, though, also be used to describe applications that have a tiny component of the solution loaded on the client PC. The host server for a web-based system could be a local server, or it could be accessed via the internet. A web-based application uses a web browser's graphical user interface. It means that a single, responsive web application can be utilized across multiple gadget types. Although web apps and cloud environments will need to be tested on different browsers, there is no need to test them on diverse frameworks. Software as a Service (SaaS), targets the end-user or business. It concerns the delivery of a software application over the internet to multiple users (Ali & Nasr, 2017).

Cloud computing has a profound impact on the entire I.T. industry as a new business model. The rapid development of cloud computing can help enterprises access high-performance I.T. services at a lower cost and is conducive to small and medium-sized enterprises to access high-performance I.T. services like large enterprises. At the same time, the reduction of the I.T. burden can help enterprises concentrate on their core business. Furthermore, the process optimization based on cloud computing can achieve a large-scale reconstruction of the industry and enhance the overall I.T. standards and competitiveness. Here are some other reasons why every enterprise might need cloud computing for their business:

- **Cost savings:** Cloud computing removes the requirement of a company to invest in storage hardware and servers.
- **Focusing on the business:** Since all the services will execute over the internet, a company does not have to bother about technical issues and other physical storage and backup problems. A company can thus focus more on their core business.
- **Performance:** It delivers reliable performance irrespective of the geographical location of the user. Another key feature could be the automatic updating of services and applications.
- **Security:** Cloud Computing offers optimum security that protects companies against unauthorized access, modification, and data loss.
- **Flexibility:** Even if part of the cloud environment fails or stops working, the other resources continue to work until the problem is fixed (Chandra & Rastogi, 2018).

This makes software development and testing more simple. It cuts development expenses and diminishes development time. Dissimilar to a conventional program installed

on each device, web-based ERP solutions run from a host server. There is no installation on local machines. Program upgrades are all fulfilled centrally. That decreases the costs of installing and updating the program. This also ensures that all CALs are using the same version of the program every time. CALs can access a web-based platform anywhere. So long as they have an internet connection, a web browser and the pertinent login details. It means that users can access the data they demand when they are away from the workplace. This also offers the possibility of staff working from home. The distribution of data among the developers and teamwork on projects is made much simpler with web-based platforms.

Figure 56

Differences Between On-Premise and Cloud ERP

Categories of differences	SaaS-ERP(Cloud ERP)	On-Premise-ERP (Traditional ERP)
ERP system total cost	Monthly Subscription Fee for ERP system No maintenance cost	Cost of license Maintenance cost is often annual
Cost of ERP Installation	No installation cost because the system is already installed on the server provider	Costs to set up the hardware and install ERP software
Updated	Included in the subscription fees	Included in the maintenance fees, but needs extra fees for updating hardware and software
Implementation time	Short time for implementation	No quick implementation
Flexibility in the ERP modules	Additional modules can be added in a short time if required	New modules may need to be added to the installation of a new package from the ERP system and removed from the old package
Selection of modules	Packages can be subscribed from modules by offers so they cannot subscribe to one module only, which reduces the flexibility of choice	Only required modules will be purchased
Mobility	Accessed from anywhere	Accessed from the location of ERP system servers, the system can be accessed via the web from anywhere, but special packages must be purchased, which leads to extra cost to the customer

Note. From Hadidi et al.

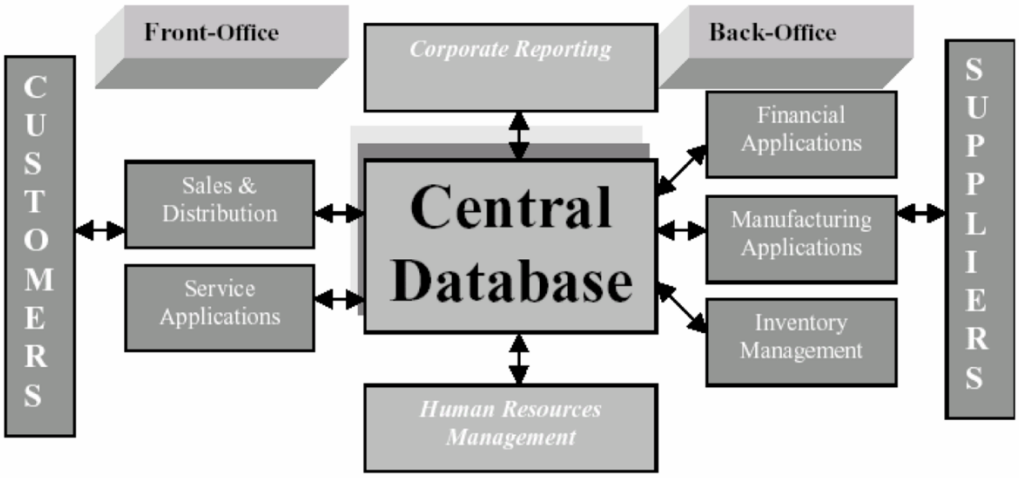
The information is stored in one central hub, so CALs can share it and work together on tasks. That is also smoother to integrate web-based ERP platforms than isolated desktop programs. As web-based applications are deployed on web servers, security is controlled

by an IT expert. That prevents sensitive corporate information from being kept on many local client PCs, not as safe. Employees can access data when they are away from the workplace via a web app. Therefore, the information does not need to be kept anywhere other than the safe central location.

Web-based ERP alternatives can extirpate the demand for powerful client PCs. All the operation is carried out on the host server. So, the storage disks, processors and memory requirements for client PCs are reduced. The users may log in and start using the program by thin clients, mobile devices, or personal computers. In all aspects, it is a remarkable cost-saving decision to move the whole ERP structure from local computers up to the cloud. Also, in most businesses, the deployment of web-based programs leads to the streamlining of business processes. Often, paper-based processes can be replaced by workflow-based optimizations. The business flow improvements can lead to increased employee productivity and decreased costs.

Figure 57

A Web-Based ERP Model



Note. From eiilmuniversity.ac.in

Behind the logic of moving the ERP programs to the cloud, there is a goal of achieving the ultimate simplicity in technical jobs. The deployment of web-based programs demands no software loading on the client PC. A random user is ready to go once their user name, password and authorization details are defined on the cloud side. As of today, there is no other option beyond this fact in terms of simplicity, scalability, feasibility and even security. This fact sets cloud technology as more than a place where companies store their data. The cloud has become the digital environment for all the actors, including software developers, customer companies and end-users. With this revolutionary change, the conventional "code-sell-install" process has evolved into a lighter but more powerful compilation of collaborative digital tools. In fact, the Internet and Web technologies can support the entire supply chain's operations. Internet-based supply chain operations are fast and inexpensive. Moreover, customers can instantly check the status of their orders by simply clicking their computer mouse. Corporate executives and managers can conduct real-time access to the firm's inventory level, and so do their suppliers and distributors. Specifically, Web technology made the following contributions to SCM (Chou, 2004).

In a summary, the advantages of the cloud (the web) based ERP solutions are;

1. Accessible anywhere, anytime.
2. Easy data sharing and collaboration
3. Centralized and multilayered security
4. Reduced hardware investments
5. Increased scalability and adaptation skills
6. No more system update issues
7. Platform happy (Multi-device, multi-operating system friendly)

8. Quick development cycles thanks to hyper-location accessibility
9. User tracking, KPI analysis features become easier
10. Offline using capabilities

On-premise ERP systems usually require large upfront and ongoing investments to purchase and manage the software and the related hardware, servers, and facilities necessary to run it. If the company does not have a large or experienced IT staff, it may also have to invest more time and money in additional personnel and train them. Even more importantly, on-premise systems require that the IT team spend a significant amount of their time and budgets ensuring the company's system is up-and-running when it is needed, including maintenance of hardware, server rooms, and more. When it is time for the ERP system to be upgraded, IT must redeploy the system across the various users' computers and re-implement multiple customizations and integrations installed on their previous software.

For cloud-based ERP, initial costs are typically much lower because the companies implement the software to their requirements and then access it through their computer's internet connection. In addition, the cloud ERP provider hosts and maintains all of the I.T. infrastructures for the customer companies, ensures the system is always running, that the data is secure, and that product enhancements are rolled out painlessly to their solution without breaking their previously implemented customizations. Recent advances in cloud computing lead to a fundamental paradigm shift in how information technology supports complex business systems.

Given this setup, instead of investing in a fully-fledged in-house I.T. infrastructure, companies would subscribe to business applications like office applications on a pay-per-

use system from external service providers over the internet. With the current state of the economy, cloud-based products could be an appealing concept to companies with limited I.T. infrastructure budgets. An example of this setup would be Salesforce.com's Customer Relationship Management (CRM) solution. Clients subscribed to this service would avail of these CRM applications on a computer workstation with internet access, thereby eliminating the need to install, configure and maintain an in-house comprehensive Enterprise CRM software solution within the company (Jalao, Shunk, & Wu, 2012).

Ultimately, this allows their IT resources to focus on innovating and helping grow the business more effectively, rather than spending a disproportionate amount of their time maintaining and managing their on-premise systems. Cloud ERP also offers a predictable, pay-as-you-go subscription model that can make cash flow management and plan much more accessible. Therefore, to enhance the sustainability of business operations, enterprises have interests in enterprise resource planning transitions from an existing on-premise method to a cloud-based systems (Byungchan & Hyunchul, 2020).

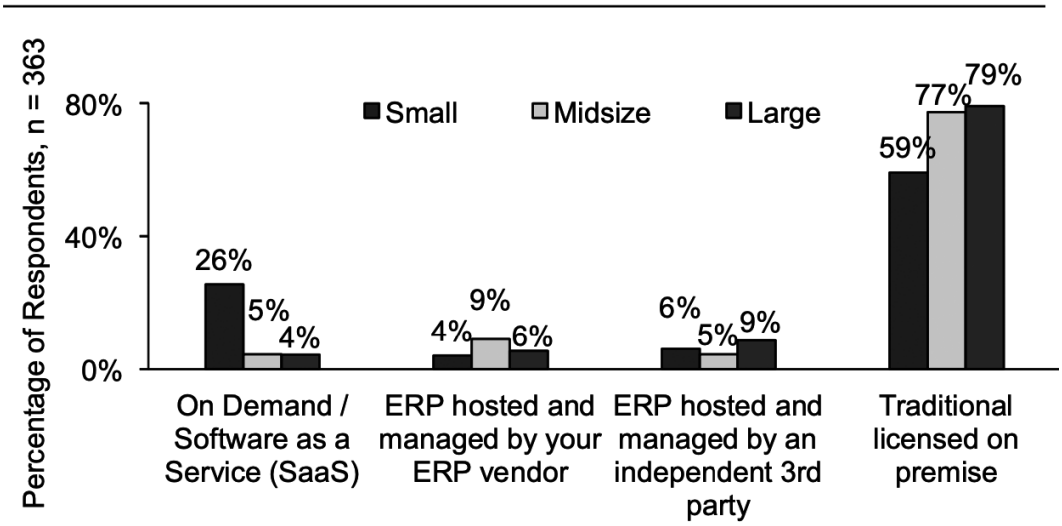
At a time when industries and economies are decreasing their growth forecasts into single digits, IDC has predicted that SaaS growth will be more than 40% in the current year. SaaS offers "right-sized, zero-capex alternatives to on-premise applications" and easy-to-use subscription services, which are attractive points to companies (Cole, 2021). According to the 'Cloud Computing Guide Book' of BDM Publications, 85% of all new software developed in 2020 was cloud delivery. As a result, the tendency of developers and customers leaned onward the cloud solutions, and as a result of this tendency, 57% of the cloud services were taken up by web-based applications (BDM Publications, 2019).

According to Gartner, By 2018, at least 30 per cent of service-centric companies will move the majority of their ERP applications to the cloud. The concept of a single ERP suite that meets all of an enterprise's needs is dead and replaced by a hybrid ERP approach that combines cloud point solutions with a smaller "core" of on-premises ERP function, such as financials and manufacturings. Gartner predicts that hybrid ERP environments will be the norm within five years. "Longer term, over the next ten years and more, we envision a scenario where more of the market 'flips' to the cloud. Instead of having on-premises core solutions that are complemented by innovation or differentiating processes being supported in the cloud, some organizations will move all their ERP functionality to the cloud," said Nigel Rayner, research vice president at Gartner (Smart ERP Solutions, 2021).

According to data from Aberdeen Group's 2012 ERP Benchmark Survey as of October 2012, most ERP solutions are currently deployed on-premise, as shown in the figure below. The same report indicates, the percentage of the cloud-based ERP programmes is 19%, and on-premise software is 57% in the logistics industry as of October 2012. This fact is unsurprising since SaaS solutions are only now coming to the forefront. For many years, on-premise solutions were the only option. Therefore, it is mostly "younger" implementations that are deployed in this manner. However, today, the gap between on-premise and SaaS solutions is more pronounced in larger organizations (Castellina, 2012).

Figure 58

ERP Deployments, October 2012



Note. From Aberdeen Group

On the other hand, the same report shows that the willingness, particularly in the logistics industry, is vital to move their ERP deployment environment to the cloud by 70% until 2025. This indicator shows how keen the supply chain industry is to keep the innovative and leading role in designing and implementing efficient digital revolutions. The same research also focuses on validating perceptions of the participating entities. The results show that organizations with SaaS ERP achieved ROI more quickly than those with on-premise ERP. Additionally, for those organizations that need to get their ERP up and running as soon as possible, SaaS solutions average 6.95 months from installation to "go live" compared to 11.02 months for on-premise solutions. Also, when it comes to organizations that have limited I.T. resources, ERP solutions that are deployed on the cloud environment delivers smaller I.T. workload in their cost-houses (AberdeenGroup, 2019).

Figure 59

SaaS versus On-Premise Validating Perceptions

Note. From Aberdeen Group

As a supportive case study, in 2012, the Queensland Government commissioned KPMG to estimate the potential cost of establishing new data centres for Noosa Shire Council, de-amalgamating from another council. KPMG's report estimated a total capital expenditure of 5.22 million USD, including data centres, business applications, computers for employees, data and voice services and project transition costs. Fixed assets accounted for $4.04 million of these capital costs. They included $1.36 million in data centre assets, including servers, operating system and virtualisation licences, primary and secondary data centres, disaster recovery systems and backup systems. The report also estimated annual operating expenditures of $3.86 million. In addition, the estimate included management costs of $1.65 million, almost 30 per cent of the total project costs. The council did not follow the on-premise application path. Instead, it bought a SaaS solution for an initial fee of around $1.2 million, with additional annual payments of approximately $1 million. In 2018, the council extended its SaaS contract with the same service provider for another eight years. In addition to saving millions of dollars in I.T. infrastructure and management costs, the council could also deploy the solution quickly. It was implemented in four

months with zero I.T. infrastructure and staff, compared to at least a year for on-premise deployment (TechnologyOne, 2019).

Suppose an organization has high confidence in the capacity of internal I.T. resources and high confidence in its ability to deliver necessary results. In that case, the on-premise cost structure can be expected to save money over the long term compared to the cloud. If, instead, the convenience and flexibility of the cloud are sought, with the extra hand-holding for upgrades and guidance services, and the operating budget can afford an ongoing multi-year cloud subscription, then relying on the external centralized hosted solution could be more attractive. The capital budget would also be less impacted when cloud subscription (expensed) is chosen over on-premise license purchases (capitalized) (Fisher, 2018).

According to the case study research performed on a petroleum company in Greece by three scholars from The University of Aristotle and The University of Thessaly, the total cost of ownership and operating were more affordable when the company switched its ERP deployment environment from on-premise to a SaaS-based cloud product. Overall, an on-premise ERP solution scores 12.913.600 Euros as TOC, whilst a cloud product delivers 5.734.454 Euros for the same concept, which is less than half of its opponent (Bibi, Katsoros, & Bozanis, 2012).

Figure 60

Total Cost of Ownership Comparison

System installation costs	In-house solution	SaaS	IaaS (open source)
Software costs	1,300,000(C_d)	31,200(C_{SaaS_sub})	
Professional services (C_{ps})	234,000	56,160	234,000
Integration (C_{int})	975,000	234,312	975,000
User training (C_{ut})	39,000	10,000	10,000
Hardware-middleware (C_h)	40,000		3,745
Operational expenses (C_o)	490,760	383,000	446,000
Totals	3,078,760	995,472	1,668,745
Annual costs			
Subscription fee	600,000	312,000(C_{SaaS_sub})	3,745
Software maintenance			2,000
Hardware maintenance (C_{a_hmain})	2,000		
Professional support fees (C_{a_ps})			
Customization			
Totals	602,000	312,000	5,745
Operational expenses			
Administrator/IT staff (C_{adm})	483,000	357,000	483,000
Switches, routers, wireless (C_{sec})	2,000	2,000	2,000
Network infrastructure and Internet (C_{ic})		24,000	24,000
Power, electricity (C_{pow})	1,440		
Floor space (for hardware) (C_{floor})	4,320		
Totals	490,760	383,000	446,000
Total cost of ownership			
Up-front expenses (C_u)	3,078,760	995,472	1,668,745
Recurring annual fees (C_{ad})	602,000	312,000	5,745
Operational expenses (C_o)	490,760	383,000	446,000
Total TCO for 1 year	3,078,760	995,472	1,668,745
Total TCO for 5 years	7,449,800	3,775,472	3,475,727
Total TCO for 10 years	12,913,600	7,250,472	5,734,454

Note. From IEEE Software

Most ERP systems cannot handle every granular aspect of an organization. Thus, companies may need to integrate a core ERP system with ancillary systems. This approach is called a best-of-breed strategy. Instead of relying on one platform to supply all the company's needs, a best-of-breed strategy is about evaluating niche systems from multiple vendors. Companies then integrate various applications to create a solution that is right for their operational needs (Panorama Consulting Group, 2021). In this aspect, the cloud and

web-based platforms are reliable and viable alternatives as they supply a vast amount of smooth inter-connection tools to decision-makers.

Cloud implementation costs are usually much less. It is because data systems are preconfigured and require less installation. In addition, service support is included as part of the data system license. Service support requires in-house informational technology (I.T.) and additional consulting, as needed in on-premise ERP decisions. Regarding data security subjects, the security depends on the protocols and protections in place by the developer or I.T. team. Typically, on-premise software is less vulnerable to outside breaches but is more vulnerable to security concerns related to human error. In the cloud option, security depends on the software company's protocols and protections. In addition, cloud software often serves a more extensive client base, which allows for more security infrastructure and may mean a greater risk for cyber-attacks. Finally, On-premise ERP alternatives occasionally offer mobile interfaces and access. This situation will vary by vendor. Cloud options are available on any device with internet access and a web browser (Tribal Leval Institute, 2021). Cloud computing provides virtualization, automated service management and self-service resource allocation techniques to cloud customers. Customers can select a suitable platform according to their specific requirements, so it can be stated that cloud computing may cause an increase in operational efficiency (Yarlıkaş, 2014).

In conclusion, the cloud habitat is the most feasible environment for an ERP designed for maritime, logistics, container trading, freight forwarding companies.

3.2 Database Infrastructure and Main Software Language

KSHAL is structured on the Microsoft SQL Server DB system, a powerful, relational database management system. This DB system is actively used by developers when building up an ERP solution such as ours. A relational database management system (shortly DB) is a common type of database that stores data in tables to be used with the other stored datasets. Most databases used by companies these days are relational databases instead of a flat-file or hierarchical databases. The majority of current IT solutions and programs are based on relational DB platforms. Relational databases have the strength to manage multitudes of data and complex queries. Multiple tables are standard usage for modern databases as we live in the era of big data and deep learning. The information blocks are often kept in several tables, also named ‘relations’. These tables are divided into rows, also called records and columns (fields). There can be hundreds of thousands of rows in a DB. Columns comprise one specific data type, like port name, container type, currency, or price.

MS SQL Server is a scalable, secure and reliable DB option that came forward among its rivals after our AHP analysis. ERP systems used at international maritime companies matter most because a DB can harness large amounts of data as the business grows – up to gigantic weights in size. One of the critical reasons behind DB’s performance is cutting-edge multicore processors, which can efficiently scale with minimal effect on performance. This interprets limitless data management abilities, even as the business grows and makes growing demands of its database. In the SCM industry, the capacity to track historical performance data is invaluable. Microsoft SQL Server’s performance

abilities and scalability mean large amounts of data are forever at users' fingertips and at speeds that ensure steady, predictable performance.

Despite having the capability to add numerous users and accounts, Microsoft SQL Server also provides sensible security measures to restrict access when necessary. Admins can detect and define which users have access and what level of authorization they are allowed to modify and view different data. User access features can be customized with specific views of the data reflecting that individual user aims to access it. Assembling security with endurance is a stamp of authentication of SQL Server, with imposing uptime abilities to put end-user's minds at ease that access is preserved even in the event of a system outage. If a crash or other outage happens, SQL Server has auto-recovery features that go into effect instantly, without the demand for an administrator to intervene. SQL Server will automatically deploy database restoration to the last state of consistency. If the point of having a DB is to create on-demand access to large quantities of data, this reliability is our golden key.

Today, neither software developing teams nor ERP users are in one place. SQL Server combines expressive reliability with the capability to extract data when and where demanded, with onboard reporting tools available on the Azure VPS platform that support the creation of charts and graphics for rich, valuable apps. In addition, the data can easily be moved into different forms allowing developers to quickly compile necessary data points into formats suitable for sharing with clients and other team members. With 24/7 access, interactive reporting skills and instant DB recovery in the moment of an outage, developers can put their minds at ease and count on SQL Server to take the guesswork out of database operations.

On the whole, MS SQL Server DB is the core of the KSHAL thanks to the following features;

1. Simple installation
2. Optimized data accuracy
3. User-friendly management tools
4. Solid security and versatility
5. Economical DB option for small up to medium-sized shipping companies
6. One platform for DB, code (C#) and tools.
7. A vast variety of scheduled tasks such as Job Scheduler, Query Analyzer
8. Useful tools such as reporting services, integration services and profiler
9. Microsoft's industry-standard high-quality support and documentation
10. Quick response and adaptation on SSIS, SSRS and SSAS requirements.

According to Wikipedia, there are nearly 700 different programming languages and ref some other indexes there are nearly 9000 (Fowler, 2020). Each has its field of service and syntax. Any coding language closer to machine language that commands the transistors embedded into the processors is classified as low-level language. Since coding languages are an in-between for human and computer languages, they interpret the computer’s native language of binary, which works with 1s and 0s. Some languages are high-level, which means they are easier to use but are less detailed such as HTML and, arguably, Phyton. Some are low level, which is harder to use but offer more control over the computer such as Assembly and C. Since the concept of this research is entitled to propose a web-based ERP alternative for maritime logistics companies, the purpose, varieties, fields of usage, advantages and disadvantages of these programming

languages will not be reviewed in-depth to keep the paper inclined to the international trade and logistics department more than the computer engineering division. It must be well explained why a particular coding language is used for developing KSHAL but not the other one with all aspects.

KSHAL was developed by C# coding language. It is an object-oriented, mid-level programming language invented by Anders Hejlsberg in response to its rival Java for Microsoft back in 2000. C# is a multipurpose, multiparadigm coding language that can be considered a hybrid of C++ and Java. However, it is owned and strongly supported by Microsoft, and it works in harmony with other MS products, such as the MS SQL Server DB management system. It is advantageous to construct software that digitally breathes in an environment where other tools such as DB, development kits, and hosting services collaborate synergically. From a neutral point of view, its cross-platform capability is one of the advantages of C#. It can be used by any device as long as .NET infrastructure is installed. C# has another significant advantage of a strong memory backup. There would be no problem with the memory leak and other such issues in the C# as it happens in C++. In this case, C# has a prominent edge over all other languages.

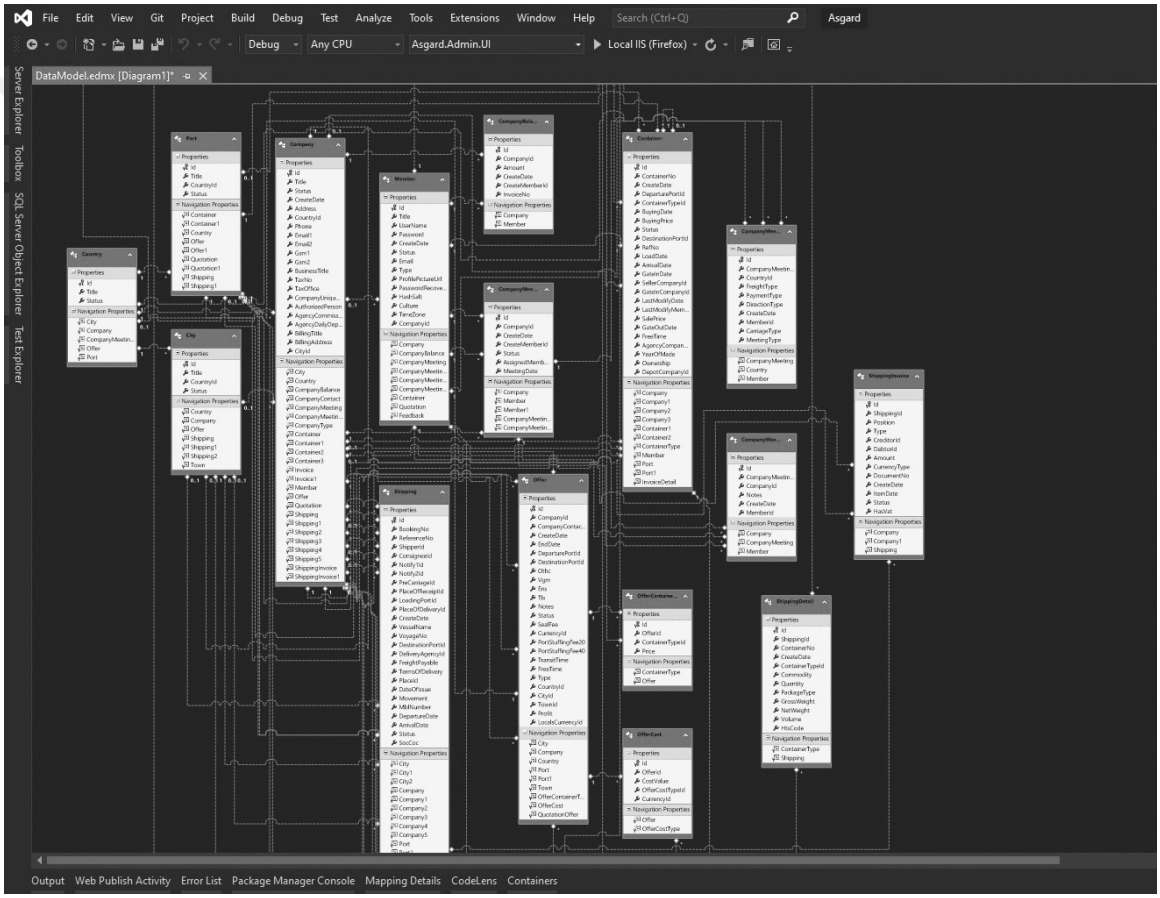
KSHAL, in a nutshell, is being coded by C# on Visual Studio; it is using MS SQL Server as DB and gets hosted by Microsoft's Azure VPS service. In addition, it runs on .Net and includes ASP at the front-end of the program. So, it is possible to name KSHAL as a compilation and a result of the Microsoft stack software.

The data model has been built by establishing relations between tables representing parameters that are used on KSHAL. It all starts with countries. When

cargo is shipped, it may be shipped to a city that is registered under the country. Customers, warehouse locations, ports are also directly associated with the country cluster.

Figure 61

Data Model of KSHAL



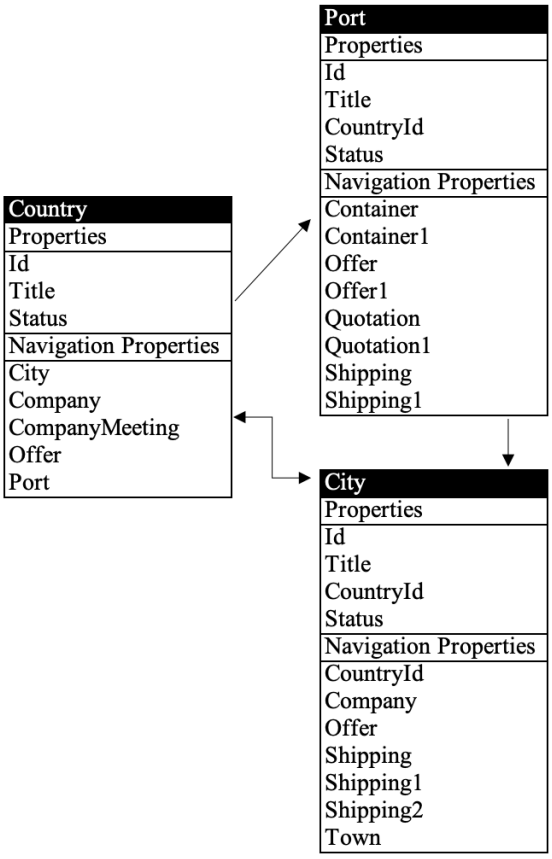
As shown above, KSHAL's data model was constructed by parametric containers such as; countries, cities, ports, companies, members (users), shipping modulation, quotation modulation, container modulation, CRM modulation, reports, feedback modulation. All these modules (also named as data containers) are interlinked and related to each other. The relational connection links are visually shown on the IDE, making the

whole flow easier to administrate. Although the data model map looks complicated, it has a lean design when it comes to processing information through those tables and columns.

If a new company (a customer, an agent, or a vendor) gets registered into KSHAL, the registration step starts by submitting information about the company's country of origin.

Figure 62

Data Tables Relation Model Detail



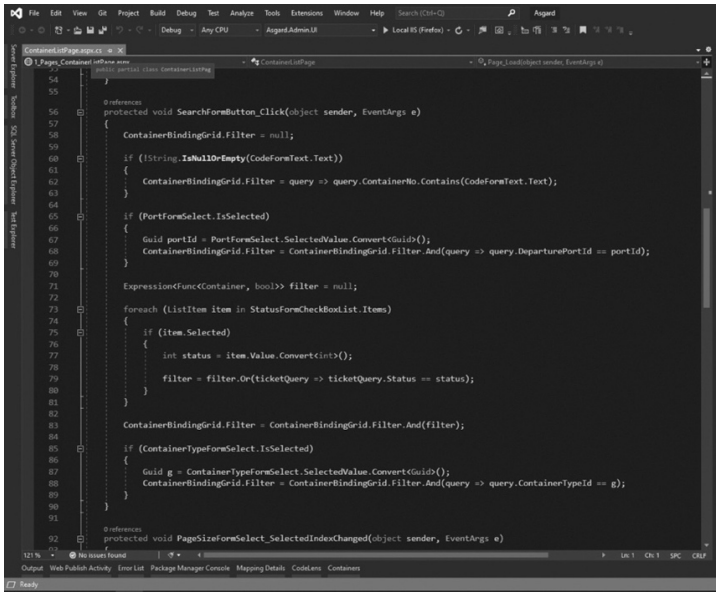
The properties section defines how to identify relevant data in the model. These items are restricted to end-user's navigation. Navigation Properties show us the clear connection of each data node with the logical parent, such as the "CompanyMeeting" node related to the City table since the meetings occur at the customer's premises. Ports are

related to cities as well as offers, shipping modules number 1,2 and 3. All the tables which are directly linked (associated) work in the hierarchy. There is no way of thinking of a city without getting that data related to a country table. Just like in physical life, a city can not exist without a country. A port can not be located where it is not classified as a legitimate location, such as a town of a city or a city of a country. By this expression, we can interpret this workflow as programs that imitate the life we all live in. KSHAL is a practical simulation of what we do during routine shipping operations in our daily life. It deliberately aims to simplify logistics operations by its database model, screens and menu structure.

C# collaborates efficiently with MS SQL Server DB management system as both belong to Microsoft's development environment called Azure. As a result, they pair and interoperate seamlessly.

Figure 63

Container Repository Coding Screen

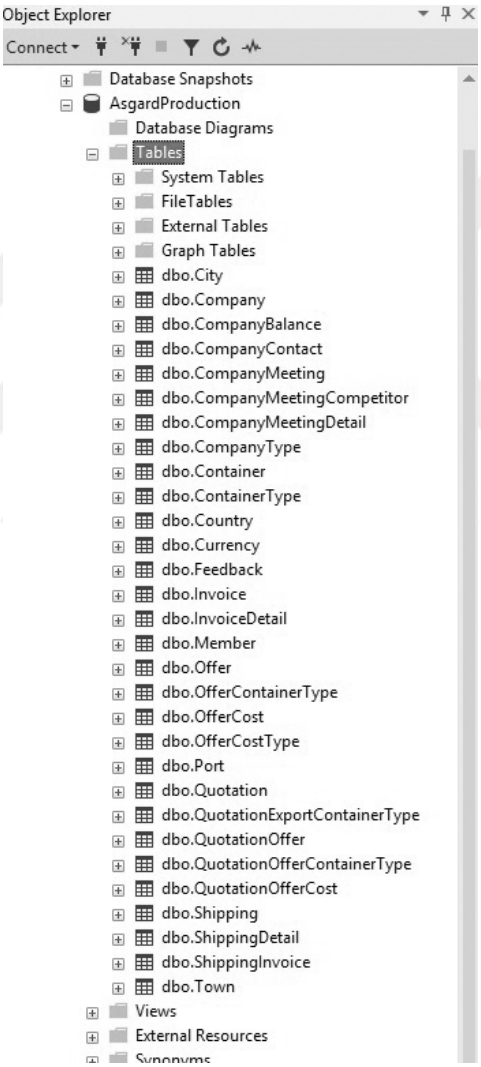


This intention of keeping the coding language and DB structure within the same supplier increase coupling and defeat the purpose of abstraction. Anyhow it is necessary to

build up tables accurately to put out a solid, reliable ERP solution. In this respect, it is a challenge to keep a lean design with robust data handling capabilities.

Figure 64

Table Sctructure of KSHAL

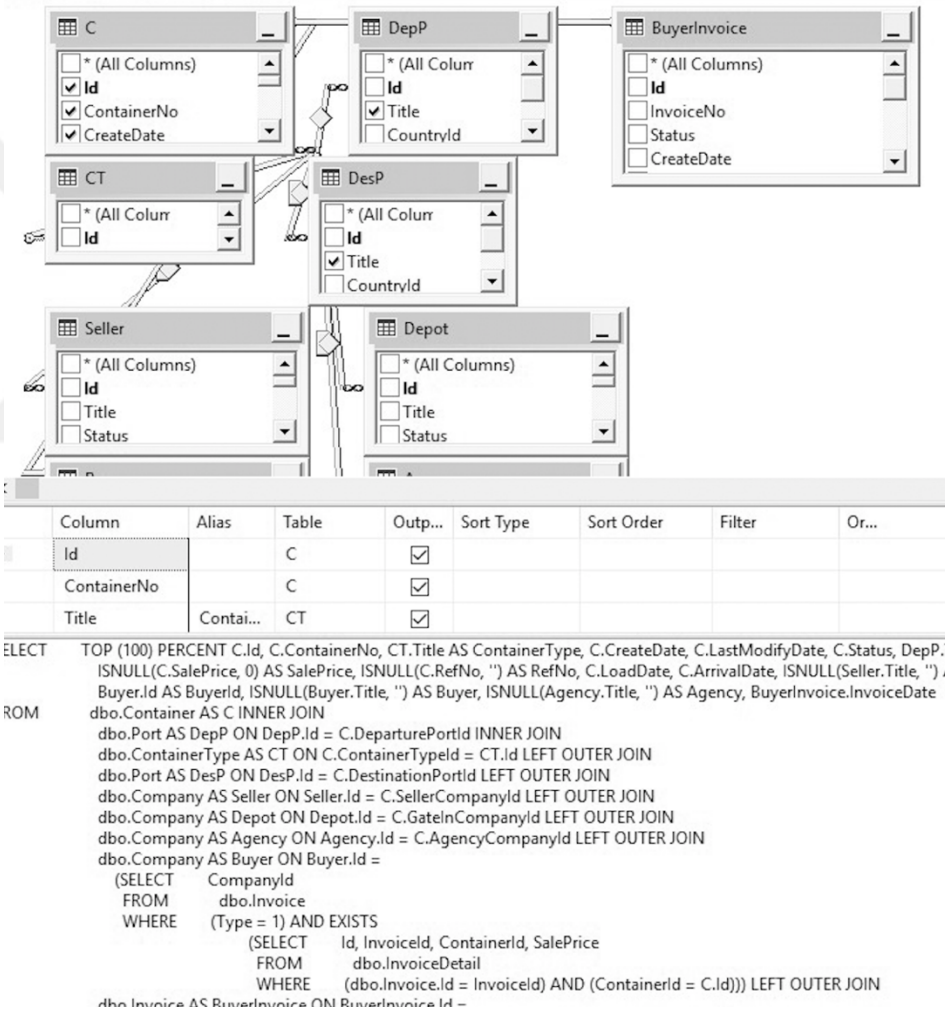


At this stage, a table structure was built for all the activities taking place on KSHAL. Tables are simple gateways between the front-end and database. When a user access KSHAL and submit a container for selling, buying, or shipping purposes, there is an associated table to handle this query and address it to the right 'stack' in the database. We

have the number of tables increasing as the program grows. Each new module is represented by a table and inter-related to other tables thanks to connections built at the back-end.

Figure 65

Table Connection Map



We require vendor invoices (BuyerInvoice) related to container depots and the vendor's company card (Seller) to create work automation. Once a KSHAL user purchases a container from a vendor, the type and quantity of the container(s), buying price and pre-defined selling price information are automatically created in related stacks through tables.

The cost is marked as an 'expected charge' until the vendor's invoice reaches the KSHAL user company (the buyer in this example) and is submitted into the system. Once the buying invoice (vendor's invoice) is submitted into KSHAL, its status change from an expected charge into realized charge. These two are different stages of container trade and shipping operations. From time to time, it is observed that there are differences between the expected cost and the invoiced amount. To create accurate profit/loss reports, these figures must be assigned to different tables. It is also possible to indicate that the roles of KSHAL users change based on how they operate in their transportation jobs. While purchasing a container, the user is a customer from the container vendor point of view. The program must respond to those profile shifting operations. While selling the same container to final customers, the same KSHAL user turns into a seller. How and when is this paradigm shift in the software? How shall we differ in those roles?

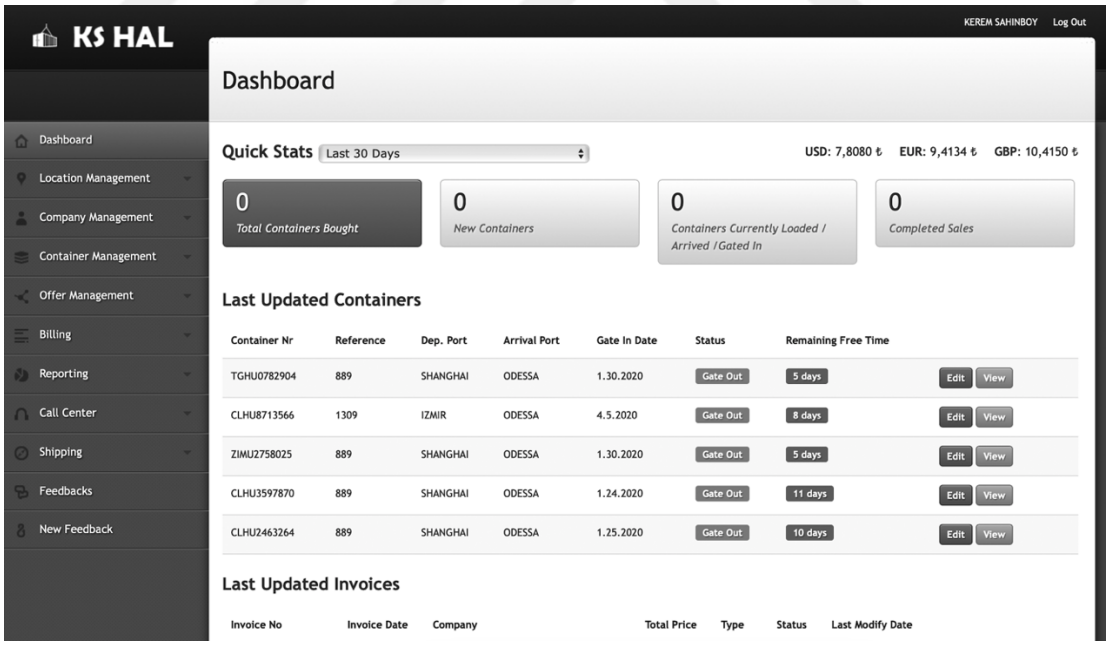
In summary, the DB structure of KSHAL is a map of relations between tables linked to each other based on real-life operational tasks. All those table infrastructure functions with the same logic which humans work in the shipping industry. The reasoning behind the table relations is not different than shipping a container from one marine port to another or buying and selling a 40 feet high-cube container anywhere in the world. The importance of the database infrastructure and the coding language come forward when we work with a lightweight, web-based ERP alternative for accomplishing our critical tasks. This synergic collaboration between C# and MS SQL Server DB becomes evident when users realize that the tasks and queries are handled via KSHAL without conflicts, thanks to a pre-defined table structure that prevents superpositions. It is another proof that successful coding begins with building up a lean, understandable, and reliable database.

3.3 User Experience Designing Steps

User experience (UX) encompasses all aspects of the end-user interaction with the company, its services, and its products (Norman, 2021). In the IT industry, particularly while developing an ERP for the maritime industry, UX design is the process that developers apply to create software solutions that deliver meaningful and performance-boosting features to users. This process includes the design of the entire workflow, screens, and program menus while simultaneously considering aspects of branding, usability, functionality and simplicity.

Figure 66

KSHAL Dashbord

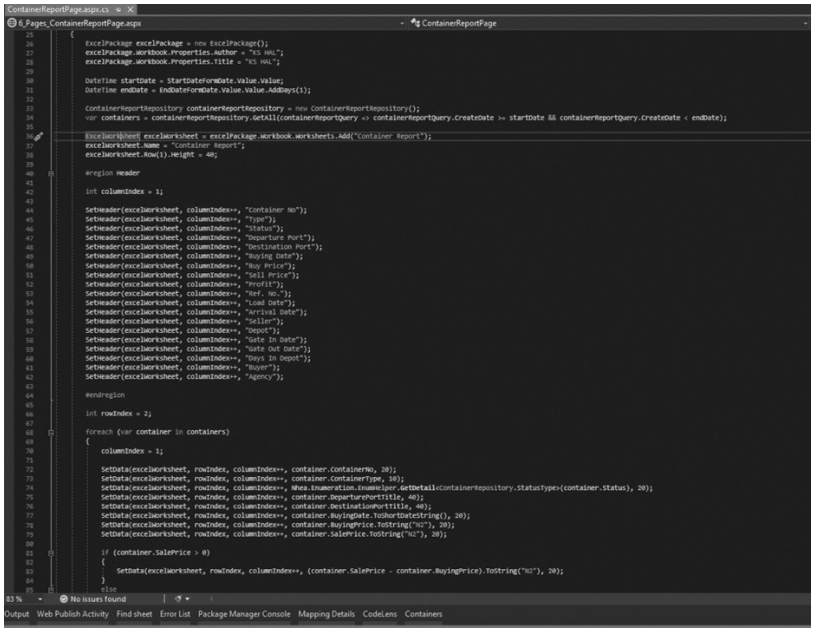


One of the obstacles in software development projects for the SCM industry is the complexity of customers' demands. Until the last decade, the customers tended to demand software as complex as possible. A lack of know-how heavily led to this behaviour. On the one hand, the customer should not have deep knowledge of the software development

process. On the other hand, the customer should employ I.T. consultants full time or outsource them who may dulcify the client's extraordinary, unfeasible requests. We have observed several worthwhile projects left on the shelf without realization due to excessive and undoable demands of buyers when it comes down to the ERP development side. This behaviour has been changed during the last decade thanks to a certain amount of projects that have been built and put into use by transportation and logistics companies in Turkey. SCM companies acknowledged the powerful effects of simplicity and feasibility. Complicated software screens no longer represent robustness. "Take what you need" became a common slogan for both software developers and software buyers from the logistics sphere. UX became a priority before doability.

Figure 67

Container Sales Module Codes Screen



Today, SCM companies know that if they simplify what they need, they will be more likely to get this project fit into their budget. Also, maritime companies become

experienced in scaling their software requirements and separating them into different phases. Industry actors have learned the answer of "Any reasonable demand can be coded but at what cost?" and shifted their approach to scale their requirements from top necessary software requirements to least essential details. In this respect, more ERP projects could be designed and supplied to maritime companies. Turkish logistic industry could not imagine a transport company would hire over a hundred people recruited to develop ERP systems in-house. Ekol, as one of the biggest supply chain companies of Turkey and Europe, has nearly a hundred I.T. specialists, software engineers, data analysts programming digital solutions for their customers (Şahinboy, p. 2018). Increased level of common experience carried the quality of results upwards. At this stage, it is possible to observe that UX became a priority than feasibility since there are few to none unfeasible demands coming from customers to software developers. As we have solved what should be done and what should not, the user experience card became the wildcard during the competition.

While building up an ERP for the shipping industry, a lean user experience powered by a simple design can assist customers in reaching up to their goals more effectively than the opposite ones who have complex screenflow and difficult navigation. The word of simplicity does not represent the primitiveness of the ERP solutions, but on the contrary, it is a difficult task to achieve. It requires deep know-how in supply chain management and software development to offer a platform that handles heavy duties with a lean design.

From another point of view, UX is more than being a guideline for a sleek design. It defines how the software creators approach the fundamental human needs in certain cornerstones of their daily, routine jobs such as responsiveness of the program, streamlining of the business processes even increasing their motivation levels. *User*

experience is the feeling that the users of the program rank. It is a gateway between clients to code while interpreting their commercial requirements. UX, from another angle, is the name of the journey that never ends; it is not a process with a final station. UX is a perception of CALs, buyers, partners, associates, developers, all third parties involved in creating software. Software is a living organism that survives in its digital habitat and continuously evolves. UX is the DNA code of this lyrical construction, more or less as the soul of the whole project.

Despite the common perceptions, UX should be created by experts from the league for which the ERP is being designed. UX should not be left in the hands of software developers alone. We applied this rule while building KSHAL. KSHAL's UX was designed by focusing on simplicity that led the project into a clean and sleek design with a powerful back-end interaction with the purposeful front-end built. While contriving this structure, the main guideline and direction assigned by some questions also proceed parallelly with the hypothesis questions of this paper. These questions, which we have asked to find the right track while building a brand new software for freight forwarders, container merchants for their operational tasks, were as follows;

1. **Who will be our target consumer group?**
    - Small and medium-sized freight forwarders
    - Container merchants which trade brand new and 2nd hand equipment
    - Container depots that store stocks for short or long terms
    - Maritime companies which have active sales and marketing teams
2. **Who will use the program particularly working at these consumer groups?**
    - Shipping operators while routing their loading orders

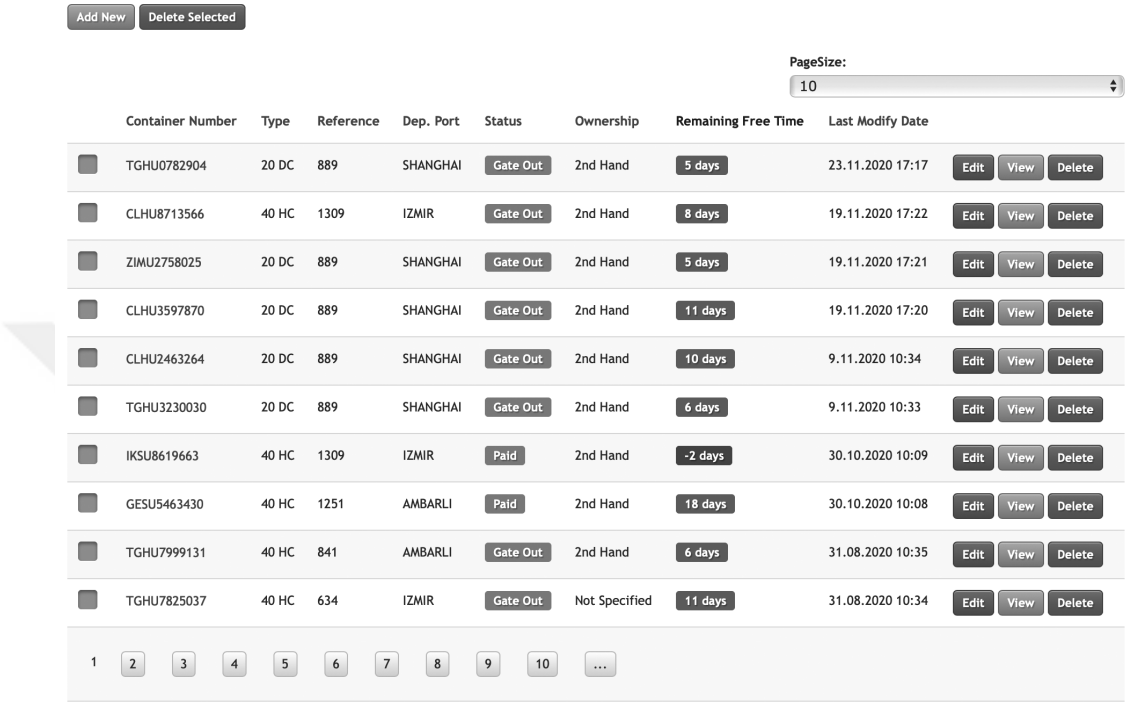
- Freight selling teams while sending and receiving price quotations
- Marketing teams while submitting their visit reports
- Bookkeepers while issuing invoices and registring them to accounting
- Container merchants while buying and selling their equipment
- Container depot officers while calculating storage dates and expenses
- Abroad agents for shipping and container selling activities.

3. **What will KSHAL revolutionize and be impactful in terms of operations?**
    - It must create automation with human interactivity in container sales as no other software alternatives do.
    - It must work faster and more simply while managing shipping data in operational screens.
    - It must make B/L submitting easier than existing ERP alternatives
    - It must be sold cheaper than its rivals without compromising the robustness

The three questions that have been asked are constructed in harmony with this dissertation's primary approach, which is also built by the research questions. While we develop a shipping industry program, we simultaneously seek answers for our research topic. Since we have analyzed the alternatives and decided on which DB management system, coding language to use for KSHAL, it was necessary to merge these technical aspects with practical applications and needs, which have become borderlines of our UX designing process. UX of KSHAL is the purified expression of converting particular know-how into codes. No software engineer may know container shipping better than an expert experienced in this field. So, we may acknowledge that KSHAL is the first and only ERP platform designed by shipping and maritime experts in Turkey.

Figure 68

Container Management Module



Once we defined the mainframe of UX for KSHAL, we have moved into breakdowns for minor details such as customer type prioritization. There are many fields in the maritime, shipping, transportation industries. A trucking company that works as a haulier, a freight forward company that has no vehicles, a trucking company that works as both a haulier for full truckloads and a consolidator of less than truckloads, a shipping company that deals with breakbulk shipments in specific geographies, a container merchant that sells or leases certain types of equipment for several purposes, a maritime logistics company that solely ships export and import full container loads (FCL), a transport company that offers multimodal transportation services or a company that offers all services mentioned above or more could be taken into our target consumer group. In order to make the KSHAL project feasible and realistic, we narrowed the target audience down

to a few precise segments and activity areas. In this way, we achieved to keep the program's simplicity and increased its depth in serving fields.

25% of users leave after four seconds if a page doesn't load (Coulter, 2021). In monetary terms, this means losing a quarter of our potential customers. The design must be efficient, so we prioritized speed and simplicity above the spectacular. The keyword here is *balance*. KSHAL's visual design, which is a part of UX, should look attractive and eye-catching, but not to the extent that it creates problems for the user. Customer loyalty becomes persistent once the speed and accuracy of the ERP are ensured.

The UX of KSHAL was designed as a human-oriented platform that solves the problems of industry members. Complicated application steps of programs, mixed up design with overloaded screens cause negative response at the end customer's side. Simplicity is a challenging goal while designing software that will serve freight forwarders and SCM experts. KSHAL's simple design is powered by stalwart know-how and software engineering. While its rival ERP alternatives complete specific tasks in a more considerable number of steps, KSHAL's design features realized the same tasks: the bill of lading creation, invoicing, freight quotations (cost) registry price offer sending in fewer steps.

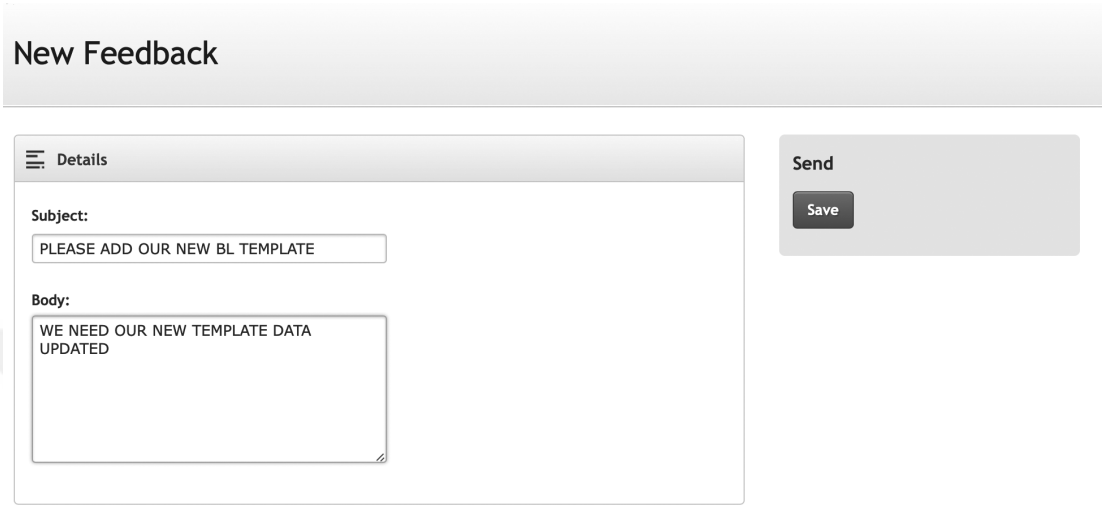
Deploying programs much earlier than the project deadline is called crunching or crunch mode in the IT world. Crunching is one of the biggest managerial mistakes while developing software. Programmers are stressed out to work in intensive schedules, which leads the whole project into premature deployment full of flaws. We have avoided releasing the program with errors while designing the UX of KSHAL, thanks to our CPM/PERT project applications. KSHAL project from start to end went completely free of crunching mode. The final product must be intact, and UX must rule that intacticity at the beginning

is typical behaviour of suppliers of programs. End-users must not experience a program that is full of errors, crashes and incompetences. Our attitude towards our future potential customers began from our UX design principles. In specific experiences in our industry, ERP alternatives usually carry several errors when they are sold. It is surprisingly a tolerated occurrence by both suppliers and buyers. If an aircraft can not be set for flight without fulfilling all necessary quality checks in the same way, an ERP must not be sold as a ready-product to end customers. As we have mentioned in a few sentences above, UX is not just a product design. However, it is a unique, tailor-made invention of the whole journey that also includes respect to the nature of the business and target customers. Every single screen, all the corners, sections, menus, database connections were tested by our team quadruple times before deploying KSHAL. From this perspective, we may state that the UX of KSHAL is one of the driving forces of its excellence.

Another UX feature of KSHAL is the top-notch importance paid to customer interactivity through the platform. Customer feedback, questions, requirements, demands are empowering elements of a successful design. Once the software is sold to several customers located in different countries, these elements must be handled by technological standards through the program systematically. Any CAL may have a sudden requirement that needs to be replied, immediately. KSHAL has a feedback module in which customers may submit their questions, demands without leaving the program. Once the feedback is submitted, KSHAL provides a ticket number for an easy follow-up. This topic will be discussed in detail in section 3.11 at later stages. The existence of the protocol between KSHAL and customers is proof that our UX placed the customer's satisfaction in the centre of the project.

Figure 69

Feedback Submitting Tab



Customer fidelity brings sustainable profits, and that makes KSHAL a progressive ERP alternative for transport companies. In order to gain customer fidelity, KSHAL UX was designed for further projections. One of those projections is the SaaG system that classifies KSHAL as a pioneering product of its kind. SaaG (Software as a Gateway) is a technique of promotion that renovates conventional sales methods. In the following stages, KSHAL will not be sold for money. It will be provided to customers based on our data processing and handling contracts, allowing us to analyze their corporate data with the support of artificial intelligence and deep learning algorithms. No monetary exchange will be required to 'purchase the program". KSHAL will process the data handled through its servers and provide proscribing solutions to customers on demand. If any customer asks for these additional services that can be named consultancy, they will remit for what they order from KSHAL. In another saying, KSHAL shall provide prevention tools based on customer data by processing their activity flow. As in contemporary medicine nowadays, a sickness may be prevented before it occurs by prescribing the right medical solutions to

patients. In order to find out the possibility of this sickness, the medical entity must have the codes of a whole gene pool of the patients. The same mentality is viable in the software industry of the near future. Hopefully, KSHAL will be one of the first ERP platforms in the shipping industry that is sold at no cost to customers. In the SaaG system, conventional software sales is not an income source of the supplier. However, it is an obstacle to gaining access to more comprehensive, more profound and richer data sources. We need to have adequate data to define the problems accurately and create suggestive tools for avoiding problems before they occur. We will witness a radical paradigm shift. So, a software supplier will become a data farmer that harvests the crop and add value to it for the benefit of the end-user and itself. The orthodox paradigm will be shifted into a direction where software companies act as consultants on demand. This approach is also embedded into the kernel of KSHAL's UX from the beginning. This subject will be re-discussed in section 3.12 with details.

Without getting far from the technical context, the UX of KSHAL also represents the usability patterns. *Usability* is the concept used to define whether the software is easy to use and how rapidly essential tasks can be practised. We defined five critical factors of usability for KSHAL as ;

- **Efficiency**: The degree of measurable increase of productivity once customers start using KSHAL as their primary operational ERP system. Efficiency criteria represent both the result and also the goal of the program. It is one of the reasons why KSHAL exists. Thanks to this fact, it is also the key factor of its signature UX design.

- **Learnability**: How simple and fast KSHAL can be learned by an average user? Once it took part in our UX design, DEA applications were also measured in section 4.4.
- **Memorability**: How customizable KSHAL is, and how fast end-users adjust the program into their routine tasks? Memorability is the fuel of the leverage effect of ERP systems. A successful ERP solution must be easy to customize, and all navigation features have to be effortlessly, straightforwardly memorable.
- **Error Evaluation & Handling**: How fast does KSHAL cover user-related mistakes without risking the operations? How simple is it to reach developers without leaving the platform? How responsive may the KSHAL structure ever get? These questions are taken into consideration while creating a user experience design for KSHAL.
- **Contentment**: What makes our users happy? At the end of the day, this is the ultimate question that must be answered to create a game changer software solution for the maritime industry. KSHAL's user experience design with all its aspects has been built for answering this crucial question.

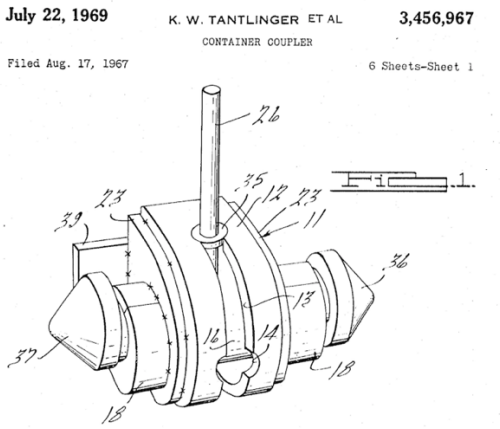
KSHAL is a software alternative for the freight industry with a simple, effective, reliable and robust UX design that acts as a bridge between practical maritime business know-how and software development divisions.

3.4 Container Management Module

The first shipping container was invented and patented by Malcom McLean in 1956 (PS Logistics, 2020). Since then, containers became a vital part of international transportation. Shipping containers are strong, stackable, affordable to acquire, safe, theft-free and easy to transfer from one location to another. The success of shipping containers was coming from their simplicity and durability. This invention was followed by the patent application of twist locks that stabilizes and interlocks the containers when they are in a stack. Keith W Tatlinger and Adrian F Hulverson's application through Freuhauf Corp was patented in 1967 in the USA. This invention accelerated the boom of shipping containers taking over the maritime logistic industry (Wikipedia, 2015). A metal box with twist locks became the main source of influence that shaped the contemporary maritime markets which we know as the container shipping business, nowadays.

Figure 70

Tatlinger's Patent Application



Note. From https://patents.google.com/patent/US3456967A/

Shipping containers set the maritime business more practical than carrying commodities in wooden crates on general cargo vessels. Before shipping containers were

invented, sea freight levels were much higher per cubic meters or tonne due to the ineffective use of space on general cargo vessels. Thanks to their feasible design, shipping containers cut space losses down to a minimum and increased business possibilities.

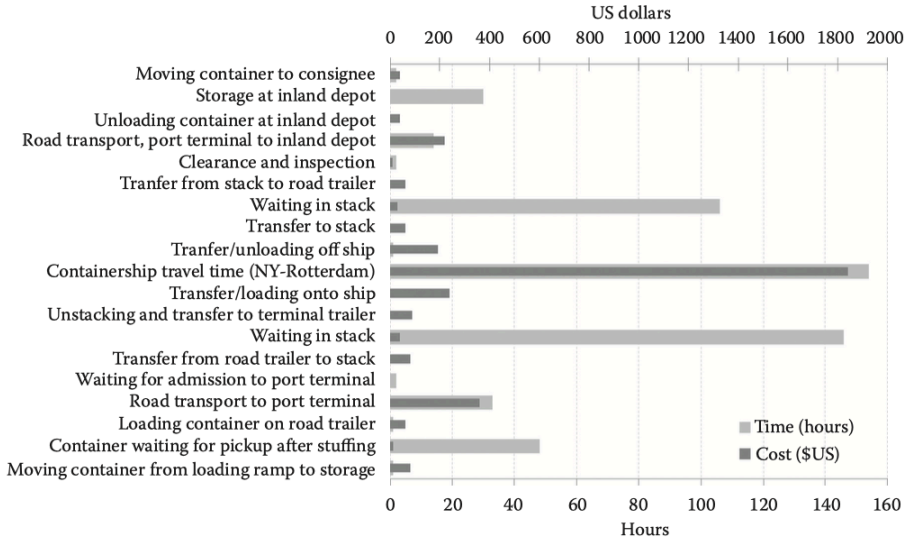
In the beginning, there were just two types of containers that had been put into service as 20 Feet Dry Van Container (20"DC or 20"DV) and 40 Feet Dry Van Container (40"DC or 40"DV). TEU representing twenty feet equivalent unit in the maritime business, became a measurement unit for space or freight calculations. As shipping containers became popular and the containerization era blossomed worldwide, the type of shipping containers has increased without compromising their interlocking features. So, all types of containers, disregarding the shape and purpose, are suitable for safely stacked one on top of the other and interlocked by their corner points. This simplicity and feasibility also became one of the driving forces of multimodal and intermodal transportation fields. Any container can be shipped port to port, transferred on rail cars, stored on almost any harsh climate conditions, carried on truck chassis and even floats in the sea.

The invention of shipping containers has improved the efficiency of the maritime industry and revolutionized the scope of international trade by increasing the number of trade hubs. With the help of constructively designed shipping containers, the size of vessels gone larger to carry more shipments at once. As of 2021, the biggest container vessel's size became nearly half a kilometer (399.9 meters) and its capacity reached up to 24000 TEUs (Marine Insight, 2020). Hyundai Merchant Marine's M/V HMM Algeciras is the largest container vessel to date in the world. Comparing to M/V Ideal X which was sailed from Newark Port to Houston in 1956 by carrying just 58 containers, the size of the change is literally immense (Thompson, 2018).

Shipyards evolved, ports were reconstructed to fit into the containerization era, and distribution channels have been re-designed to fulfil their new roles. In this respect, containers can be classified as real game-changers in the maritime business. In the later stages of this development process, all the industries have taken part in this transition and designed the container type they will use. During this development process, container movements had also been upgraded by variations of steps and services.

Figure 71

Container Operation Steps (Time/Cost)



Note. From J.Paul Rodrigue, 'Global Studies' Hofstra Univ. 2012

All of the service mentioned above steps became routine operational stations through container shipping and handling procedures. In addition to this, the market has been enriched and expanded by expert companies specialising in each of these operations. For example, nowadays, we have expert companies that are solely providing container fumigation and clearance services. There are tally companies that are monitoring container movements in and out of boards for their customers. Today there are tank containers for

shipping liquid goods of food and chemical industries. There are platform containers and open-top containers to ship oversized, out of gauge goods. There are heat-controlled, refrigerated containers for all kinds of cold-chain distribution channels. We have hanging garment containers, car carrier containers, top-loading barley containers, livestock containers, drum containers, half neck containers for carrying minerals and forestry products. Shipping containers meant more than a paradigm change in the maritime business through transportation, but it has socio-economically changed the whole business concept.

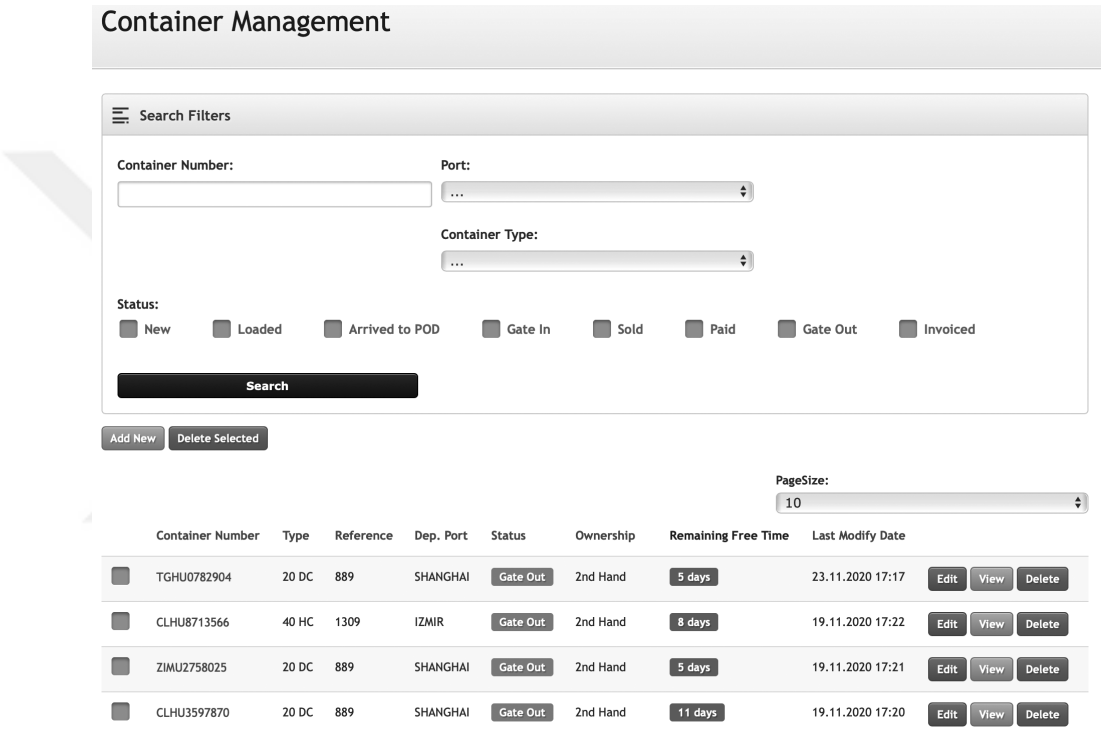
There are new jobs sparkled that followed the footsteps of the container shipping industry. Container-producing factories, container repair and modification yards, container depots, container merchants which buy and sell used or brand new units appeared at the stage of the international transportation world. As of 2021, there are over 38.5 million TEUs of shipping containers in service, 23.3 million TEUs ex-service but in commercial circulation and 10 million TEUs produced but not set in use yet, worldwide (Budget Shipping Containers, 2020). As of November 2020 nearly 15 million TEUs being shipped monthly (Container Statistics Worldwide, 2020). International Standardization Organization (ISO), has regulated the identification method of freight containers with their ISO-6346 rule in 1968 and this method is in use since then. Containers are identified with a combination of four letters and seven digits and this combination is shown on a minimum of three sides of them.

The container management module (CMM) is the flagship of KSHAL. It is used for buying and selling all types of used or brand new containers, setting them for lease, calculating profits/losses, warehousing expenses, agency fees, demurrage incomes and

costs and tracking all sorts of demographic and operational information correlated to containers in the inventory list.

Figure 72

Container Management Module Dash Screen



CMM was designed for merchants, dealers, forwarders, exporters and importers to provide automation in container procurement and selling activities. It is a unique tool that utilizes some problematic processes to manage in the past, such as container tracking, storage and demurrage calculations in the container trading business. When the number of containers in stocks reaches up to hundreds of units and circulates between tens of different depots, these tasks may become troubling responsibilities. In our UX, KSHAL positions the container merchant in the centre of the operations. The container merchant is a deal that buys containers from several vendors and sells or leases the containers to customers. We have multiple warehouses in a country of origin where the container dealer is situated. The

container merchants buy containers from their vendors right at these spots. The common practice in the container-buying and selling business is that all actors use similar container depots that they have contracts with. Another point of buying or selling is container yards. These units (containers) can be sold through these warehouses.

The container merchant's business gets triggered by contacting a vendor and registering it into the KSHAL system after they agree on mutual commercial particulars. Our relational database structure provides a stepwise flow by opening a company card in the company management module (CML). KSHAL defines roles for each inscribed entity as shown in the below table.

Table 92

Roles of Inscribed Companies in KSHAL

Container Seller	Our vendors which sells us containers
Agency	Our agency abroad which cooperate with us
Depot	Container depot we use to store our equipment
Container Buyer	Our client which purchases or leases containers from us
Shipping Line	Container carrier or NVOCC
Customer	Any client except container buyers
Trucker	Company which hauls containers for us

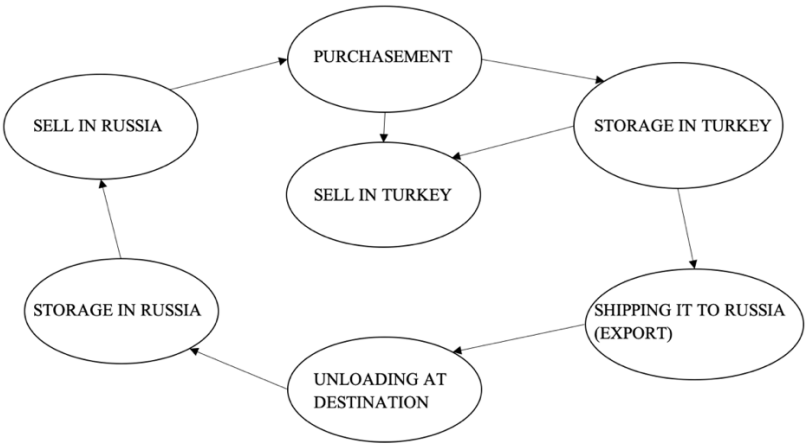
These roles were designed parametrically and can be customized based on the user company's requirements. These roles can be modified, decreased, or increased by adding differentiated identifications. KSHAL is capable of handling new roles without compromising its operational structure. For example, a container seller (CS) is our vendor and a trucker, a depot, and an agency. We purchase their products or services. Specific experiences have shown that a company can become both a seller and a buyer simultaneously. For instance, an agent or a trucker may/can purchase a container from

us, or a shipping line we use to ship our containers may lease our units. KSHAL is also capable of assigning multiple roles to the same entities in cross-functional commercial activities.

Just like all other SCM operations, container dealership functions in loops. Traders buy a container, store it at a warehouse, ship it, store the empty container at the destination warehouse, and sell it. Anyhow, this cycle is not the only scenario that KSHAL is capable of managing and responding to. Containers can be bought at the port of destination and stored there; they can be sold right at the same spot without shipping elsewhere or sold at any interlinked station of the loop, which is shown below.

Figure 73

Container Trade Loop



These containers can be both as customs cleared equipment or units in international circulation. According to Turkish Customs Law, no container can be used permanently without properly customs cleared and imported. Freight containers are permitted to stay in the country for six months. This date can be extended in case of further applications. Before the deadline, container(s) must be shipped abroad. According to our diagram, containers

can be sold simultaneously they are purchased from our vendors. In this case, we act as an intermediary company without storing the units. Also, containers can be purchased and stored at a depot which we control. In this case, we, as container merchants, must bear storage expenses. These units can be sold in Turkey right from our warehouse. According to Turkish Customs Law article number 4458, 3930 and 5108 second-hand containers can be imported with zero customs tax, just by paying 18% VAT and customs brokerage fees (Gümrükler Genel Müdürlüğü, 2019). Briefly, we may perform domestic commercial activities within our circles and KSHAL is able to handle these operations flawlessly.

In addition to our case scenario, containers might be sold to international customers. For delivering these containers to clients, equipment must be shipped abroad on board. Container dealers face hardships while trying to find economical ways of shipping equipment to international customers. No containers can be shipped as empty, considering the profit margins per container are low. If the equipment is shipped as empty, origin port terminal handling charges (OTHC), sea freight, destination port terminal handling charges (DTHC) and inland haulage of containers from port to destination depot create a noticeable loss on the seller's account. In this case, it is a beneficial decision of container merchants to act as freight forwarders. This allows them to position their fleet of containers for their cargo and ship them to whichever destination they think they will have potential customers. With this method, they will be saving themselves from all transportation-related expenses which were listed above. These fees will be billed to the exporter or the importer of cargo shipped in these containers that will be sold at the port of destination once they are emptied and returned to depots. This operation turns container merchants into non-vessel owner

common carriers (NVOCC) if they build up certain routes and promote their shipping services under their bill of ladings.

The variations of a simple task such as buying and selling containers might turn into a complicated series of events. In addition to the above, container lines have different policies towards such attempts when freight forwarders want to ship their equipment. Particularly in Blacksea, Aegean, and Mediterranean markets that are classified as short sea markets, which are small economical zones where the competition is tight, shipping lines tend to classify NVOCCs as direct competitors and apply additional fees when they attempt to ship their containers, such as Shipper's Own Container Surcharge (SOC Surcharge). Furthermore, shipping lines have a substantial income flow from demurrage expenses that occur when the containers are used longer than the free times shown of the bill of ladings at the destination port.

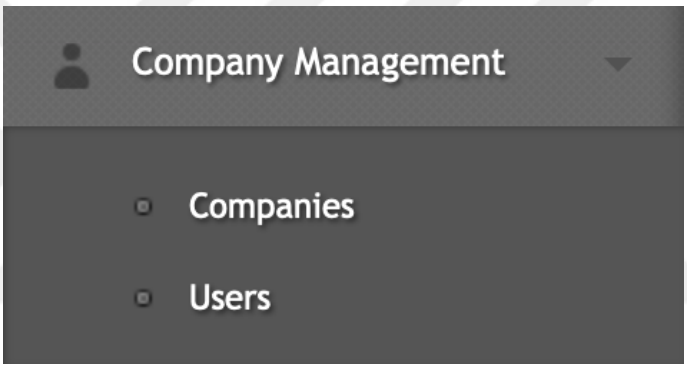
Demurrage income is the profit out of thin air. When SOC equipment is used, the container line has to sacrifice from this opportunity. The reason for explaining these variants or probabilities to such a detailed extent is to show how KSHAL can handle all these complex operational occurrences. There is no single type of container dealership on the scene, and due to this fact, there can not be a single type of ERP that handles such operations. Anyhow, KSHAL is the only ERP solution in the market that container merchants designed. Therefore it is one of the most comprehensive digital tools in the maritime industry, connecting CS with its international business partners in the same operational environment.

It was indicated before; all operations begin with opening a company card in KSHAL and submitting new company's particulars to the system. The company

management module is the common place where we record and keep company details of parties of all roles. Therefore, it is revisited often by all users from the operations department to sales personnel. Company card submission must be valuable and straightforward to prevent users from recording this information elsewhere, such as notebooks, local computers, or mobile devices.

Figure 74

Company Management Module Menu

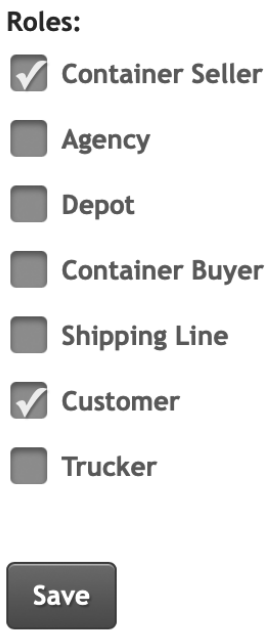


Short title of the company, business title, and billing title sections must be separately submitted while registering a company. Short title assists us to search the registered company much more effortless. We have two different forms for the business title. On several occasions, the billing title may have a brand name displayed and known publicly and an official title registered into government systems. Those three sections can be the same as well as those three might be completely different. The company's address and billing address of the company are also separately defined columns for companies located at one place while keeping their billing address elsewhere. It is common among companies incorporated in former Soviet Union countries, such as Russia, Ukraine, Belarus, and the Baltic States. Following these steps, we submit country and city information, tax number and tax office data of the company we register into KSHAL. The company unique

ID section was created for Turkish entities, and it helps us submit their MERSİS (Merkezi Sicil Kayıt Sistemi) numbers. In the last step, we define the role of the company. This step is momentously determinant of how the company we registered into KSHAL will be classified in our business transactions. Any company can be both a container selling vendor and a container shipping container customer for us. So, the ERP must be ready to handle companies that have dynamic roles and activities with us.

Figure 75

Customer Roles

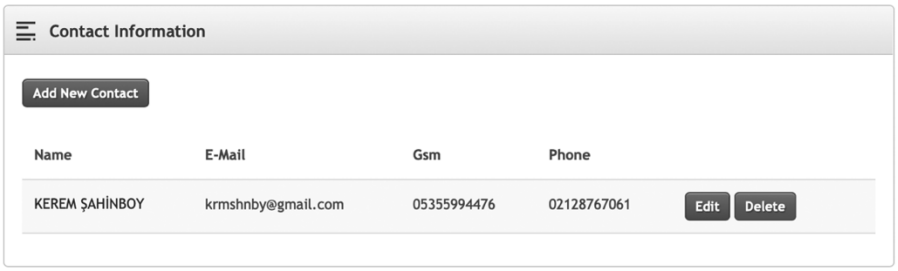


The roles can be dynamically increased and decreased by the administrator. Each maritime company has its business model, and KSHAL was built to respond to such variations efficiently. Any company might have all these roles above at the same time or just one. It does not change the fact that KSHAL renders these companies based on their roles and their interactivity purpose with the structure.

A new data box appeared to submit contact information once we saved the company's particulars into KSHAL. Here we submit the person's name, surname, e-mail, Gsm number and office phone number.

Figure 76

Contact Person Definition



Each company, role, and the registered contact person have different access permission that defines the borders of their interactivity with KSHAL. Finally, at the last step of the company registry, we submit user cards to KSHAL.

As well as companies having different commercial roles, users may have their roles as well. For example, these KSHAL users might be using KSHAL as their ERP structure or their customers, agents, vendors. How do we benefit from these user roles? We will observe it in later stages with examples.

Table 93

KSHAL User Roles

Super Admin	All read, write, modify permits. Full access to all zones
User	Dynamic restrictions. KSHAL users of all or certain modules
Agency	3rd party agents who have restricted access to certain modules
Call Center	Staff who just make out calls for marketing
Sales Representative	Each sales person may reach their version of KSHAL
Container Customer	Container buyers who log in observe stocks for sale and buy.

A proper and well-designed ERP should be a marketplace where people come by, shop as they like, pay and leave. People should not be occupied by the tasks which codes can accomplish. This is how we create an automation that functions seamlessly.

We had the same approach while designing KSHAL. Super Admin user profile is our godlike user with full access to all zones, all activities with complete r-w-e (Read, Write, Execute) permissions. There is only one being above the Super Admin, that is the architect. The architect does not interfere with the daily tasks but is more likely to involve with the development process of KSHAL. User as a profile is used for our staff who use KSHAL for all our shipping, billing, container operations. Those users have access to all zones, including CRM, reports but not the right to modify or delete certain sections such as container data, expected costs. If anybody with user rights attempts to delete container data or change figures related to container-buying, selling amounts, demurrage tariffs, invoices must apply to Super Admin. This feature is there just to increase security.

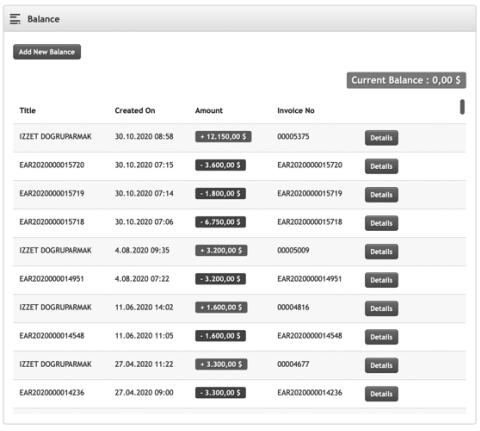
In specific experiences, it is observed that people tend to report higher profits while showing these figures in their routine reports and then changing those relatively high and unrealistic numbers back to normal. These destructive behaviours became abusive permanently at companies that employ commission-driven personnel. In order to forestall falsified data submissions and manipulations, the user has "read" and "write" permits but not "modify". Agency as a user definition represents our domestic or international partners. They may be our shipping partners, container depots, truckers, or else. They have permits to log in to KSHAL, read specific data, and modify defined places, such as container gate in date and container gate out date. This feature is there to add automation for shipping, container sales, cargo delivery processes. Call Center and Sales Representative user

definitions may seem closer to each other, but those are different activities than each other, and they must be separately constructed. Thi subject will be evaluated in section 3.8 in detail. The container customer role is defined for local and international clients who purchase secondhand or brand new containers. They are joined into the KSHAL system in order to create a semi-automatical procurement process. Any company registered as a container buyer, which also has users with container customer roles, may purchase equipment online through KSHAL stocks. Container customer role offers possibilities to users to monitor container stocks, locations, equipment type, the quantity of each equipment type.

How is it possible to create a fiscally sustainable and reliable environment without risking our receivables while our customers strolling in our ERP and making decisions? KSHAL's online container purchasing/sales feature was upheld by the credit or balance definition section. With this module, we can receive deposit payments from our customers.

Figure 77

Financial Balance Module

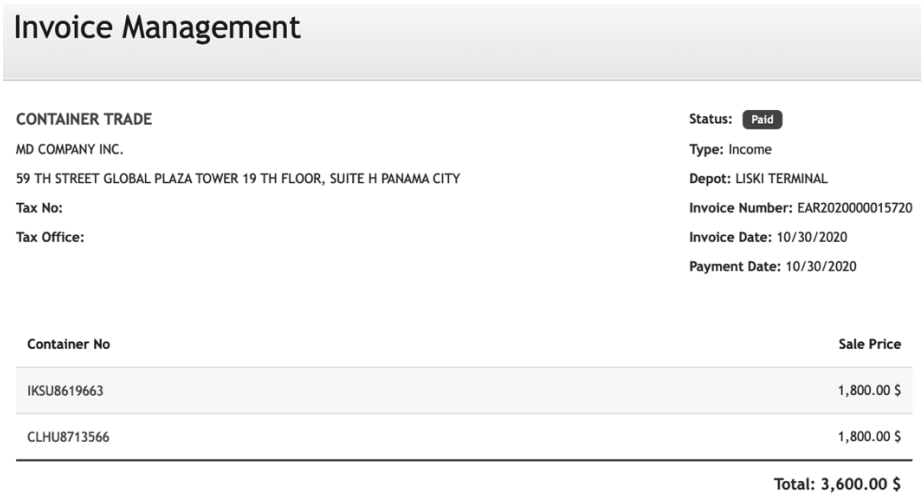


Those payments are registered to their company cards, and the same data is linked to their current balance sheets. After each purchase, the cost of the container is deducted

from their deposited payment. When the balance of the deposited funds is insufficient, KSHAL halts the online procurement process automatically until the customer remits new funds. Adjustments are shown with + (plus) marks and displayed as green colour. They represent our (KSHAL using the company's) income. When a customer purchases a container online through their screens on KSHAL or by email, a new record of the deduction is shown with a - (minus) mark and displayed as red. This feature helps anybody using KSHAL to know if a particular customer has enough 'paid' deposits to buy new equipment or not. When we click on the Details button on the right-hand side of the module, KSHAL takes us to the billing section, particularly the related invoice of that procurement decision.

Figure 78

Details of Purchased Containers

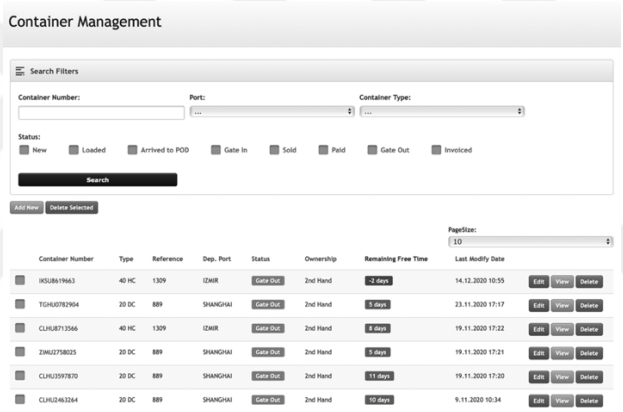


It shows us the numbers of which containers have been purchased, the sales amount of each unit, the depot's name, these units have been released, and the transaction status as 'paid'. We will look into those status remarks in the later stages of our dissertation. As a summary of this sub-section, we can see that company cards are vital while running all

shipping operations on KSHAL. We define all company particulars into this module, create new users for those companies and assign roles to those users. Each of these customizations responds to the different demands of our customers. Moreover, all these roles, user definitions are fully customizable, parametric tables that can be customized quickly based on the KSHAL using the company's activity field.

Figure 79

Container Management Module Dashboard



The container management module has four menu items to run the operations. It is the least amount of menu items while handling such necessary operations on KSHAL. As simplicity was our motto initially, we aimed to design a less confusing structure while still delivering the full ERP support to its customers.

Table 94

Container Management Module Menu Items

Containers	Takes us to container management module dashboard
New Container	Submitting newly purchased containers into KSHAL
Container Types	Sub-module for defining containers types
Bulk Update	Status update feature for departures, arrivals for more than one unit

KSHAL has four menu items in the container management module. First, the containers button takes us into the dashboard, where we have a complete picture and control over our stocks. New container button to register newly purchased equipment while submitting their details in KSHAL. Third, the container types button, while we add new types of containers, we buy and sell. Fourth, the bulk update button when we have more than one container that arrives in the destination port, and we need to update their arrival time at once.

There are two table sections on the container management module dashboard: one for searching through the stocks and one for their operational details such as container numbers, container's age as brand new equipment or a second-hand unit, departure ports, and demurrage free times. We can observe a detailed search feature on the upper table in which we may track containers by submitting their container numbers, the port of loading and container types. In addition to the above search service, there are operational steps we can render container's status by clicking on checkboxes as follows;

Table 95

Container Movement Steps

New	When we bought the equipment(s) from our vendors.
Loaded	When it is loaded with cargo and shipped
Arrived to POD	When the container(s) arrived to port of destination
Gate In	When the container(s) entered into our depot as empty
Sold	When the equipment is sold to a customer
Paid	When the payment is received
Gate Out	When the sold container left the depot
Invoiced	When container sales invoice is issued

All these status steps we have are submitted into the system either by us (KSHAL using company) or by our agents who have proper authorization for submitting Gate in, Gate Out dates at the port of destination. These steps are also fully customizable and can be increased or reduced by the workflow, business type and operational requirements of KSHAL users. Container numbers on the dashboard are clickable links taking us into details of each container's background, such as the date we purchased it, where we stored it at the port of origin, our vendor, our buying and selling prices, shipping details. On the dashboard's right-hand side of the lower table, we have edit view and delete buttons when we log in as Super Admin. For lower authorizations delete button is dysfunctional. The edit button is also restricted to modify critical areas.

The operator may start by clicking on the New Container button on the left-hand side menu or the Add New button on the dashboard. Container number, container type, ownership status, depot we store our container in the country of origin, departure port if a container is shipped elsewhere, destination port, free time in days for demurrage at the port of destination, our vendor, buying price, buying date, expected sales price and year of made must be submitted in order to create a new container record in this module.

Two important points need to be looked at. The first of them is free time data. *Free time* is the date assigned to a container in which the loaded container stays at the consignee's disposal free of charge. As this time duration changes region by region, the common practice is that seven calendar days are free of charge for consignees. They will spend time for customs clearance, customs inspections, inland haulage from port to unloading place and returning the empty equipment to the designated depot. Based on our mutual contracts or destination country's customs regulations, free time might be

multiplied. It can be 14 days, 21 days, or in some extreme conditions (such as sending containers to distant locations by railways) 28 days. After the free time expiry, demurrage expenses are calculated according to tariffs shown on the bill of lading. It is challenging to have hundreds or thousands of containers located in different depots or shipped to dozens of different customers. Each has different free-time contracts with us. In case of lack of control, we may face significant income losses from the amounts we could not track and charge to our customers.

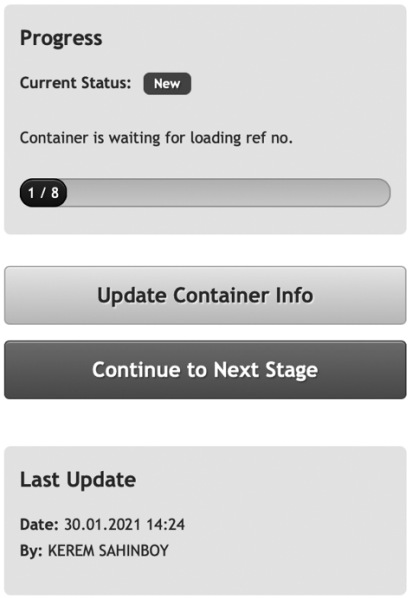
Nevertheless, KSHAL fulfils this critically important task successfully. There is a free time counter on the dashboard for each container that turns red when free time is expired. Demurrage income is one of the fruitful sources of profits for container merchants that must be focused on sincerely and carefully.

Another important point in container trade is the year of made (YOM) criteria. Containers are metal boxes that have 10 years lifespan (How Durable are Shipping Containers?, 2018). They have been built against harsh climate conditions and the tension they have to bear when stacked. They are capable of intaking up to 28 tons of cargo if they have heavy-duty container classification. All these operational bumps, accidents, stowage pressure on board or the ground cut their lifespan shorter. After ten years in shipping operations, these containers are put in secondhand container trade circulation where companies benefit from their simple and solid built. However, only a limited number of short sea carriers accept them as SOC without sufficient security certifications. Considering their weakened stowage resistance, it is a severe risk to keep using old units in the shipping business. If not carefully operated, these containers may cause horrendous accidents that may end up as life-threatening experiences. Their floors may get loose, and

all the cargo may fall on and off during the lift. While in the stack, they may lean sidewards and destabilize the vessel by collapsing the upper containers. They leak and spoil the cargo. Risks and threats are varied. Due to this fact, while buying and selling secondhand shipping containers, YOM is an essential factor defining the sales price to end customers. So, an ERP that is used in such tasks must be able to show the price range and YOM correlation in reports. Naturally, the aim is to purchase younger units rather than volatile equipment. In this respect, KSHAL has a section where we submit YOM and track it all through our operations.

Figure 80

New Container Process

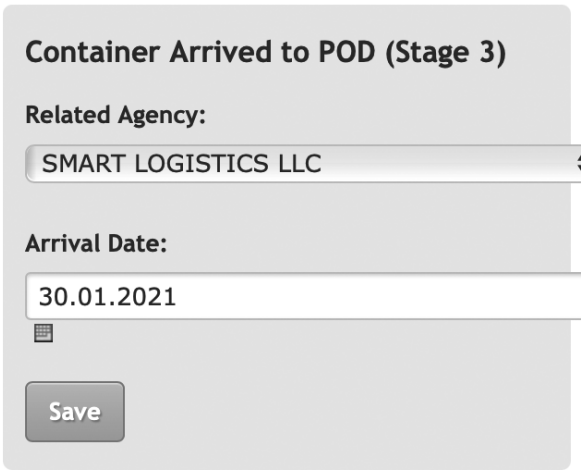


As we submitted the new container's basic details into KSHAL, it also means the commercial journey of that unit had begun. At the first step, we have a container at our warehouse in the country of origin. The country of origin could be Turkey on many occasions. However, there are also transit-trading possibilities, such as purchasing

containers from China and shipping them to Ukraine without a stop in Turkey. KSHAL is capable of handling such hyper-location scenarios without difficulties. At step two, we load the containers with general cargo and ship them to the destination port on board of contractual shipping lines. They must be submitted on KSHAL when we have the departure date information and bill of lading numbers. This action will update the container status from NEW to LOADED. The loaded status shows containers shipped on board. Naturally, these units must be handled by at least one of the agents we have at the destination port. Technically, we may have a minimum of one up to an infinite number of agents at the destination port. Practically, the feasible quantity should not exceed five. In step three, we assign these containers to our desired agent, and a particular record of the container appears on the agent's screen of KSHAL. Shipping advice notices take place in a single-window structure on KSHAL.

Figure 81

Third Step of Container Status

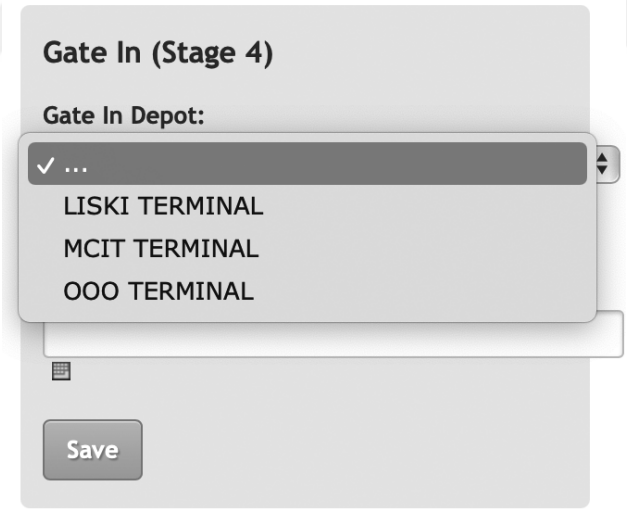


The above figure shows us that Smart Logistics LLC will be the handling agent of this particular container that arrived at Odessa Port of Ukraine on the 30th of January 2021.

We must follow up on the container and the cargo separately. The cargo in the container might not be associated with the related agent. Agent's duty on this occasion is tracking movements of the container, monitoring its status until it gates into our contractual container storage facility. Agent's task is not limited to this. Our agent at the destination port might guide any customer who approaches us to purchase the container. To show the containers, repair the containers, represent us abroad to government departments, customs clear the containers in case of putting into domestic circulation of the destination country, ordering survey or tally services are part of agents' routine services.

Figure 82

Gate In Terminal Selection

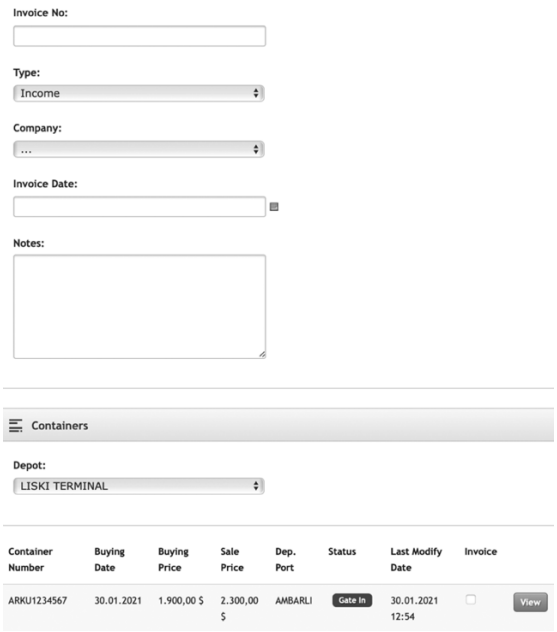


During our container trade operations, we may use multiple hubs for container storage. Each may have benefits or disadvantages over another location. When we decide where to return empty units, we must be able to notify all the parties by one source of code. Above, we observe stage 4, selecting which terminal we use and when the container gates in. Gate-in definition is used while containers enter certain areas such as ports, terminals,

factories and gate out is used for the opposite ways. After each progress, the same data gets updated on dashboards of users. So far, we have bought a container stored at our warehouse in the origin country. Our freight forwarding department loaded cargo into it. The containers are shipped to POD, unloaded, and returned to our storehouse as empty. It is ready for being sold to whoever wants to pay and purchase it. Container buyers often require photos of the containers or visit warehouses to observe their physical appearance. Even though those will not affect their cargo worthiness, rust and dents are negative factors while selling secondhand containers. Containers as commodities are sold quickly as they are highly demanded equipment for shipping and non-shipping purposes.

Figure 83

Invoicing Module



At stage five, we move to the invoicing part of the process. If a customer used the KSHAL system and had a paid deposit, container(s) can be purchased directly through the

program. If the customer was not registered into KSHAL, containers are sold in conventional methods.

KSHAL shows units that are suitable for sale only on this screen. The selling price comes as predefined from Stage 1. SuperUser can reduce or increase the selling price on demand if necessary. Once the invoice is issued, the sold price is deducted from the buyer's deposit, and the new deposit amount (pre-payment) is refreshed. All container traders provide a short free storage time for their customers. In common practice, it is seven calendar days. The buyer either should pick the container up within this time limit or ask the same storage facility to shift the warehousing services from the seller's account to the buyer's account. Gate out, as indicated above, represents the date on which the sold container was released entirely from the seller's accounts by all means, legally and operationally.

Figure 84

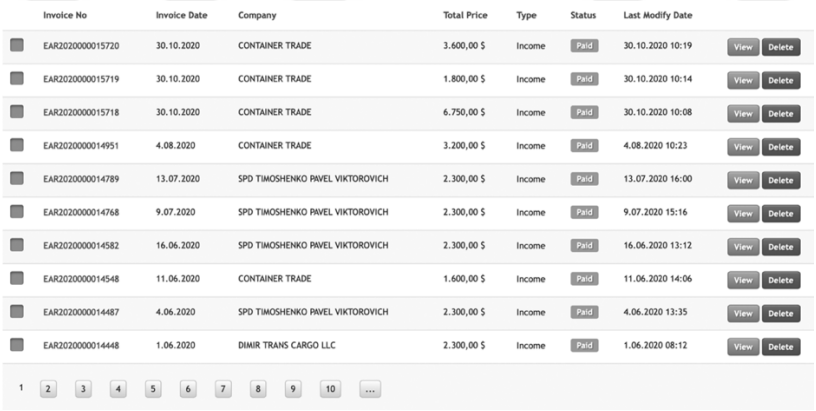
Invoicing Section Code View

All KSHAL modules correspond to each other actively. The structure gets cross-checked by financial checkpoints routinely. If a container buyer does not have sufficient

funds deposited, the system does not allow any operator to release a container to the buyer. This logic was influenced by the prepaid mobile phone operator cards system. Simply, any container buyer must load 'credits' into their account in order to log in to the KSHAL system and purchase units automatically. Each module has its unique dashboard on KSHAL. The upper section is left for searching tools, and the lower part of the page is left for recent data. The lower box data are correlated to their operational modules. If we are on the billing module, we observe the latest invoices issued or received. If KSHAL users are on the container management module, they observe the latest list of containers with their status indicated.

Figure 85

Billing Module Dashboard Lower Box



Invoice No	Invoice Date	Company	Total Price	Type	Status	Last Modify Date	
EAR2020000015720	30.10.2020	CONTAINER TRADE	3.600,00 $	Income	Paid	30.10.2020 10:19	View Delete
EAR2020000015719	30.10.2020	CONTAINER TRADE	1.800,00 $	Income	Paid	30.10.2020 10:14	View Delete
EAR2020000015718	30.10.2020	CONTAINER TRADE	6.750,00 $	Income	Paid	30.10.2020 10:08	View Delete
EAR2020000014951	4.08.2020	CONTAINER TRADE	3.200,00 $	Income	Paid	4.08.2020 10:23	View Delete
EAR2020000014789	13.07.2020	SPD TIMOSHENKO PAVEL VIKTOROVICH	2.300,00 $	Income	Paid	13.07.2020 16:00	View Delete
EAR2020000014768	9.07.2020	SPD TIMOSHENKO PAVEL VIKTOROVICH	2.300,00 $	Income	Paid	9.07.2020 15:16	View Delete
EAR2020000014582	16.06.2020	SPD TIMOSHENKO PAVEL VIKTOROVICH	2.300,00 $	Income	Paid	16.06.2020 13:12	View Delete
EAR2020000014548	11.06.2020	CONTAINER TRADE	1.600,00 $	Income	Paid	11.06.2020 14:06	View Delete
EAR2020000014487	4.06.2020	SPD TIMOSHENKO PAVEL VIKTOROVICH	2.300,00 $	Income	Paid	4.06.2020 13:35	View Delete
EAR2020000014448	1.06.2020	DIMIR TRANS CARGO LLC	2.300,00 $	Income	Paid	1.06.2020 08:12	View Delete

1 2 3 4 5 6 7 8 9 10 ...

For increased security measures, KSHAL keeps logs of each user's activity on the ERP and displays it wherever necessary on the program. In this way, we know who modified the records, and if any modification is against our company rules, it is easier to spot the responsible for it. Almost all ERP solutions have this feature available on the server-side, but KSHAL is one of the few alternative platforms that visualize the logs. The

reason behind this manner is using the log boxes as prevention stations to avoid data manipulations.

Figure 86

User Log Box

We came in this section showed us the process from buying a container to selling it. It is essential to indicate that proper software must fit into a maritime company's workflow while enriching and adding new models. In this respect, it would not be too difficult to say that shipping software is a semi-custom-made, tailored product that should be customized based on each customers' unique, genuine business processes. KSHAL, which is a ready product, was designed open for further customizations. Even in a narrow market segment such as the container trading business, there are a few dozens of different business types.

A company may sell the containers domestically or internationally, or both. A container trader may hire container storage and work with them on different contract conditions such as FIFO, LIFO, hybrid model or even randomized stock movements. These are the lightest parts of the whole variations that may occur just during a container trading process. The compatibility and responsiveness of an ERP on such occasions is a sign of strength and competence. We are convinced that KSHAL has those features.

As a conclusion of this section, the container module of KSHAL fulfils all buying, selling, cost-profit recording, status checking, shipping automation requirements. It is one of a kind by adding third parties into the core of the business. Our agents may log in and update gate-in, gate-out dates of the containers associated with their accounts. Our container buyers may log in and purchase whichever equipment is available in our stocks as long as they have paid the deposit shown on KSHAL.

KSHAL operators are able to issue income invoices and also register cost invoices. The bulk update feature assists us in modifying records of containers in enormous quantities at once with ease. It is a simple, robust, consistent shipshape software alternative for maritime logistics companies.

3.5 Price Quotation Module

Freight quotations are the face of marketing departments and also most likely the face of companies in the SCM industry. Trade models traditionally apply iceberg transport costs, where the value of the good transported upon arrival is reduced by a percentage of the initial value to reflect transport and other trade costs, whereas freight charges in transport and logistics models reflect physical characteristics such as weight and distance (Strandenes, 2013).

A freight quotation should be as simple, as understandable as intact as possible. On the other hand, it must be lean and informative. Along the way, when shipping lines, trucking companies and air cargo carriers grew, freight quotations also became complex documents to understand by end customers. Surcharges cited laws, seasonal fees, warnings, restrictions, liability reminders that turned freight quotations into hard to read and difficult to acknowledge documents. There must be a balance between appeal and functionality. Therefore freight quotations are gateways between transport companies and their potential customers. These documents show the strength of the corporate structure, and they can be considered early signs of how serious and experienced the offering party is. Freight quotations as digital documents are distant relatives of the "letter of intent" (LOI). They show an intention or a willingness to a certain degree which can be interpreted as a shipping company's positive approach to ship potential customer's goods.

Freight quotations are also service commitment papers that draw the borders of what will be done in which terms. Any price quotation that is simple, understandable and at the same time comprehensively multi-angled shows proficiency of the offering party. Besides the appearance of freight quotations, the background of how maritime companies

produce them will be examined in this section through the screens of KSHAL. How do we store our cost-house data and keep it valid? How is it possible to create an infrastructure which even makes novice employees create price offers through the ready-made templates? How fast can we respond to our customers when they need a freight quotation? What are the fundamental components of an efficient price offer? How do we prevent our staff from sending duplicated cross-offers to the same customers? What are the methods of recording our costs most feasibly and simply into our ERP modules?

KSHAL's pricing module is concentrated on container shipping services. It manages costs and generates sales prices based on our number of selections. Container shipping lines have a common tendency of sending their price proposals in breakdowns. These expenses may get extensively complicated from time to time. Also, several regional surcharges are valid for specific geographies, such as War Risk Surcharge applied in dangerous territories such as Israel, Yemen, or Ice (Winter) Surcharge affected in winter times in ports such as St.Petersburg of Russia. So, there is the body of basic freight as a cost and its additional, relative surcharges listed down in freight quotations. Bunker surcharge (BAF) is applied on basic freight as an addendum. It is an indexed expense with volatility, and each month it is amended based on new fuel expenses and trade factors. Therefore, BAF is the multiplication of bunker charges and trade factors.

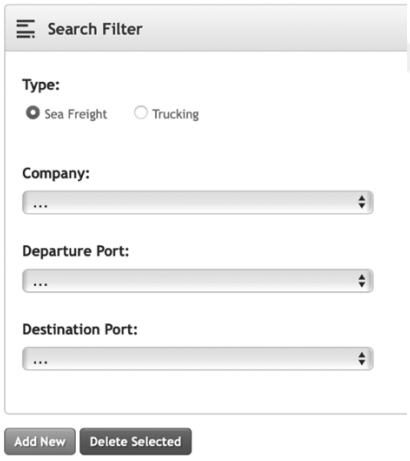
$$BAF = Fuel\ Expenses\ x\ Trade\ Factors$$

The trade factor is average fuel consumption for a given trade varying according to the route, vessel direction, distance, transit time, the weight of the load, size of the container, build of the ship and fuel efficiency of the vessel's engines (ContainerExchange, 2020). Each of these parameters has its scaled importance on the final BAF figure, which is

declared and applied monthly. CAF is the prefix of Currency Adjustment Factor that helps prevent currency-related losses on accounts of shipping lines that have to bear and deal with multiple currencies while calling different ports along the way. Peak Season Surcharge (PSS) is applied on BAS (Basic Sea Freight) to increase the earnings of shipping lines in seasons when demand is high. Container lines shape up their final freight levels by adding required surcharges in needed times. This method saves shipping lines from re-calculating BAS, calculated at once and used as a kernel of their price quotations. The number of surcharges varies up to a few tens of them available in the container shipping industry.

Figure 87

Freight Quotation Module Search Tool



Since surcharges have become an integral part of BAS, compiling, calculating these costs accurately and producing freight quotations out of those parameters became a technical goal for shipping ERP programs. There are surcharges added on BAS as a percentage, such as BAF, CAF. Surcharges are added on BAS as fixed fees, such as ISPS (International Ship and Port Facility Security Code) or Container Cleaning Fee (CCF). Several surcharges are applied on each TEU, such as Congestion Fee, while several

surcharges are applied for each M B/L, such as ENS (Entry Summary Declaration). This basket full of fees, surcharges, and seasonal expenses applied on BAS consecutively are not tasks for end customers to deal with. Calculating these groups of surcharges is in specific experiences confusing and occupying jobs for ordinary export and import companies. In addition to the above fees applied on BAS, OTHC (Origin Terminal Handling Charges) and DTHC (Destination Terminal Handling Charges) are applied together with BAS shown below figure.

Figure 88

Hapag & Lloyd's Freight Quotation Sample

Unless otherwise specified, all rates are subject to all surcharges as they are valid at time of shipment. The currently applicable surcharges are:

Export Surcharges				
Terminal Security At Origin	USD	10	10	10
Preliminary Custom Formalities	USD	61	61	61
Terminal Handling Charge Orig.	USD	165	165	165
Sealing Charge At Origin	USD	7	7	7
Freight Surcharges				
Marine Fuel Recovery	USD	132	264	264
Heavy Lift Charge (Between 13.0 and 19.999 TON)	EUR	50		
Heavy Lift Charge (Between 20.0 and 34.0 TON)	EUR	100		
Import Surcharges				
Terminal Security Charge Dest.	BRL	45	45	45
Local Logistics Fee Import	BRL	121	121	121
Terminal Handling Charge Dest.	BRL	880	880	880

The Lumpsum includes the following assessorial charges:
Carrier Security Fee, Transport Additional Origin, Tax Export

Notes
Subject to B/I Or Swb Issuance Fee: BRL 460 per Bill of Lading
Subject to B/I Fee: USD 30 per Bill of Lading

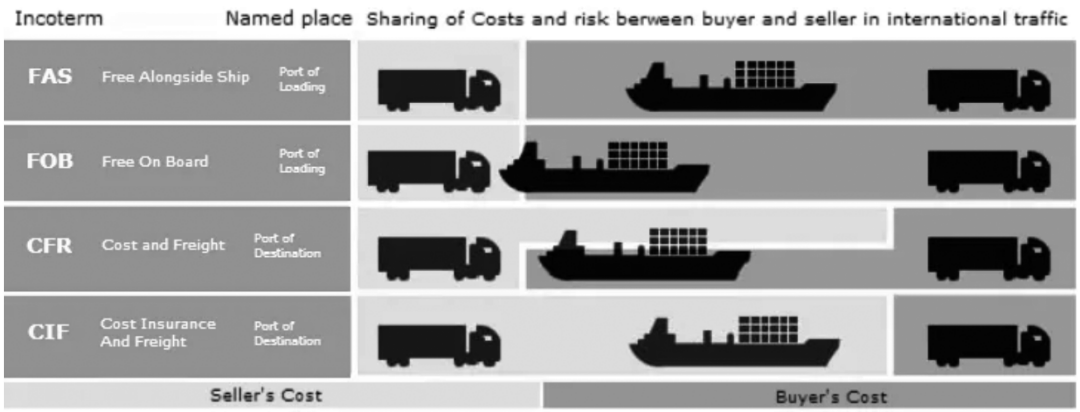
The accountability of these cost houses, which we may separate as origin-related expenses, BAS-related expenses and destination-related expenses rendered by Terms of Shipment (TOS) rules, are also known as Incoterms. They are widely used in international trade processes. They are a series of three-letter trade terms related to the standard

contractual sales practices. The Incoterms rules are intended primarily to connect the tasks, costs, and risks associated with transporting and delivering goods.

Governments accept the rules, legal authorities, and practitioners worldwide to interpret the most commonly used terms in international trade. They are intended to reduce or remove altogether uncertainties arising from different interpretations of the rules in different countries. As such, they are regularly incorporated into sales contracts worldwide (Shipping Terms, 2019).

Figure 89

A Section of Incoterms 2010



Maritime software alternatives must handle these multilayered pricing calculations seamlessly. They must be able to handle the adjustments dynamically as well. If a particular surcharge is applied seasonally, it is unnecessary to keep them displayed on main screens. In routes such as China to Europe, rates change as fast as stock exchanges. There are a dozen shipping lines call Shanghai almost daily voyages in peak seasons. Each container line has different allocations on their vessels, different quantities of empty equipment and strategically different pricing strategies. In this picture, the number of occasions is many for compiling these rates from each shipping line on time, storing these rates, which come

as break down of charges on our ERP and proposing those rates to our customers within validity terms as lean as simple as possible.

On the contrary to significant trade routes, short-sea rates, such as the Blacksea container shipping market or Mediterranean container routes, are relatively stable. So far, we have tried to visualize how pricing ingredients work in the container shipping industry. When we look at a simple scenario of shaping up an export container quotation, our cost house will have to be dealing with the below parameters;

Figure 90

Port to Port Sea Freight Parameters

OTHC	Calculated
Free in	Per Unit
Thc	Per Unit
M B/L	Per Shipment
Isps	Per Unit
Temporary Customs	Per Unit
Seal Fee	Per Unit
Agency Fee	Per Unit
Telex Release Fee	Per Shipment
ENS	Per Shipment

→

BAS	Calculated
BAS	Per TEU
BAF	% on BAS
CAF	% on BAS
Marpol Src	Per TEU

→

DTHC	Calculated
Free out	Per Unit
Thc	Per Unit
Delivery Order	Per Shipment
Isps	Per Unit
Temporary Customs	Per Unit
Insurance	Per Teu
Tally Fee	Per Teu
Container Cleaning	Per Teu

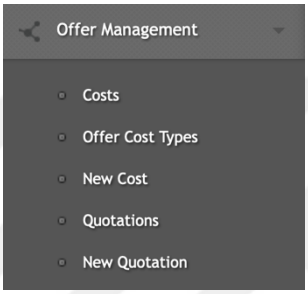
For reaching to final freight sum, the end customer must calculate all the above surcharges. If the shipment is FOB (Free On Board), BAS + DTHC must be paid by the consignee, and the shipper must pay OTHC. If TOS is FAS (Free Alongside Ship), sea freight is being constructed by (OTHC + BAS + DTHC) and paid by the consignee. These variations are facts of maritime logistics, which all proficient ERP solutions essentially be able to handle without difficulties while storing the costs and creating freight quotations.

KSHAL's pricing module is based on proper cost recording features. KSHAL generates sales prices via available and valid costs by applying a flat profit rate or a percentage. Both of these options can also be modified manually. The pricing module is

titled Offer Module on KSHAL. Costs link takes users to the dashboard, where they can search through sea freight or trucking costs. The trucking costs department of KSHAL involves domestic container haulage services but not international trucking business.

Figure 91

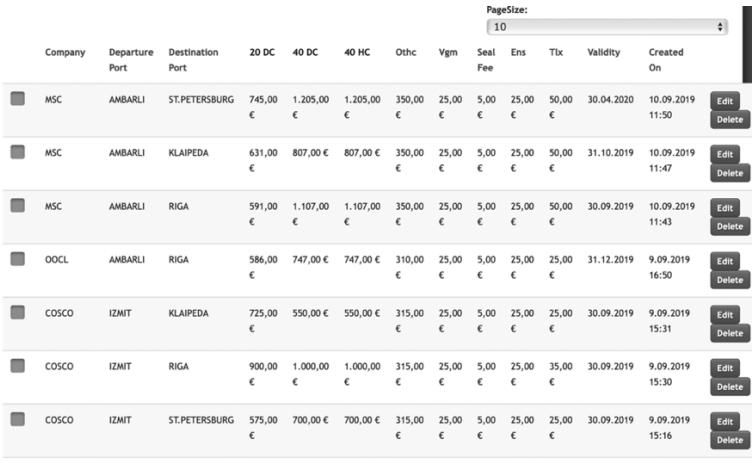
Offer Management Menu



On the cost, dashboard users have a list of costs that have been retrieved from various container shipping lines in default order that shows the most recent records as first in line.

Figure 92

KSHAL Cost Module Dashboard



	Company	Departure Port	Destination Port	20 DC	40 DC	40 HC	Othc	Vgm	Seal Fee	Ens	Tlx	Validity	Created On	
☐	MSC	AMBARLI	ST.PETERSBURG	745,00 €	1.205,00 €	1.205,00 €	350,00 €	25,00 €	5,00 €	25,00 €	50,00 €	30.04.2020	10.09.2019 11:50	Edit Delete
☐	MSC	AMBARLI	KLAIPEDA	631,00 €	807,00 €	807,00 €	350,00 €	25,00 €	5,00 €	25,00 €	50,00 €	31.10.2019	10.09.2019 11:47	Edit Delete
☐	MSC	AMBARLI	RIGA	591,00 €	1.107,00 €	1.107,00 €	350,00 €	25,00 €	5,00 €	25,00 €	50,00 €	30.09.2019	10.09.2019 11:43	Edit Delete
☐	OOCL	AMBARLI	RIGA	586,00 €	747,00 €	747,00 €	310,00 €	25,00 €	5,00 €	25,00 €	25,00 €	31.12.2019	9.09.2019 16:50	Edit Delete
☐	COSCO	IZMIT	KLAIPEDA	725,00 €	550,00 €	550,00 €	315,00 €	25,00 €	5,00 €	25,00 €	25,00 €	30.09.2019	9.09.2019 15:31	Edit Delete
☐	COSCO	IZMIT	RIGA	900,00 €	1.000,00 €	1.000,00 €	315,00 €	25,00 €	5,00 €	25,00 €	35,00 €	30.09.2019	9.09.2019 15:30	Edit Delete
☐	COSCO	IZMIT	ST.PETERSBURG	575,00 €	700,00 €	700,00 €	315,00 €	25,00 €	5,00 €	25,00 €	25,00 €	30.09.2019	9.09.2019 15:16	Edit Delete

Each column title is clickable links that, once clicked they sort the whole column either alphabetically or numerically in ascending order. We can search active (valid) and

deactivated (invalid) tariffs here on this page. The reason why invalid rates are also shown on the software is to give users a glimpse of the historical evolution and change of the freight levels. We can observe the name of the container line, port of departure, port of destination, BAS based on various types of containers and conjuncted surcharges such as OTHC, Vgm, Seal Fee, Ens, Telex Release Fee. In addition, we are able to see the validity of the cost and the date it was created. KSHAL is able to assign two major currency types as USD and EUR, to all expense items.

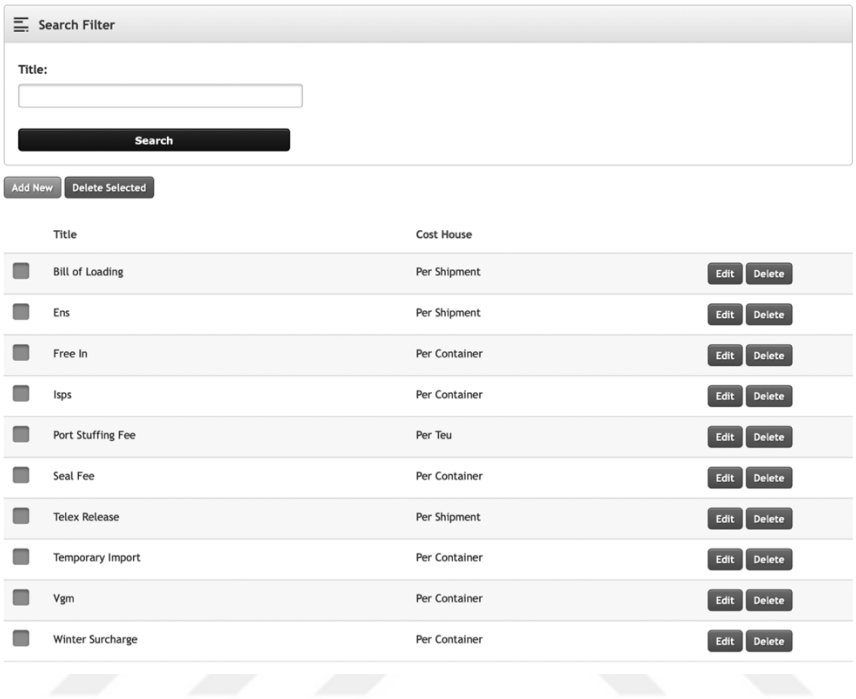
Figure 93

Cost-House Assignment

In order to give absolute freedom and initiative to KSHAL user companies, all surcharges can be defined freely and assigned to different calculation criteria parametrically via the Offer Cost Types page. As we have indicated above, specific surcharges are calculated by shipment while a portion of them are applied by container or even by TEU.

Figure 94

Offer Cost Types



When defining a new surcharge, KSHAL simply asks two questions: the name of the surcharge and which cost house it will be related to. We may also minimize our focal point down to cost house definitions. As a default set-up, KSHAL calculates surcharges for each shipment, container or TEU. Anyhow, we are able to increase or decrease these variables as well. This flexibility is one of the driving forces of the KSHAL Offer Module.

New cost submission is managed by drop-down menu steps. In the first step, the user is asked to choose between sea freight or trucking options. Based on this choice, forthcoming data columns automatically change. For example, suppose the user is submitting a sea-freight related expense correlated forms to be displayed and asked to fill. Suppose the user submits a container haulage-related expense (trucking freight) to those columns which are related to the trucking business shown.

Figure 95

Sea Freight Cost Definition

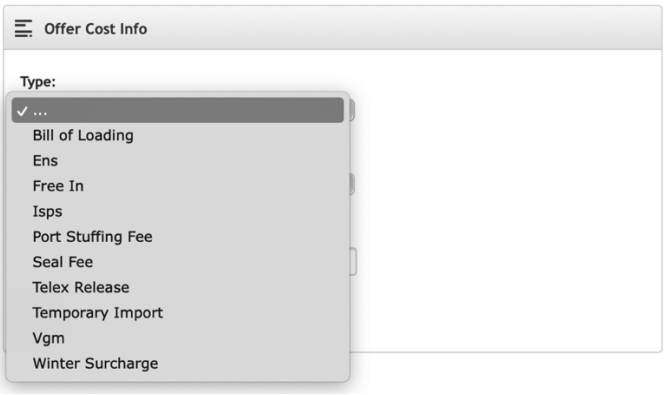
Once the sea freight option is chosen, the operator appears to fill the 'step by step' form sequence. We have to select our vendor shipping line first, define the validity of their offer, submit the name of the port of loading and the port of destination as well. Notes box left as a dead text section for any special notes, which may help other operators to see while sorting out the costs on KSHAL. In the following step, the currency of BAS is submitted. As mentioned above, BAS can be in USD, EUR, GBP or TL. KSHAL can use all these currencies, which are updated daily by direct XLM correspondence between KSHAL and the Central Bank of Turkey. So, all these currencies and exchange rates are effectively active on KSHAL while calculating the end customer tariffs. After all, columns are filled up starting from 20 Feet Dry Container (20DC) to 45 Feet High Cube Container (45HC), the user submits transit time between POL and POD and free of charge demurrage days (Free Time) as these details are shown on freight quotations. One of the essential

requirements to submit is the contact person of the container line. This data is coming from company cards. We, as users of KSHAL, must know by whom the costs had been offered to us. This feature is a lifesaver when or if a container line operator ignores which tariff tier has been offered by their staff.

Surcharges became visible to get filled by the operator only when the user pushes the save button.

Figure 96

Surcharge Registry Screen

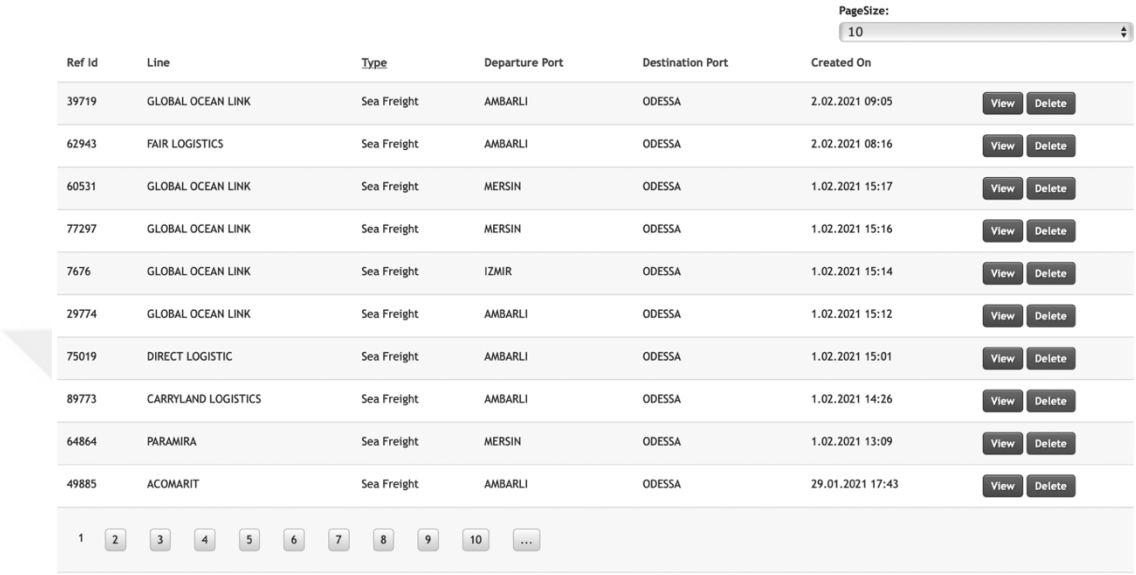


Each surcharge may come in different currencies. Each container line has its template of offering surcharges. While M B/L fees are quoted in Turkish Lira, the seal fee may be EUR and Telex Release fee in USD. At this stage, the sea freight cost registry is completed. Users of KSHAL benefit from having a pool of sea freight alternatives in a wide range of shipping lines, BAS, transit time, free time options. Any authorized person may be able to create freight offers instantly with a few clicks.

The quotation menu link takes KSHAL users to the dashboard of sent offers, where we can observe grouped freight quotations in ascending order from newer date to older date.

Figure 97

Quotations Dashboard



PageSize: 10

Ref Id	Line	Type	Departure Port	Destination Port	Created On	
39719	GLOBAL OCEAN LINK	Sea Freight	AMBARLI	ODESSA	2.02.2021 09:05	View Delete
62943	FAIR LOGISTICS	Sea Freight	AMBARLI	ODESSA	2.02.2021 08:16	View Delete
60531	GLOBAL OCEAN LINK	Sea Freight	MERSIN	ODESSA	1.02.2021 15:17	View Delete
77297	GLOBAL OCEAN LINK	Sea Freight	MERSIN	ODESSA	1.02.2021 15:16	View Delete
7676	GLOBAL OCEAN LINK	Sea Freight	IZMIR	ODESSA	1.02.2021 15:14	View Delete
29774	GLOBAL OCEAN LINK	Sea Freight	AMBARLI	ODESSA	1.02.2021 15:12	View Delete
75019	DIRECT LOGISTIC	Sea Freight	AMBARLI	ODESSA	1.02.2021 15:01	View Delete
89773	CARRYLAND LOGISTICS	Sea Freight	AMBARLI	ODESSA	1.02.2021 14:26	View Delete
64864	PARAMIRA	Sea Freight	MERSIN	ODESSA	1.02.2021 13:09	View Delete
49885	ACOMARIT	Sea Freight	AMBARLI	ODESSA	29.01.2021 17:43	View Delete

1 2 3 4 5 6 7 8 9 10 ...

Each freight quotation has a random reference id. Reference identification numbers are assigned to price offers in random order. Thus, they are not increasing numerically but are generated randomly. This tiny but essential feature provides confidentiality for KSHAL user companies. In most cases, freight quotations change hands. It is a common practice that shipping companies obtain their competitors' price offers via their proxies. In this way, they simply become able to benchmark their sales prices and monitor the activity level of their competitors. Among these parameters, quotation reference IDs are also important indicators that show how active the offering party is. If it runs in numeric order, it may still give a bit of a sign that the offering party is less active than what the market knows or the opposite way. This feature helps us blur the sight of possible third parties, which may retrieve more information about us.

Any authorized user may get into the details of freight quotations by clicking on the View button positioned on the right-hand side of each row. Users may screen the

quotations on this page but can not change them as they are already placed offers. We can see to whom the freight quotation has been sent and created on this page. All the freight quotations can be re-produced by clicking on the Export Quotation button, which is positioned at the upper right corner of the page.

Figure 98

Quotation Detail Page

KSHAL produces freight quotations in PDF file format by using NRECO technology of .NET. NRECO (.Net REusable COmponents) is an efficacious tool when a number of file formats are converted into other types of output files without compromising the purpose and content. Due to security reasons, freight quotation files are generated in PDF file format on KSHAL. However, on certain occasions, we have either experienced or distantly observed some inconveniences that have occurred when end customers purposedly or mistakenly modified or manipulated the freight quotation files sent in text

formats. Therefore, PDF files serve well to avoid misunderstandings between the shipping company and the end customer.

The KSHAL user who creates the freight quotation may choose which items to be shown on the proposal file, besides the ready-made templates available correlated to each TOS. For example, in the below figure, we can observe the final form of a freight offer that has been made for a freight collect basis, port to port container shipment.

Figure 99

Freight Quotation Format

2/2/2021

Company: GLOBAL OCEAN LINK

Person: EKATERIBA GORINA

Ref Id: 39719

According to your inquiry we would like to quote you as follows from AMBARLI to ODESSA;

Line	40 HC	T.Time	F.Time	TLX	ENS
ADMIRAL	295.00 $	4 days	21 days	-	-
COSCO	285.00 $	3 days	21 days	-	-
OOCL	185.00 $	3 days	14 days	-	-
ARKAS	371.00 $	3 days	14 days	-	-
MEDKON	250.00	3 days	7 days	-	-

Rates are including the following surcharges:

Seafreight, Baf, Primage, Isps, Agency Fee

Terms & Service Conditions:

- Rates are valid until 2/28/2021 as subject to changes on Baf, Caf and other surcarges.
- Our quotation is limited by availability of both equipment and allocation on vessels.
- Only general goods are accepted. For Imo, heat controlled and live animals pls ask.
- If cargo will be stuffed at port additional CFS expense will be added to seafreight.
- Vessel Schedules : http://www.asgard.com.tr

We expect your kind bookings and further questions concerning our quotation.

Best Regards,

IZZET DOGRUPARMAK

izzetd@asgard.com.tr

As it is a FOB shipment, OTHC is payable by the exporter. Therefore that sum is not shown. Also, DTHC is payable by the consignee directly to the shipping line agent at POD, so that portion is also excluded. Obviously, the customer has asked for a freight proposal for only 40 Feet High Cube containers by various shipping lines. The final quotation file is lean, purposeful and comprehensively understandable. There is nothing

visible unwanted. As a result of this, we achieve our goal of minimizing any possible questions that may arise due to a lack of understanding. Among our statistical experiments, we have observed that creating and sending a freight quotation takes less than a minute on average if the receiver's details had been pre-defined into the company cards module of KSHAL. This speed is one of the advantages through the process of retrieving new orders as we move faster and more accurately than our possible competitors. The shipping business is all about speed, accuracy, feasibility, simplicity, and fiscal feasibility. Thus, KSHAL comes in handy for maritime logistic companies for such requisites.

KSHAL can compose two types of freight quotations structurally; one for "port-to-port" shipments, and the other is for multimodal (Door to port, port to door, door to door, door to the ramp, Etc.) transports.

Figure 100

New Freight Quotation Screen

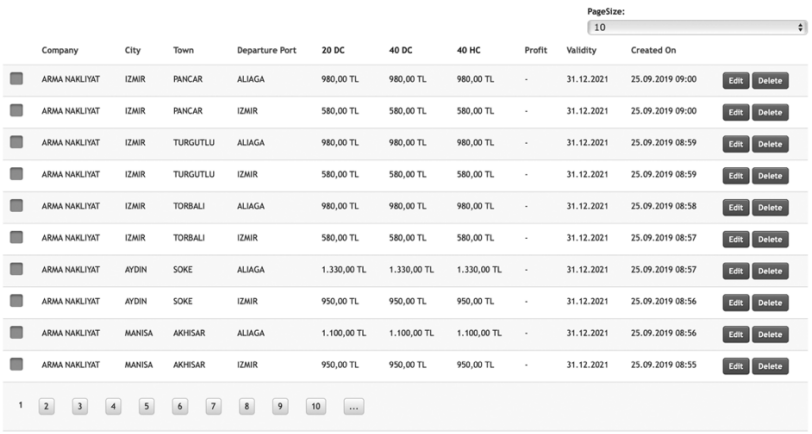
Both of these options are equally important in the shipping industry. As world SCM markets emerge and are interlinked, customers' common tendency is to sub-contract all their logistics demands onto one service provider that performs all tasks seamlessly from start to end. Thus, creating multimodal freight quotations through ERP systems in the maritime industry requires somewhat more comprehensive know-how. Constructing a

functional software architecture that gets these pieces of the puzzle compiled and offered to customers is a challenging task that we are convinced of on the KSHAL project.

Container trucking services, or by general definition, "pre-carriage", is an integral part of container shipping activities. Containers need to be carried onward and backwards between container yards and places of loading, which might be the factory, warehouses, open area yards, container freight stations at ports, or else. These movements are performed by trucks with container chassis and railcars designed for container carriage, barges, or autonomous electric vehicles. Basically, pre-carriage has an important place among our other sea freight-related costs. On the other hand, containers are mainly being carried by trucks to the doors of the exporters. Therefore, KSHAL has a cost recording module for trucking services. Both of these options are equally important in the shipping industry.

Figure 101

Trucking (Pre-Carriage) Dahsboard

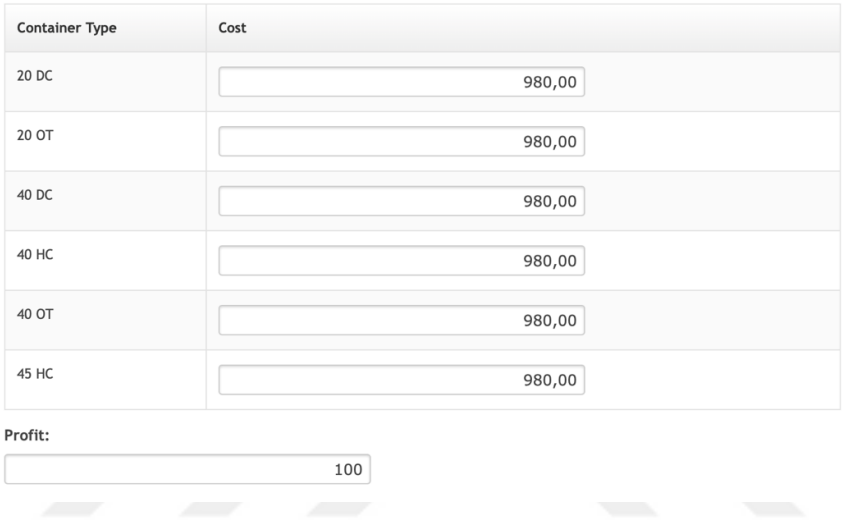


Trucking costs are displayed on its dashboard the same way KSHAL displays container stocks, sea freight quotations, container shipments and CRM records; in ascending order filtered by dates as default. Users may sort the records alphabetically as well. Here on this dashboard, we can observe the trucking costs connected to departure or

arrival ports. Which trucking company, from which town of the city to which container port questions are answered while submitting new trucking costs.

Figure 102

Profit Calculation Box



Users can define their trucking profit margin while submitting the pre-carriage costs. That can be a flat rate to the top of the costs shown in the figure or any ratio. Here in this figure, we may see that our profit for trucking is 100 TL. This feature assists us in generating all freight quotations automatically without minding our profit margins which are pre-defined in the system. Anyhow, it is possible to modify the margins manually too. When a KSHAL user attempts to create a door to POD, free out sea freight quotation, the formula will be as follows;

$$Lumpsum\ Freight\ =\ (Trucking\ Cost\ +Profit)\ x\ VAT\ +\ OTHC\ +\ (BAS+Profit)$$

Profit margins applied to trucking and shipping activities but not origin THC as these figures are publicly known transparent fees for all commercial entities. The source of the profit, especially in Turkey and when it is export bound deliveries obtained from carriage activities. Anyhow, this is just a custom more than the law, so any freight forwarder

may also add their profit margin on OTHC or DTHC (if Liner Out delivery is asked) through KSHAL.

The Offer Management Module of KSHAL is an all-embracing, ambidextrous and comprehensive tool for recording costs, comparing alternatives, creating freight quotations and tracking them on dashboards. Offer Management Module also repels unnecessarily repeating jobs such as asking for the same quotations from container lines on different working days. Two or more sales operators who have no tool, such as KSHAL, may accidentally request the rates of the same route from the same shipping line. On the one hand, it is a sign of disorder at the maritime company, and on the other hand, it is a complete waste of time for the marketing department. In such cases, container lines may refuse to work with such companies or label them as frivolous parties. Staring at the subject through our windows does not change the fact that KSHAL creates a common digital working ground for its users while filtering the price request of end customers.

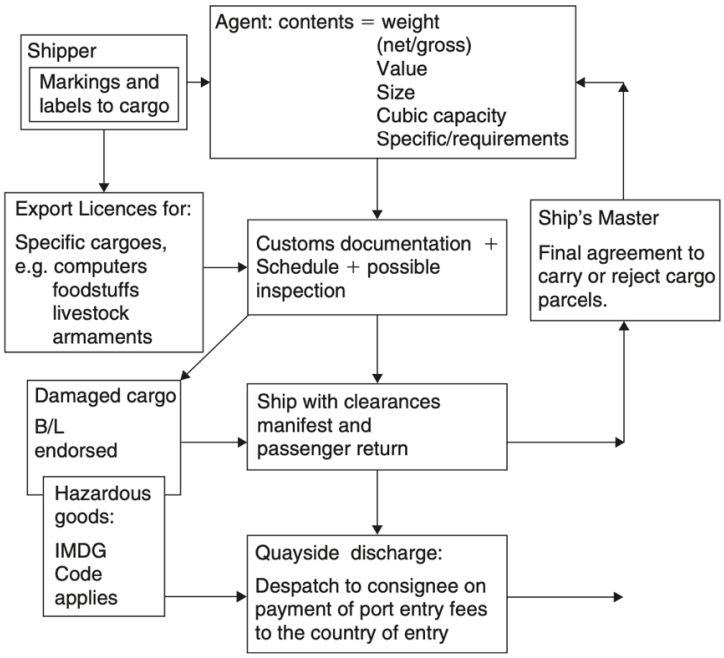
End customers may ask for rates via phone, email or fax. They may send their freight quotation requests to a different number of salespeople of the same company. Responding to the same request over and over is also a sign of ineffective usage of company sources. It is not a luxury but an obligatory need to monitor which customer(s) asked how many freight quotations, which period and how many of these price offers have been realized as concrete shipping orders. At the end of the day, transport companies are commercial bodies there for sustainable profits, and these activities must be actively observed via ERP platforms such as KSHAL. As a result, we may acknowledge that KSHAL's price quotation module is modelling the container shipping industry's needs accurately and responding to those who want to simplify these tasks in a budget.

3.6 Shipping Module

The operational occasions in container shipping vary. These variations may get complicated, multilayered and difficult to handle from time to time. It is one of the reasons why the shipping module has the top priority on KSHAL. Freight forwarders design this module for freight forwarders who ship containers worldwide. They may have their "own" containers (SOC), or they may be using the containers of shipping lines (COC) for their shipments. In container shipping, there are a dozen of sub -and jobs done by different expert companies. Stevedoring corporations to handle port activities while tally service providers monitor container movements in and out.

Figure 103

Common Container Shipping Operations

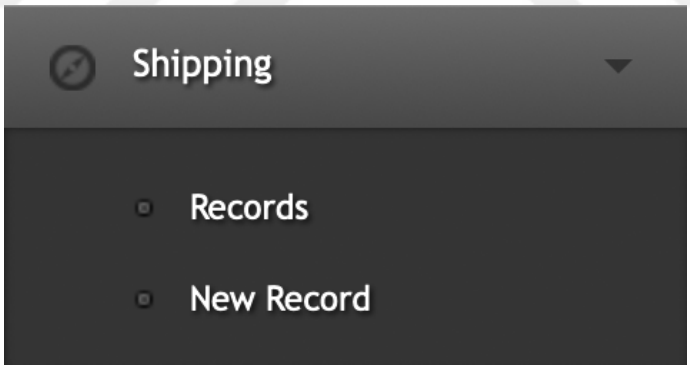


Note. From D. House, Cargo Work For Maritime Operations, p.256 Elsevier, 2005

There are port operations, container shipping lines, vessel owners, customs brokers, freight forwarders, container leasing companies, freight insurance agents, line agents, cargo surveyors, container hauliers, container freight station (CFS) operators and fumigators who are also providing lashing operations. As well as these are individual and independent business activities, they are also intersecting clusters that may come across on many occasions. For example, we may observe freight forwarders who are also container truckers. There are stevedoring companies that also provide tally service. There are licensed cargo surveyors who also sell certified lashing services. Almost all container line agents also have their customs brokerage companies.

Figure 104

Shipping Module Menu



Each of these roles requires a different type of IT solution. Each of these jobs has different flows, and they do need customized expert systems. While developing a maritime logistics software alternative, the logical approach appears to be focusing on one of these job types at the beginning. Otherwise, the whole development project may go out of control and becomes an impracticable disaster. In addition to this, the software design must be as simple as lean as possible without sacrificing comprehensiveness and without sacrificing robustness. In the light of this explanation, KSHAL's shipping module was designed and

programmed for freight forwarding companies that ship containers, mainly FCL. The whole structure of KSHAL has been designed parametrically, and it can be expandable with the support of its relational DB management infrastructure.

The shipping module menu has only two buttons on the left navigation panel. Records link to take users to the dashboard and new record link to take users into new shipping record screens. This is designed purposedly as lean as possible to keep the philosophy of KSHAL's simplicity approach. However, there was no concession of sleek design while applying the rules of simplicity. We display columns on the shipping module dashboard such as; Booking No, Ref No, M B/L No, From, To, Line, Vessel, Voyage, D/D, A/D, Created on (date).

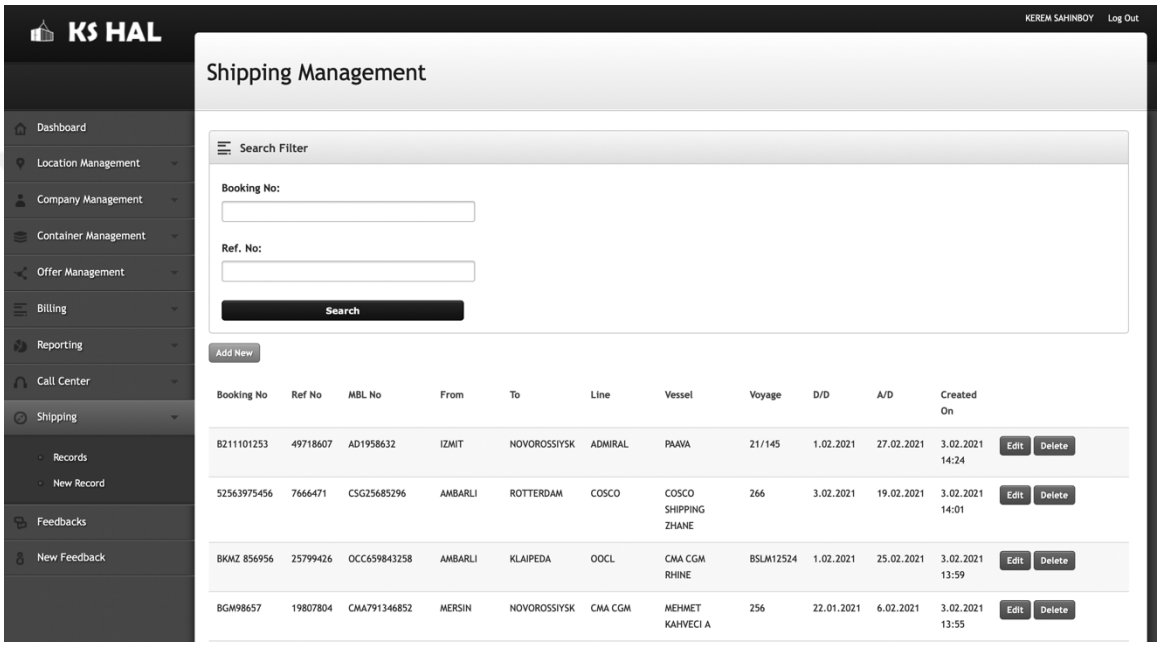
Each of these columns and data strings can be modified the way KSHAL users desire. They are pre-defined on this screen to show all essential particulars for quick data sorting. Booking No column represents the tracking number given by shipping lines once freight forwarders made the container reservation on behalf of their end customers. This number is used on all documents, all through the shipping and accounting processes. They are displayed on M B/Ls, invoices, pre-alerts and statements of accounts. It is not as exact as M B/L numbers. Reference Number column (Ref No) is KSHAL's cargo position number assigned to each shipment the way container lines have their unique booking numbers.

KSHAL user company uses these reference numbers all through their operational tasks. We need our unique reference number system besides just using Booking Numbers of shipping lines because we apply for our reference numbers from container sales activities to shipping operations. On many occasions, we ship the containers we own

(SOC); therefore, we must keep our own 'in-house' referencing system functioning as intact and active as possible.

Figure 105

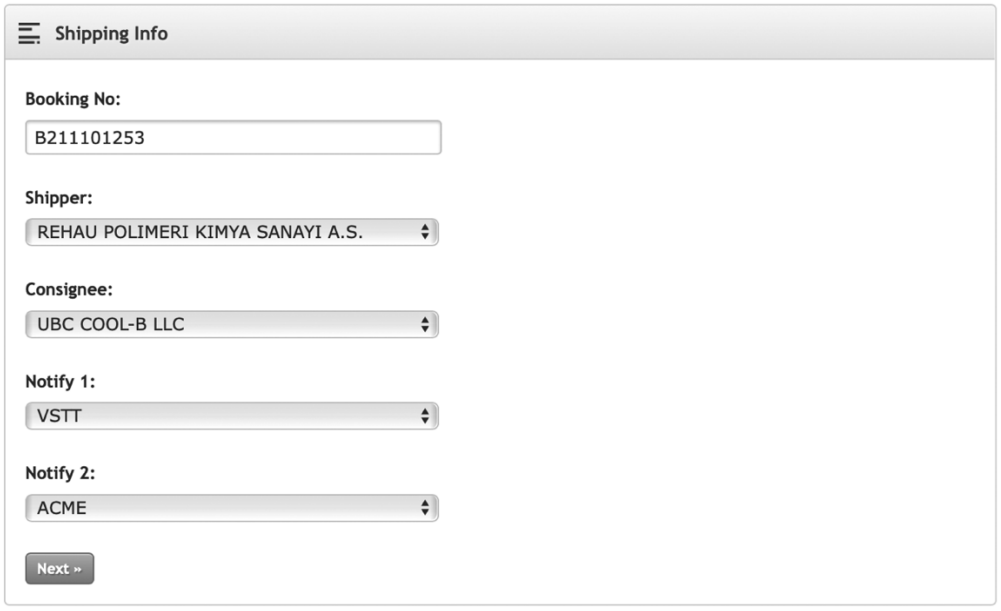
Shipping Management Dashboard



As it exists in the nature of the international shipping and forwarding business, all modules are linked to each other. For example, we may have purchased containers for selling them abroad. The shipping management module can assign these units submitted into KSHAL to shipments by our freight forwarding department whenever needed. While submitting new shipment details, it is always asked whether these units are SOC or COC equipment. It can be considered a fresh business model for freight forwarding companies that benefit from vertical and horizontal market activities.

Figure 106

Submitting Shipment Details



Freight forwarders obtain the Shipper's Instructions (SI) from exporters right before transit or export customs procedures and act as bridges between exporters and container lines. The SI is an official instruction from the exporter which indicates full details of the shipper, the consignee, commodity, quantity of packages, type of packages, the weight of the shipment and additional details in support of the cargo itself, such as harmonized customs codes, hazardous goods classification (if any) and special instructions. The SI is submitted to the shipping line's ERP via intermediary platforms such as INTTRA or directly to their web-based systems. As of today, almost all container lines have this feature publicly offered via their websites. However, the common tendency is asking container lines to create their Master Bill of Lading that does not show the actual exporter and real consignee or notify details. The notify part is merely someone that needs to be notified about the arrival of the cargo covered in the bill of lading. The details of the notify party

are provided in the shipping instruction submitted to the shipping line (Who is a Notify Party in a Shipment?, 2019).

Figure 107

A Loading Order (SI) Example

bergama group

YÜKLEME NOTASI

Invoice No: IHR2021000000024
Invoice Date: 03.02.2021

İhracatçı Firma	**BERGAMA GROUP DIŞ TİCARET A.Ş.**
Adres	KINIK OSB, Vali Kutlu Aktaş Cad. NO:3 KINIK - İzmir- 35990
Telefon	**90 232 631 3216**
Faks	**90 232 632 0512**
Kontak Kişi	**EMRE AKINCITÜRK - emre@bergamaplastik.com**
Vergi Dairesi-No	**KINIK - 165 062 0215**
İthalatçı Firma	**MEICHALEY ZAHAV PACKAGES LTD.**
Adres	EMEK AELA ST NO: 250 MODIIN 7177904 ZIP, ISRAEL
Telefon	00972 54 227 7680
Faks – e mail adres	RAMI FARVARDIN - rami@mzahav.co.il
Teslimat Adresi	**Same as Consignee**
Malzeme Detayları	
Mal tanımı	**PLASTİK GIDA KABI - FOOD GRADE PLASTIC PACKAGING**
GTIP (HTS) NO	**3923.10.90.00.00**
Yükleme Şekli	Paletli
Net Ağırlık (kg)	2.442,95
Brüt Ağırlık (kg)	3.281,75
Kap	18 PALET
Yükleme Limanı	**NEMPORT ALIAGA**
Boşaltma Limanı	**ASHDOD**
Gemi Adı - Sefer Numarası	**ASIATIC LIBERTY-159/E**
Konteyner Numarası	**ZCSU897497-4**
Mühür Numarası	**A119337725**
Konteyner Tipi	**40'HC**
Incoterm	**EXW IZMIR**
Konşimento Türü	**SWB**
Gümrük Müşaviri	**KORDON GÜMRÜK MÜŞAVİRLİĞİ**
Telefon	0232 463 20 05 / 0212 451 44 55
Kontak Kişi	GOKSU DUTKIN
Beyanname Cut off	04.02.2021-10:00

45 YEARS BERGAMA LEGACY

BERGAMA PLASTİK | one+ | berarts | Kristal DURAPET | bergama group

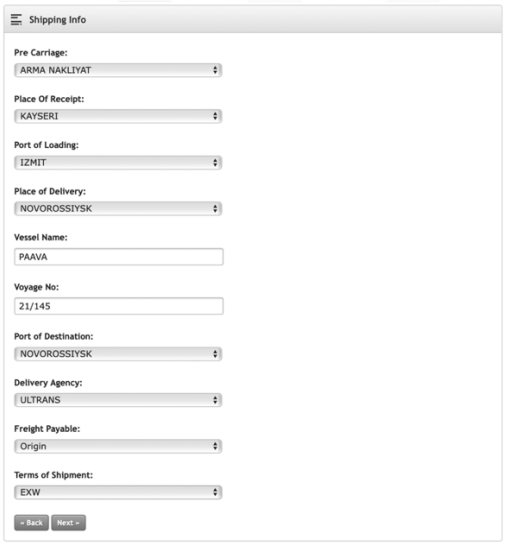
BergamaPlastik.com Factory Kinik OSB, Vali Kutlu Aktaş Cad. No: 3 Kinik / İZMİR T. +90 232 631 32 16 F. +90 232 632 05 12
Office AYTOP, Buttalgazi Mah. Sardunya Sok. J Blok No: 27 Sultanbeyli / İSTANBUL T. +90 216 592 41 55 F. +90 216 592 41 46

As shown above, loading orders (SI) must have complete details of the designated shipment. In addition to this, freight forwarders should avoid indicating the value of the goods or even the invoice numbers on their House Bill of Ladings to keep themselves away from unnecessary liabilities. Bill of Ladings are certificates and bonds that relay the official connection between all parties involved with this logistics chain, namely the exporter, importer, notify parties, carrier, freight forwarder agents, and shipping line agents. Then, based on the SI, the KSHAL operator starts submitting the information into the system.

These company details are pre-defined into company cards, and they are called from the DB through a drop-down menu structure. This feature allows us to use the same data multiple times. For example, in the second screen, we submit the following information, which is shown below.

Figure 108

SI Submitting Screen Nr 2



If any company does not exist in the system, the user must get back to company cards and register them. It is practical to check the company cards before submitting any SI into KSHAL to avoid time losses. Only two forms are submitted as dead text as one of them is the vessel's name and the second one is the voyage number that changes each time vessel's route starts from the first port of call. The rest of the data can be called from predefined data sources. The whole B/L submitting process has consisted of three steps. At the third step, we submit the issue place and date of B/L. The type of movement users must submit can be as full container load (FCL) or as less than a container load (LCL). Shipments have three different statuses on KSHAL as follows;

Table 96

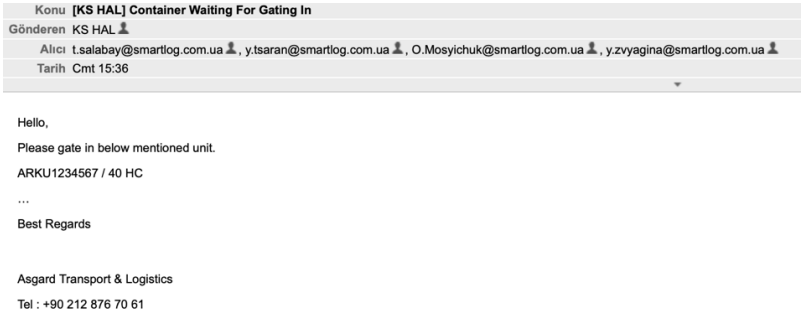
Cargo Status Indicators on KSHAL

Loading	When container(s) placed at exporter's disposal as empty
Shipped	When unit(s) shipped on board.
Arrived	When the vessel has arrived POD

"Loading" and "Shipped" stages are controlled and updated by POL side freight forwarders. Arrived information stage is controlled and updated by both POL and POD side agents on KSHAL. The POD side agents have dynamic roles in the shipping process as much as KSHAL using company (POL side freight forwarder) assign these roles to them. The POD agent receives auto alerts by emails sent through the system when a new shipment gets shipped. When SOC equipment is shipped on board, POD agent staff receive informal email notices, as shown below.

Figure 109

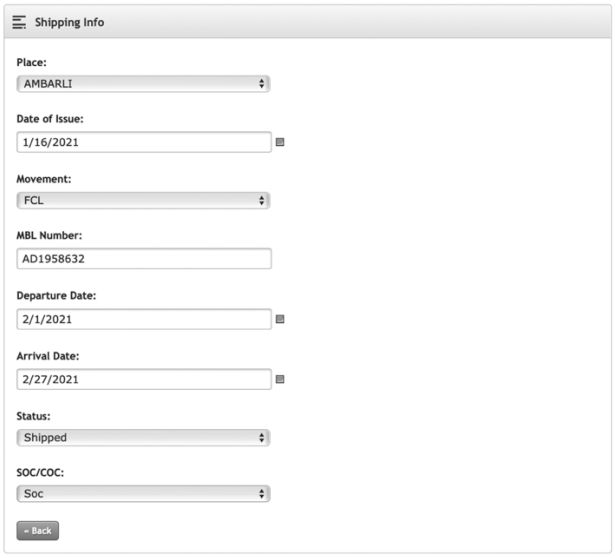
Auto Notification Email of KSHAL



These auto-notification e-mails are triggers for keeping POD agents actively updated. At the same time, they can monitor each shipment, each container consigned to them on their KSHAL screen. They are able to update container or shipment status from their system windows.

Figure 110

SI Submitting Screen Nr 3

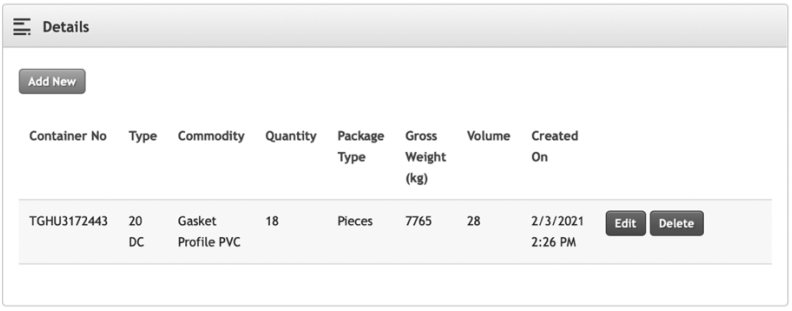


When all the shipment particulars are defined to KSHAL, we move to the following stage of submitting the cargo-related details such as container number, commodity, quantity, weight and volume. There might be a single unit on a single M B/L, or they might be several types of containers being shipped via single M B/L. KSHAL is capable of handling both variants effortlessly. The cargo details section is located right under the shipment details table on the shipping module.

As mentioned above, a shipment might be a single container, but it is not always a shipment with one unit consigned to one particular consignee. There are different probabilities, such as one M B/L may have a dozen different containers assigned to it. Each of these containers might have various container types, commodities, exporters and importers, notify details. Therefore, the cargo details section can allocate the number of containers that have different House B/Ls.

Figure 111

Cargo Details Section



When we push Add New button positioned on the left upper corner of the table, we are taken into the configurative details section, where we can submit complete details of the cargo such as container number, container type, commodity, quantity, package type, gross weight, net weight, volume (m3), harmonized customs tariff code. These details are also shown on M B/L and H B/L.

At this stage, it is necessary to put a light on the "Why do we need H B/Ls?" question. A house bill of lading is a document issued by a freight forwarder to a shipper to acknowledge receipt of their items for shipment. The shipper is the exporting company. The freight forwarder (which can also be referred to as a forwarding agent) is the company they have hired to arrange transportation of their goods to a foreign destination. The freight forwarder then books cargo space with carriers. Carriers are the transportation providers, trucking companies, shipping lines, and airlines that physically move the shipment. Some freight forwarders have in-house carrier services, while others contract with third-party carriers. An MB/L is a document issued by a carrier to a freight forwarder to acknowledge receipt of items for shipment (House BL vs Master BL, 2018). Is it enough to illuminate the practical use of H B/Ls simply by defining the roles of these supportive and correlated bonds? The truth has more than one dimension. Although freight forwarders and container

lines have cooperative relations based on mutual benefits, they are also competitors in the market. While shipping lines try to fill up allocations of their vessels, freight forwarders also work with different container lines based on their commercial and managerial interests. Marketing activities of freight forwarders and shipping lines may intersect from time to time. They are in vendor and buyer relationship on one side; they may be in direct competition against each other on the other side. This fact urges freight forwarders to keep their customer information far from sight. Although shipping lines can get these details (informally) through their customs offices, since M B/Ls, in principle, just show the freight forwarder as the shipper and its POD agent as the consignee, they will not be able to observe direct customer details from the vessel manifests. Instead, the actual shipper, the real consignee, and notify details are shown on the freight forwarder's H B/Ls. In this way, shipping lines will not be able to interfere with commercial relations between freight forwarders and their clients. Among many others, this is one of the fundamental reasons why there are H B/Ls actively used by maritime logistics companies.

Figure 112

House B/L Template Selection

Hence, we have come to the stage where we have submitted all shipment and cargo-related details to KSHAL. However, we are not done with the shipment yet. KSHAL user company as a freight forwarder entity must issue an H B/L and send it as a draft and send it to the exporter for approval. Once the shipper approves the draft, the original H B/L set

is issued through KSHAL. There are pre-defined H B/L templates embedded into the program used to generate "bill of lading" documents as PDF files. Any company may have different B/L templates or even different subsidiaries with different brand names and logos. We are able to select the desired template by using the button positioned in the upper right corner of the shipping management screen.

Figure 113

House B/L Output File as PDF Document

Shipper :
REHAU POLIMERI KIMYA SANAYI A.S.

Tyholt
Worldwide Logistics

UAB "Tyholt"
Gedimino pr. 45 - 4
LT- 01109 Vilnius, Lithuania
Tel : +370 5 1335050
info@tyholt.lt

Consignee :
UBC COOL-B LLC
PIONEER STR.W/NO RUS-309255 NEW TAVOLZHANKA, BELGOROD

Notify address (carrier not responsible for failure to notify, see clause 20 hereof):
VSTT
ST.PETERSBURG

Local vessel : from:
PAAVA IZMIT

The responssibility of each carrier being limited to its own line

Ocean vessel (or substitute): Port of transhipment :
PAAVA VOYAGE NO: 21/145

HOUSE B/L NUMBER : 49718607

Port of discharge : Ultimate destination (see clause 12):
NOVOROSSIYSK
If goods be forwarded by carrier at port of discharge

Plate No: Container No:	Number and kind of packages description of goods			Gross weight	Measurement
TGHU3172443	20 DC	18	Pieces	7,765.00-KG	28.00-CBM

Particulars furnished by shipper of goods

TOTAL AMOUNT OF CONTAINERS : 18x20 DC
Gasket Profile PVC
Time at Port of Destination : 14 Days
After a Free Time of 7(seven) days, including Sundays and holidays, from the date of discharging the container
From the Vessel up to the return of the empty container, the following demurrage rates shall
apply:From the 8th to 12th day USD 8 per day per 20' container USD 25 per day per 40' container.
From the 13th to 28th day USD 16 per day per 20' container USD 42 per day per 40' container. From the 29th day on
USD 20 per day per 20' container USD 50 per day per 40' container.
In case the containers are not returned to owner's depot within 70 (seventy) days after picking up, in addition
to the demurrage charges container, the carrier is under no obligation to accept value of container as compensation
of container demurrage.
In case the Cargo is not received then the shipper or the contractual counterparty of the carrier
on the contract of carriage shall be responsible for the demurrage and the relevant costs and expenses."

Freight and Charge to be prepaid / to be collected

ULTRANS
CAY MAH.ATATURK BULV.KOC APT.22/2 ISKENDERUN/HATAY

SHIPPED on board in apparent good order and condition (unless otherwise stated) by the shipper hereinfore named to be transhipped at port of transhipment at ship's or truck's expense but shipper's and or consignee's risk and to be delivered at the above mentioned port of discharge or so near thereto as the vessel can safely get and always afloat, the goods or packages specified herein and to be discharged at the above mentioned port of discharge or so near thereto as the vessel can safely get and always afloat, the goods or packages specified herein and to be delivered in the like good order and condition at the aforesaid port of discharge, all conditions and exceptions printed, stamped or written herein and on the back hereof, the contract on all the terms whatsoever of the carriage of the goods are superseded by this bill of lading except the conditions of the applicable tariff which are available from the carrier and which are deemed to be incorporated in this bill of lading. In case of inconsistency of any conditions of the applicable tariff with the terms stated on page 1 and 2 of this bill of lading the latter shall prevail. The carrier's responsibility shall be governed by the terms of this bill of lading (including those incorporated by reference), whether written, typed, hi-lited or printed are accepted and agreed by the shipper, consignee and/or endorsee, any local customs or privileges to the contrary notwithstanding.
If required by the carrier, one signed bill of lading duly endorsed must be surrendered to the agent to the ship at port of discharge in exange for delivery order.
IN WITNESS WHEREOF the number of original bills of lading stated below all of this tenor and date has been signed, one of which being accomplished the others to stand void.

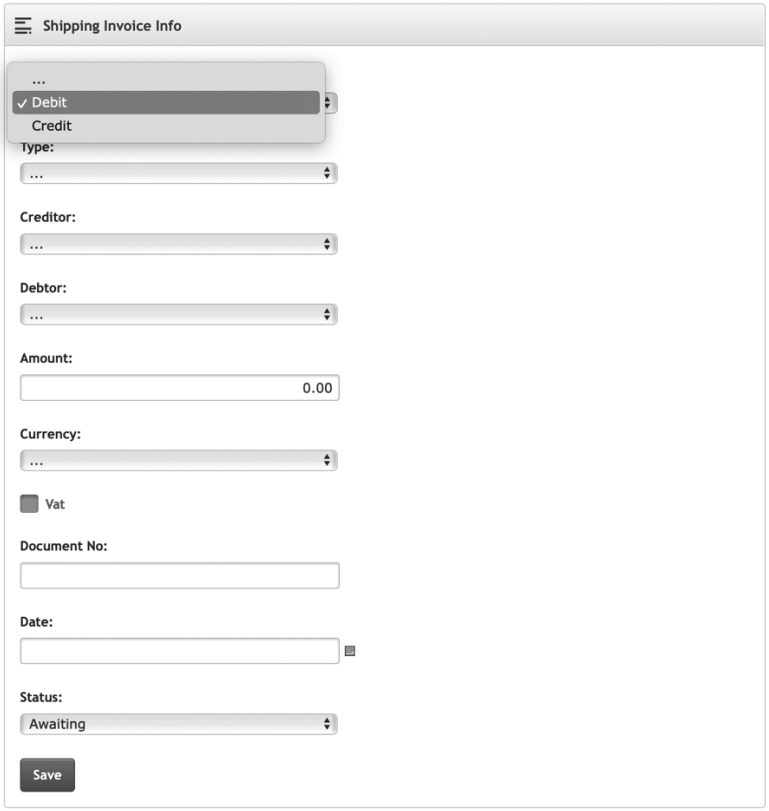
Terms of delivery	Place and date of issue :
EXW	AMBARLI 16/01/2021
Number of original Bs/L	Signed by
3 (Three)	UAB"TYHOLT" as agent of the carriers, masters, owners, of the respective vessels, severally but not jointly

KSHAL displays all the needed information on H B/L accordingly. Bill of Ladings is issued as three original issues and three copies that form a set of documents. The issued bill of ladings is later endorsed by the freight forwarder, stamped and delivered to the rightful owners.

At the final stage, we submit our 'expected' costs records and income invoices to create the shipment's Profit/Loss results. In container shipping, any expense is an expected cost until the actual invoice is received and booked. The expected cost and realized cost might differ on various occasions. Consequently, there are two definitions for the income and cost records as "awaiting' which means the invoice has not been received (or issued) and booked yet and as "paid" when a particular document is booked and paid.

Figure 114

Cost and Income Registry Section



Income invoices (Credit) are issued from this section. Cost invoices (Debit) are also recorded into KSHAL via the same forms. Once we choose Debit from the 'Position' menu, we define the cost we expect from our vendor. All the cost (and income) types are

dynamically alterable items. These invoice items come as default, as shown in the figure below on KSHAL;

Figure 115

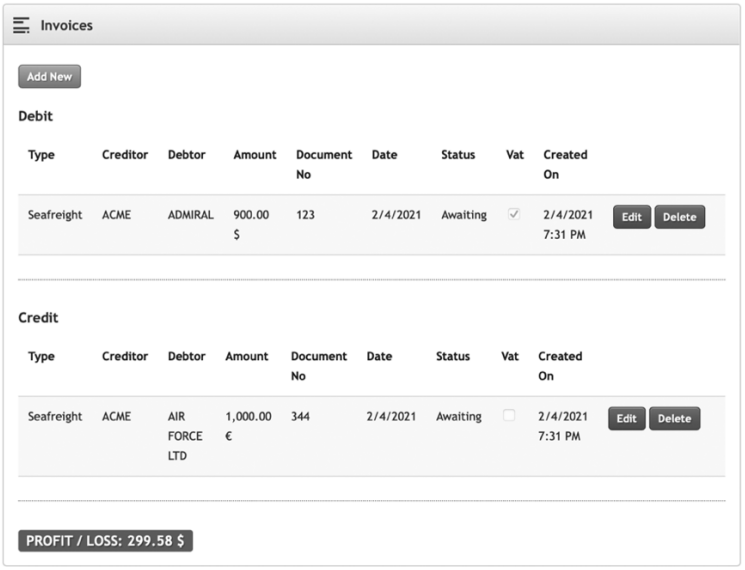
Invoice Items

"Detention" is calculated for trucks' waiting days. Free of charge detention time changes from market to market. It is 12 hours in Turkey, 24 hours in Ukraine, 4 hours in Sweden. Any time that exceeds the free detention limit is chargeable, and the "Detention" item represents this expense on KSHAL. Agency Fee is the charge we pay to our agents based on our contract, or we collect it the same way as our income. *Demurrage* is the free that is applied on containers that exceed the defined free times. Storage expenses occur in ports. Storage is calculated from day zero. The loaded unit arrives at the port until the empty units get delivered to the designated container storage. There is no free-of-charge storage in Turkey but the first three calendar days are free of storage expenses in Ukraine. Tlx Fee is the abbreviation of Telex Release Fee. It is applied when the shipper applies for cargo release to the consignee without the original bill of lading. KSHAL users may create individual invoices for each item or create a bulk invoice with more than one item shown on the document. Income invoices are generated as MS Excel files by using the EPPlus

feature of .Net. EPPlus is a library that reads and writes Excel files using the Office Open XML format (xlsx). EPPlus has no dependencies other than .NET. The last job that needs to be done operationally in the shipping module of KSHAL is submitting expected costs and income items. The ERP has a currency converter feature that can automatically calculate profit or loss results of different currencies and display the result in the primary currency, which is pre-defined as USD. When it is a profitable result, KSHAL indicates the same in green colour. When it is a loss, it is indicated in red colour with a minus in front of the sum.

Figure 116

Profit & Loss Table



As a conclusion and a closure of this chapter, the shipping module of KSHAL is a consistent and hardwearing part that delivers technological facilities and an easy to adapt and learn container shipping operations model. As well as the other modules of the program, the shipping module is fully customizable, responsive, lean, and straightforward to utilize.

3.7 Parametric System Management Module

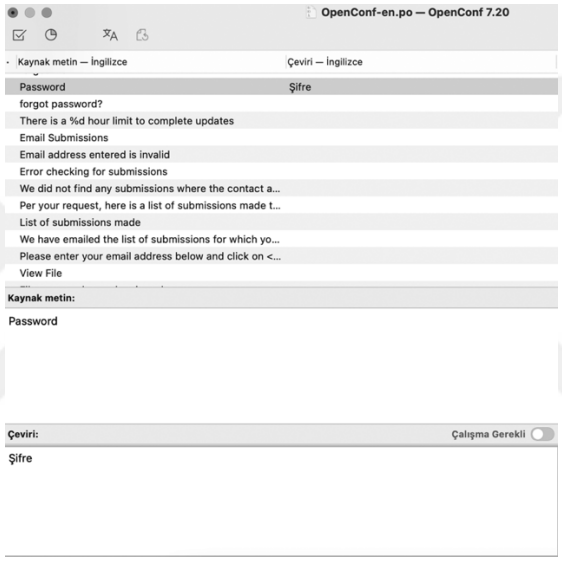
KSHAL's parametric system structure is used to define the flexibility of which the program can offer. This flexibility represents dynamism. Any ERP program with fixed navigation pannels, static components and complicated screen design is outdated. Contemporary ERP alternatives are semi-designed platforms that get their final shapes and running forms after customising their end customers' business models. It is not too daring to say that maritime logistics ERP alternatives are evolving from fixed, rigid pocket programs to tailor-made products which are open for further adjustments. There is no dispute or controversial discussion between staying loyal to our UX while providing the utmost flexibility to our users. This approach has been an indivisible part of our user experience design from day one. Supplying flexible, dynamic and parametric software as a strategical approach was embedded into KSHAL's unique UX from the beginning. Therefore, it is a coherent strategy.

KSHAL comes in English as the default language of the program. Therefore, all freight forwarders, shipping entities, SCM companies dealing with container trading, international container shipping communicate with their partners in English. Anyhow, this is not a limitation for us to get the program offers other languages. Every visible component, definition, sentence, notification, word, phrase, or link has unique singular and plural ID codes in KSHAL. This means that all these components can be changed into whichever different language is needed by using .PO files. While communicating with our international logistics partners, English is the most standardised and straightforward way; however, KSHAL has been designed to quickly adapt to other foreign languages by using portable object files. .PO files are spreadsheet-type documents that are fit for human read

and edit. The sentences can be translated into any desired language by using .PO file editors such as POEdit. Once they are uploaded on the server-side, these files are compiled and turned into .MO files.

Figure 117

POEdit Language Editing



Thanks to the MS SQL DB management system's advantages, KSHAL is able to 'speak' all languages, which can be translated by referring to our default English .PO table. KSHAL is capable of 'speaking' languages that use nonlatinic alphabets such as Russian, Greek, Tagalog, Urdu or alphabets displayed in the right to the left array such as Hebrew or Arabic. In addition to this, KSHAL customers do not need to pay for these extra language demands, unlike they are asked to pay for up to four-digit sums in USD by rival ERP programs in the market. This is one of the many advantages available when KSHAL is used at maritime logistics companies.

All maritime logistics companies shipping goods internationally use multiple currencies in their ERP programs. These currencies mostly are the United States of America

Dollars (USD), the European Union Currency (EUR), Great Britain Pound (GBP) and their local currency, which is TL in our case. The currency management system can also be interlinked into other alternative currencies and have these currencies automatically updated instantly.

Figure 118

Auto Currency Update Attributes

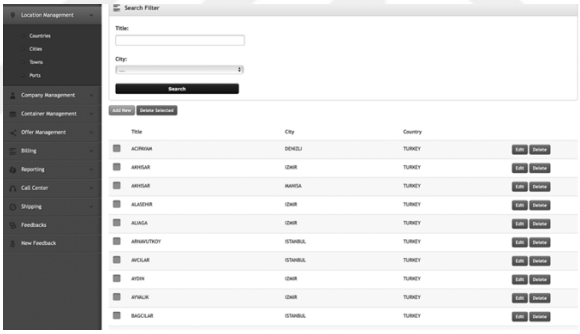
```
{
    2 references
    public static class CurrencyManager
    {
        private const string TodayUrl = "http://www.tcmb.gov.tr/kurlar/today.xml";

        2 references
        public static void Execute()
        {
            var response = Nhea.Web.Helper.RequestHelper.PostHttpRequest(TodayUrl);
            var doc = XDocument.Parse(response);

            using (CurrencyRepository currencyRepository = new CurrencyRepository())
            {
                foreach (var element in doc.Root.Elements())
                {
                    var currencyCode = element.Attribute("CurrencyCode").Value;

                    if (currencyCode == "USD" || currencyCode == "EUR" || currencyCode == "GBP")
                    {
                        var currency = ParseXml<Currency.CurrencyModel>(element);

                        var currencyDb = currencyRepository.GetSingle(query => query.Code == currencyCode);

                        if (currencyDb == null)
                        {
                            currencyDb = currencyRepository.CreateNew();
                            currencyDb.Title = currency.Isim;
                            currencyDb.Code = currencyCode;
                            currencyDb.ExchangeRate = 1;
                            currencyDb.Status = 1;
                        }

                        currencyDb.ForexBuying = currency.ForexBuying;
                        currencyDb.ForexSelling = currency.ForexSelling;
                        currencyDb.BanknoteBuying = currency.BanknoteBuying;
                        currencyDb.BanknoteSelling = currency.BanknoteSelling;
                        currencyRepository.Save();
                    }
                }
            }
        }
```

As shown above, KSHAL pulls the currency exchange data right from the National Bank's website peer to peer and displays whichever currency is desired accordingly. The number of currencies can be modified, changed based on KSHAL customers' demands. As we update this feature with new currencies, all the freight and container-related calculations are also updated in the program. Exchange rates are also displayed on the upper right-hand side corner of the main dashboard. These exchange rates are used by KSHAL when profit/loss reports are generated for each shipment or container. They are also used in activity reports.

KSHAL has its Location Management module that allows us to define countries, cities related to these countries, towns related to these cities and ports related to these towns. There is a hierarchical structure in this concept. Logically, no town can exist without being assigned to a city and no port without a town or a city that it is addressed in. KSHAL does not come as already all the cities, towns and ports of the world defined into it. These tasks can be done by the customer manually. The reason is to give users an initiative to create their working site by submitting whichever port or town they wish to submit.

Figure 119

Location Management Module

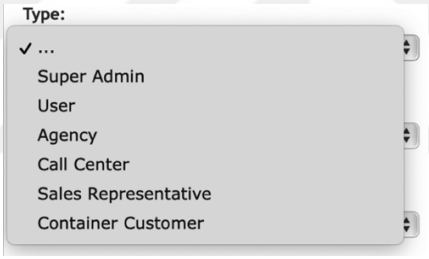


The same methodology is applied to Company Management Module. This is the place where all roads meet on KSHAL. Company cards are detailed identities of each commercial entity we interact with as KSHAL users. Our customers, vendors, shipping lines agents, container buyers are registered here. Each company has its commercial role that explains the level of communication we have between each other. These roles are also customizable ingredients of the company management module. Here in this module, Super Admin can submit new users of KSHAL and define their authorization boundaries by assigning each user a sub role as User, Agency, Call Center Staff, Sales Representative and Container Customer. Our international partners use the agency role. They have their

authorized screen structure. They have their restricted version of KSHAL, which they can not see particular data sets, such as profits and costs. Container customers can see container stocks at specific locations in whichever country the container customer exists. For example, a buyer from Ukraine may observe depots and stocks only in Ukraine by default. If the same buyer is interested in stocks stored in Israel, they must ask for an additional update in its authorizations. These roles and their Read-Write-Delete permits are also fully customizable.

Figure 120

User Roles



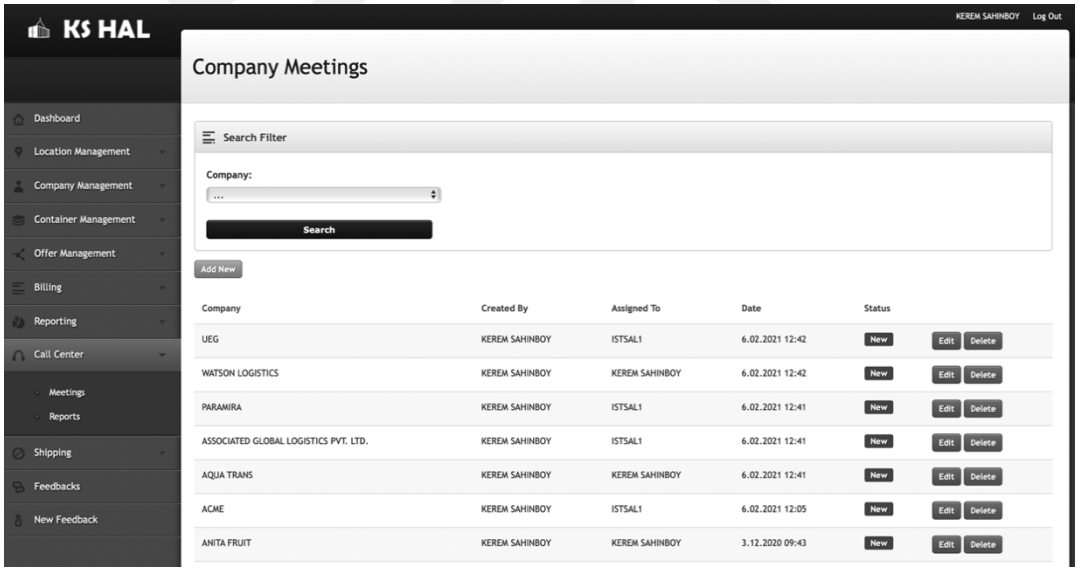
The parametric system module of KSHAL is one of its reassuring and convincing features that uplift the level of the program as a sufficient and contemporary ERP alternative for maritime companies. The stricity of conventional ERP programs will not pledge users of KSHAL; instead, they will have complete independence and initiative to design their business model with the support of web-based software that delivers stable and effective shipping solutions. KSHAL's dynamic, flexible and modular infrastructure paves its way for future developments as well. All existing modules are supplied to users without a different pricing strategy, unlike its opponents. All modules are sold as inseparable parts of the main framework in conjunction with the KSHAL's kernel.

3.8 Call Center Module

KSHAL's call centre module is designed for marketing activities fulfilled by outcalls, incalls and active sales campaigns by visiting potential or already acquired customers. In the maritime logistics industry, companies sell services, so, for promoting the services, they use an endless amount of options that are available, such as e-mail campaigns, advertising on a wide array of media sources, hot calls, customer visits at their premises or inviting them at their workplaces.

Figure 121

Call Center Module Dashboard



Freight forwarders, shipping companies, hauliers, warehouse operators, container dealers use all benefits of communication tools to retrieve validated information sets regarding which exporter, importer or container customer is active in their market segments. The information they have is valuable but evaluating it adequately and using it for their sales force is more important than just having the data. For example, it would be futile to sell freight services to an exporter that ships freight collect basis. An importer who ships

their goods in small parcels by air cargo will not be interested in discussing container trade possibilities. Therefore, SCM companies recruit experienced outcall marketing personnel for contacting relevant potential customers. Hence, we must indicate that existing, already acquired customers are also potential customers for our additional services, which we have not sold yet. Thus, each outcall we make is a valuable attempt for converting our know-how into gain. Freight forwarding companies need well-crafted, skilled I.T. products, such as KSHAL, capable of managing large sales and marketing teams. It has been mentioned before that industry players went hyper-local decades ago. Big groups such as LKW Walter positioned their primary marketing team in the headquarters while having their local sales offices perform daily visits to potential customers at their premises in different locations of the world.

Table 97

Call Center Activity Definitions

Meeting Type	Call, Face-to-Face
Country	Choose a country
Freight Type	Road, Sea, Air, Rail, Multimodal
Payment Type	Prepaid, Collect
Direction Type	Export, Import, Transit
Carriage Type	Full Truck, Groupage, Full Container

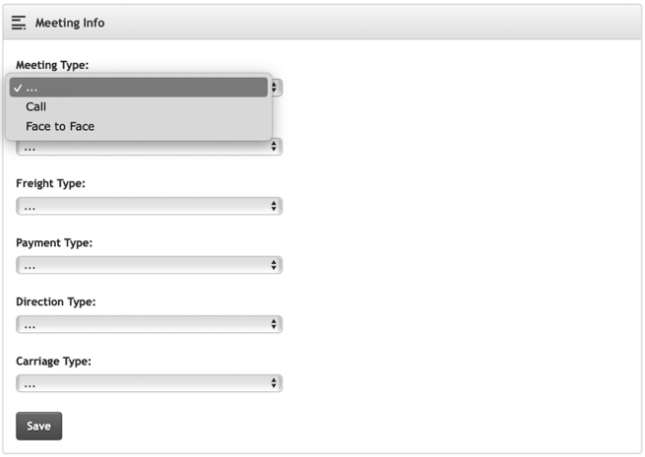
Any authorized call centre user might contact the desired sales personnel who works in the field through the program. This means that a call centre officer located in Istanbul should be able to set up meetings for an appointed sales manager who works in Kayseri through the ERP. In return, those field sales officers can submit their sales reports, price quotations, feedback notes about competitor details, marks and comments through

the same platform. From this point of view, the goal was to create a digital agora where all staff, management, partners, customers, vendors gather and create value together. KSHAL call centre module has been designed to achieve this goal, and it has accomplished it at specific scales.

According to the result of that conversation, a call centre marketing officer reaches out to a potential customer and assigns a meeting task to a salesperson. Once the assigned field sales officer performs the actual meeting, he or she submits a feedback report, mainly answering the questions of which routes (countries) the customer is dealing with, what type of transportation modes they use (road, sea, air, rail, multimodal), do they pay for freight or their buyers, which business direction do they ship their goods (import, export, transit), how do they get their goods carried (full truckload, groupage or less than container load, full container load).

Figure 122

Meeting Details Form

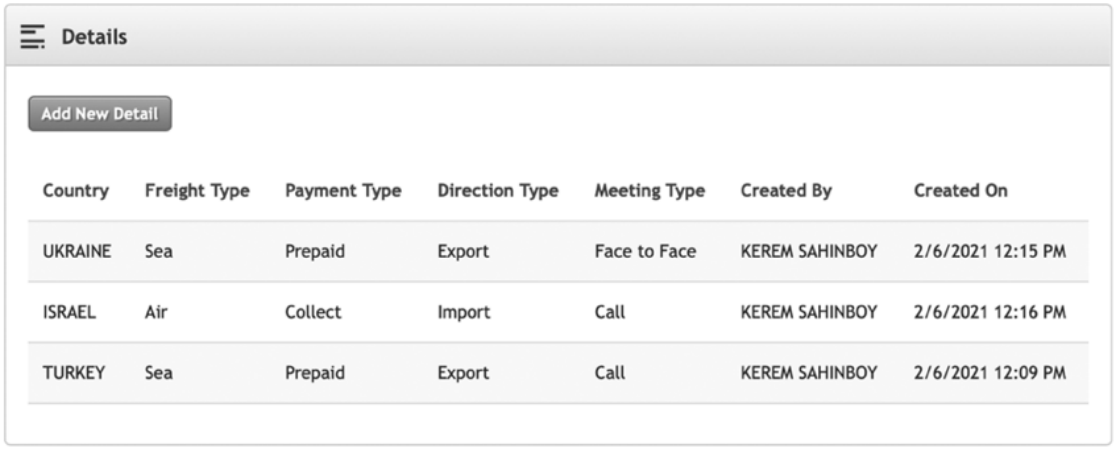


The customer might have multiple business routes, types of payment or carriage types. For instance, the customer might be shipping to The Netherlands by using

international full truck transportation services as prepaid. Also, the same customer might be imported from India by air cargo as freight collect. If they decide on freight payments at their side (based on TOS), we may engage in commercial activity faster than the option that their buyers or sellers pay for freight abroad. If the customer whom our field sales officer visited is not the freight payer party, we sent their vendor or buyer's contact details to our international partner(a) as a "sales lead" so they may initiate communication with the freight payers in their territory. All this valuable information gets submitted into KSHAL's Call Center module.

Figure 123

Meeting Feedback Table

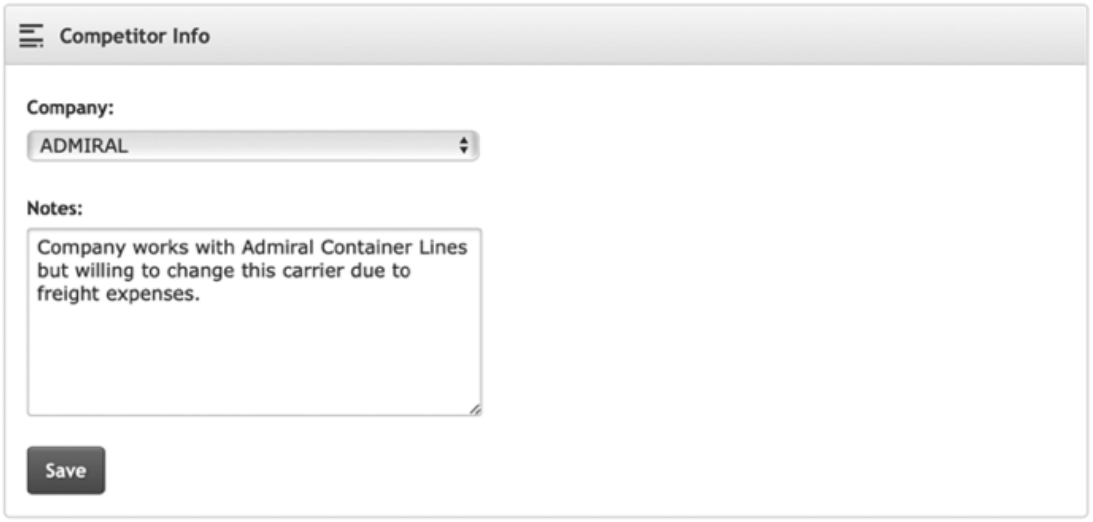


Country	Freight Type	Payment Type	Direction Type	Meeting Type	Created By	Created On
UKRAINE	Sea	Prepaid	Export	Face to Face	KEREM SAHINBOY	2/6/2021 12:15 PM
ISRAEL	Air	Collect	Import	Call	KEREM SAHINBOY	2/6/2021 12:16 PM
TURKEY	Sea	Prepaid	Export	Call	KEREM SAHINBOY	2/6/2021 12:09 PM

As seen above, the same customer has been phoned twice, one for their domestic shipments within Turkey. They pay freight themselves (Prepaid) and two others for Ukraine and Israel as each has a different mode of transportation and payment types. In addition, the customer was visited by a field salesperson (Face to Face) to discuss their sea shipments to Ukraine.

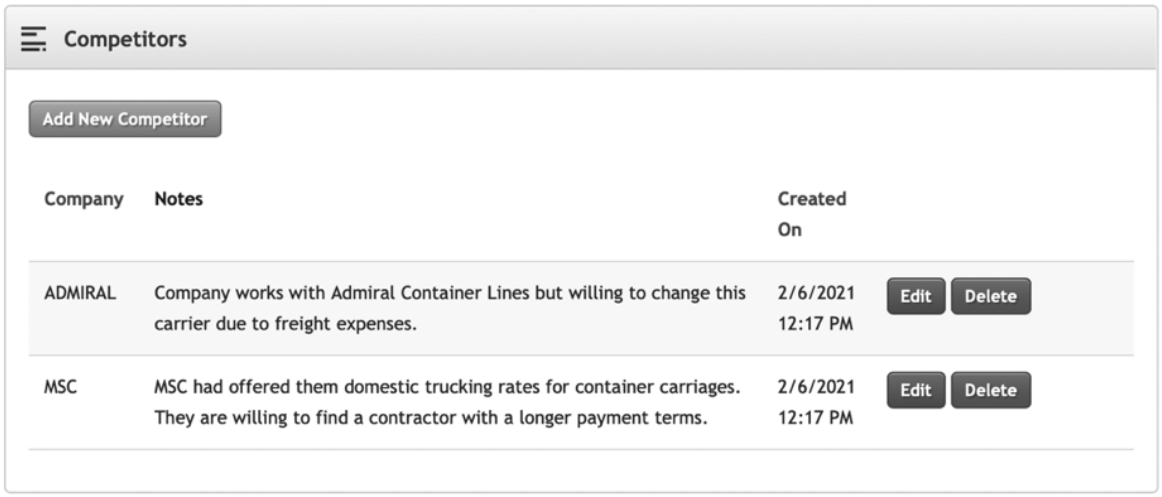
Figure 124

Competitor Information



There is a “Competitors” table right beneath this table where both call centre staff or field sales personnel may submit their phone conversations or face-to-face notes. Who are our competitors, and what should we do to attract customers to use our services instead? The purpose behind having details of our competitors submitted into company cards is to move KSHAL into A.I. direction at later stages. If we need to compile data and analyze it by the big data tools in the future, we should have found ways to keep it categorized for smooth processing. Thus, KSHAL has the least amount of free text boxes possible. Besides this method is preventing duplications (a common and serious problem among freight forwarding companies), it also collects data in well-coordinated categories.

Figure 125 - *Competitors Table*



Super Admin may obtain activity reports of each user's outcalls and customer meetings in defined terms on the Reports page. KSHAL's call centre module has a narrowed activity field comparing CRM programs. The call centre module does not have bulk email sending or newsletter apps designed within the pannel due to the negative impact of those methods being vigorously visible in the market. Nevertheless, it has complete call centre activities, meeting reporting features, comments section, activity reporting section. Furthermore, it works with the offer management module in harmony under the same roof as the KSHAL. This approach is a simple, practical and valuable tool that helps maritime companies coordinate their sales and marketing activities through the same platform.

3.9 Billing Module

The billing task is an inseparable part of the whole operations performed on KSHAL. Therefore, the development process is decided to position the billing section as an independent module in the program. One of the reasons why KSHAL has a built-in, independent billing module is the probability of issuing invoices unassociated with shipping or container trading activities. The cost and income invoices are shown in the same dashboard; anyhow, they are sortable according to their status tags. There are three status tags for invoices, as shown in the below table.

Table 98

Invoice Status Tags

New	When the invoice is issued as a fresh document.
Paid	When a remittance is received or sent related to an invoice
Canceled	When it is canceled, turns off the grid but still visible.

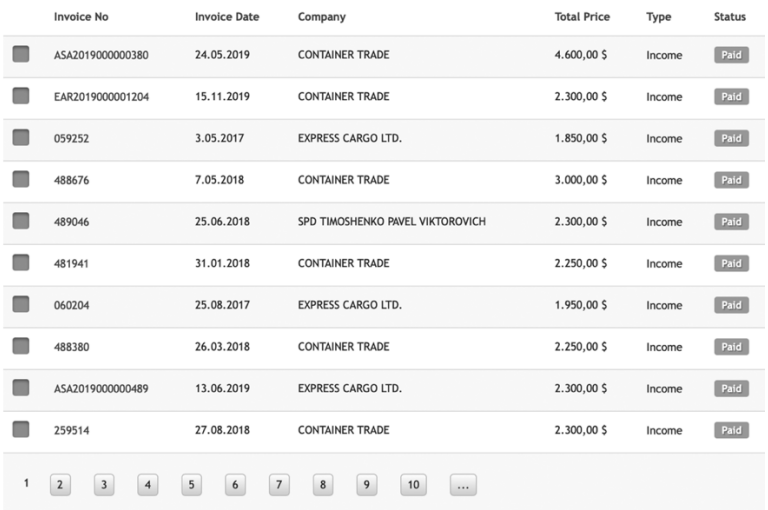
Cancelled invoices are one of the biggest obstacles in front of performing accurate reconciliation of accounts between maritime logistics companies. This problem may become unbearable if no prevention methods are applied at SCM corporations. Any ERP program must measure the mass of cancelled invoices with all aspects and reasons. In shipping, as mentioned previously, commercial roles may have bilateral identities. A vendor who is selling us domestic container trucking services may become our container shipping customer at the same time. As shipping line customers, we may become a container leasing company when the shipping line needs empty equipment for their goods. This flow explains to us how important it is to keep all the accounts accurately and continuously reconciled. Suppose cancelled invoices are not monitored at all company

stages, from the accounting department to top management. In that case, many business projections may fall short or be realized far from the plans. Intequity and accuracy of the records of receivables, cash flows, investment plans, bad debts, profit reports and performance reports depend on revealing the pitfalls before they become big black holes. In order to achieve this goal, KSHAL tracks the number of cancelled invoices. Cancelled invoices are taken off the grid, they no longer influence profit/loss reports once they are cancelled, but they are kept visually and statistically trackable for managerial purposes.

The dashboard shows us the invoice number, invoice date, whom they were issued to or by which company they have been issued to us, the sum of the invoice, type of the record, whether it is an income or a cost invoice and the status of the debit note whether it is a new one expecting for payment, a paid one or a cancelled item.

Figure 126

Billing Module Dashboard



Invoice No	Invoice Date	Company	Total Price	Type	Status
ASA2019000000380	24.05.2019	CONTAINER TRADE	4.600,00 $	Income	Paid
EAR2019000001204	15.11.2019	CONTAINER TRADE	2.300,00 $	Income	Paid
059252	3.05.2017	EXPRESS CARGO LTD.	1.850,00 $	Income	Paid
488676	7.05.2018	CONTAINER TRADE	3.000,00 $	Income	Paid
489046	25.06.2018	SPD TIMOSHENKO PAVEL VIKTOROVICH	2.300,00 $	Income	Paid
481941	31.01.2018	CONTAINER TRADE	2.250,00 $	Income	Paid
060204	25.08.2017	EXPRESS CARGO LTD.	1.950,00 $	Income	Paid
488380	26.03.2018	CONTAINER TRADE	2.250,00 $	Income	Paid
ASA2019000000489	13.06.2019	EXPRESS CARGO LTD.	2.300,00 $	Income	Paid
259514	27.08.2018	CONTAINER TRADE	2.300,00 $	Income	Paid

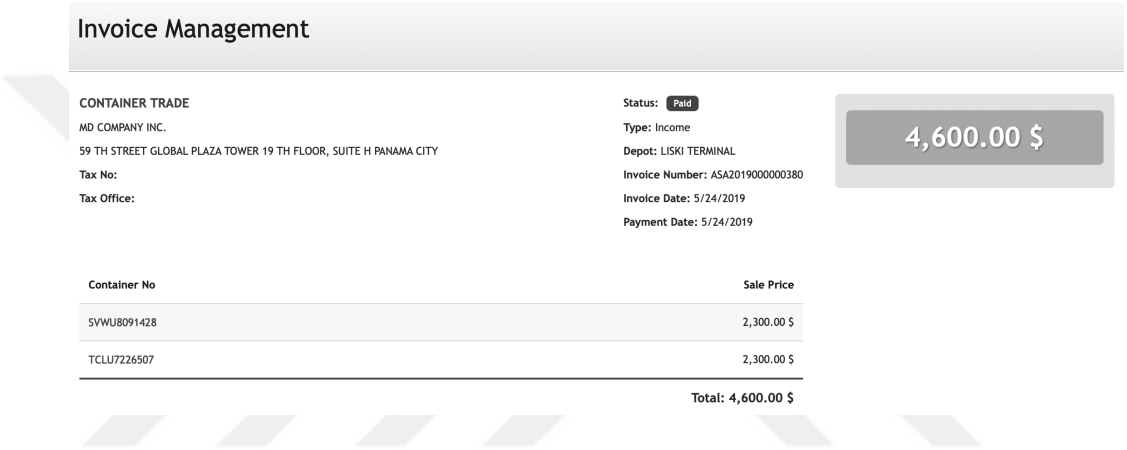
1 2 3 4 5 6 7 8 9 10 ...

When clicked on, the edit button takes users to the details of the subject invoice. Users are not authorized to delete invoices. Deleting privilege was given to Super User(s) only. On the details page, if the invoice was issued for container trading activity, container

numbers are clickable links that take us to records of designated units. The right upper corner of the screen was allotted to the general sum of the invoice displaying the amount in any currency in which the invoice was issued.

Figure 127

Invoice Management Detail Screen



Each cost must be associated with a container or a shipment that is also existing in KSHAL. Therefore, the program asks which container is this cost invoice we are recording while submitting the invoice's particulars. This feature is available for preventing record duplications and unsolicited expenses. There should not be any cost invoice that is not related to and shipment or container. The cost invoices are also pre-defined as expected costs. Once the physical invoice arrives, the same record gets updated and turned into a realized cost. At this stage, we can be sure of our profit level if all payments are made bilaterally.The billing module is not an "all-inclusive" accounting portal. However, it works as a simple and effective component of KSHAL that is used to issue invoices, register cost invoices, and control the cancelled invoices. It is directly linked to all other modules. It allows users to perform a part of pre-accounting tasks such as generating income invoices and recording payments or cost invoices without leaving the software.

3.10 Reporting Module

Reporting module was designed to show users their activity results between two selected dates in full scope. Profit or loss, containers in stocks, active buyers, routes, container types, container status criteria can be shown in the reports. Once dates are selected, KSHAL creates an Excel file output and displays these figures in order.

Figure 128

Container Report Section

Container No	Type	Status	Departure Port	Destination Port	Buying Date	Buy Price	Sell Price	Profit	Ref. No.	Load Date	Arrival Date
FSCU6998050	40 HC	Gate Out	AMBARLI	ODESSA	24.04.2020	1.800,00	2.300,00	500,00	1476	6.05.2020	9.05.2020
CLHU8713566	40 HC	Gate Out	IZMIR	ODESSA	25.03.2020	1.950,00	1.800,00	-150,00	1309	25.03.2020	30.03.2020
IKSU8619663	40 HC	Gate Out	IZMIR	ODESSA	25.03.2020	1.950,00	1.800,00	-150,00	1309	25.03.2020	30.03.2020
TCKU9018819	40 HC	Gate Out	IZMIR	ODESSA	25.03.2020	1.950,00	2.300,00	350,00	1309	25.03.2020	30.03.2020
MSCU7036573	40 HC	Gate Out	IZMIR	ODESSA	25.03.2020	1.950,00	2.300,00	350,00	1309	25.03.2020	30.03.2020
INKU6397514	40 HC	Gate Out	AMBARLI	ASHDOD	20.03.2020	1.750,00	2.300,00	550,00	1313	26.03.2020	30.03.2020
OOLU8271752	40 HC	Gate Out	AMBARLI	ASHDOD	12.03.2020	1.850,00	2.300,00	450,00	1254	19.03.2020	25.03.2020
GESU5463430	40 HC	Paid	AMBARLI	ASHDOD	11.03.2020	1.850,00	1.800,00	-50,00	1251	19.03.2020	25.03.2020
GESU5712255	40 HC	Gate Out	AMBARLI	NOVOROSSYSK	11.03.2020	1.850,00	2.300,00	450,00	1251	19.03.2020	25.03.2020
BSIU9089790	40 HC	Gate Out	AMBARLI	NOVOROSSYSK	6.03.2020	1.850,00	2.300,00	450,00	1166	1.03.2020	18.03.2020
KKFU7582555	40 HC	Gate Out	AMBARLI	NOVOROSSYSK	2.03.2020	1.825,00	2.300,00	475,00	1212	8.03.2020	12.03.2020
CLHU8780857	40 HC	Gate Out	AMBARLI	NOVOROSSYSK	28.02.2020	1.825,00	2.300,00	475,00	1210	8.03.2020	12.03.2020
CLHU8709020	40 HC	Gate Out	AMBARLI	ASHDOD	27.02.2020	1.825,00	2.300,00	475,00	1195	1.03.2020	6.03.2020
TGHU8032444	40 HC	Gate Out	AMBARLI	ASHDOD	27.02.2020	1.825,00	2.300,00	475,00	1196	1.03.2020	6.03.2020
KKFU7550820	40 HC	Paid	AMBARLI	POTI	27.02.2020	1.825,00	2.300,00	475,00	1194	1.03.2020	6.03.2020
TGHU8408505	40 HC	Gate Out	MERSIN	POTI	26.02.2020	1.825,00	2.300,00	475,00	1188	1.03.2020	6.03.2020
TGHU8172071	40 HC	Gate Out	MERSIN	POTI	26.02.2020	1.825,00	2.300,00	475,00	1188	1.03.2020	6.03.2020
TGHU7983074	40 HC	Gate Out	MERSIN	ST.PETERSBURG	26.02.2020	1.825,00	2.300,00	475,00	1175	4.03.2020	8.03.2020
SKYU2265830	20 DC	Gate Out	MERSIN	ST.PETERSBURG	26.02.2020	2.100,00	2.750,00	650,00	1180	4.03.2020	8.03.2020
SKYU2265790	20 DC	Gate Out	AMBARLI	ST.PETERSBURG	25.02.2020	2.100,00	2.750,00	650,00	1171	25.02.2020	29.02.2020
XINU8124396	40 HC	Gate Out	AMBARLI	ST.PETERSBURG	25.02.2020	1.825,00	2.300,00	475,00	1174	4.03.2020	8.03.2020
TGHU7934700	40 HC	Gate Out	TRABZON	ODESSA	7.01.2020	1.750,00	2.000,00	250,00	952	7.01.2020	17.01.2020
TGHU8154648	40 HC	Gate Out	TRABZON	ASHDOD	7.01.2020	1.750,00	2.000,00	250,00	952	7.01.2020	17.01.2020
TGHU8153702	40 HC	Gate Out	TRABZON	NOVOROSSYSK	7.01.2020	1.750,00	2.000,00	250,00	952	7.01.2020	17.01.2020
TGHU8209695	40 HC	Gate Out	TRABZON	POTI	7.01.2020	1.750,00	2.300,00	550,00	952	7.01.2020	17.01.2020
AMFU8706933	40 HC	Gate Out	SAMSUN	ALEXANDRIA	8.11.2019	1.775,00	2.300,00	525,00	841	7.12.2019	12.12.2019
TGHU9353541	40 HC	Gate Out	SAMSUN	PORT SAID	6.01.2020	1.750,00	2.300,00	550,00	950	6.01.2020	17.01.2020

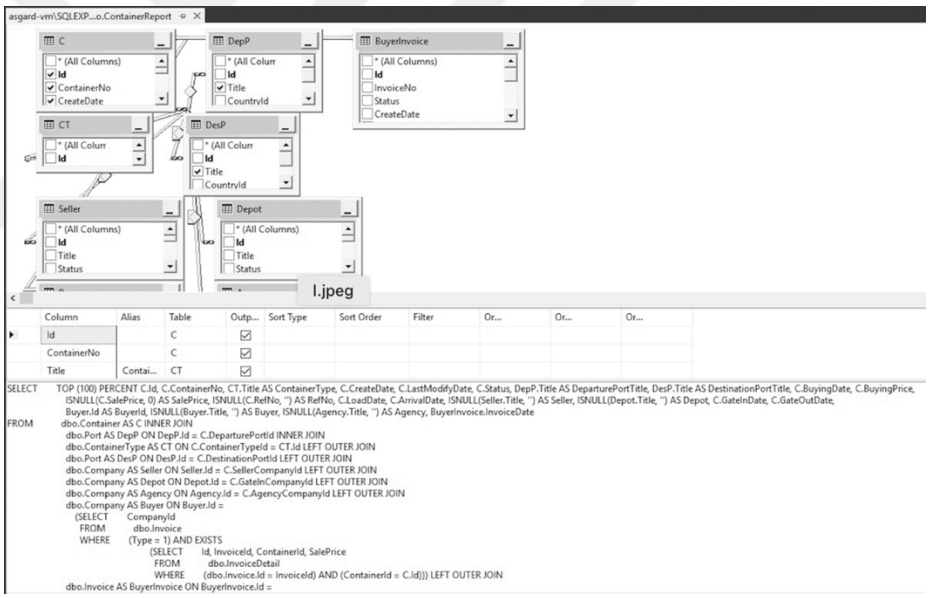
There are two pre-defined report templates available that come as default with the program. The first one is the Container Report, and the other is the Customer Report. When the container report is created, the program delivers an Excel file showing all the available variables in the ERP. It is also possible to add more customizable report templates on demand. Reporting module functionality is one of the components which ultimately gets designed for each KSHAL user company once the software is deployed for their service. Customer report shows the activity performance of different companies based on their

business volume, the number of containers purchased, total revenue and profit. This feature is also displayed as an Excel file.

One of the valuable assets and remarkable advantages of relational databases is the possibility of getting various data columns associated with each other to create customized reports through the program. For example, KSHAL can offer several reports in a broad spectrum of variables with this facility, as shown below.

Figure 129

Report Creation, Back-End



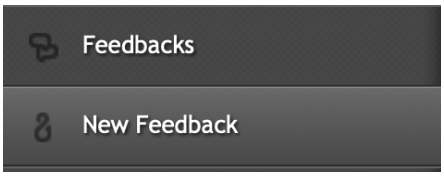
The data tables shown above can be linked to each other at the back-end to assign them designated attributes for creating brand new report templates. The way that KSHAL can offer customization of reports is also flexible. There can be user-specific reports rendered by a particular user's login credentials or user-company specific outputs. Each operation person might need to generate a different type of report. As simplicity and lean design are our primary goals while creating a web-based maritime logistics ERP alternative, having the reports module designed with the same principle reveals its consistency.

3.11 Error and Feedback Handling Module

Today, each contemporary ERP alternative must have an error and feedback handling feature embedded into the program as its integral component. Besides being a technical asset, this small but essential detail also shows how the ERP developer company approaches its customers' needs. Having a purposive error and feedback handling module is a sign of a customer-oriented management system that prioritizes its customers' demands, suggestions, and problems. From another point of view, it is a win-win relationship between the software developing entity and the users of that particular program. Occasionally, the suggestions from the customers effectively assist the developer team in re-shape certain parts of the software. Having an actively open line between these two parties permanently enriches the mutual benefit. Thus, while the ERP program becomes stronger, error-free, uniquely stable and functional, not only users of the program enjoy the results; programmers also do.

Figure 130

Feedback Module on Navigation Panel



KSHAL's error and feedback handling module establish a direct connection between the developers and the program users. An instant messaging and ticketing feature ranks all feedback messages in four stages: ' Unread', 'Read', 'In Process' and 'Completed. These stages show how each feedback is queued and processed. When a customer has a question, suggestion, complaint, error report or a request, click on the New Feedback

button. The user submits the title of the message and the details of the message in a free text format into the form.

Figure 131

New Feedback Form

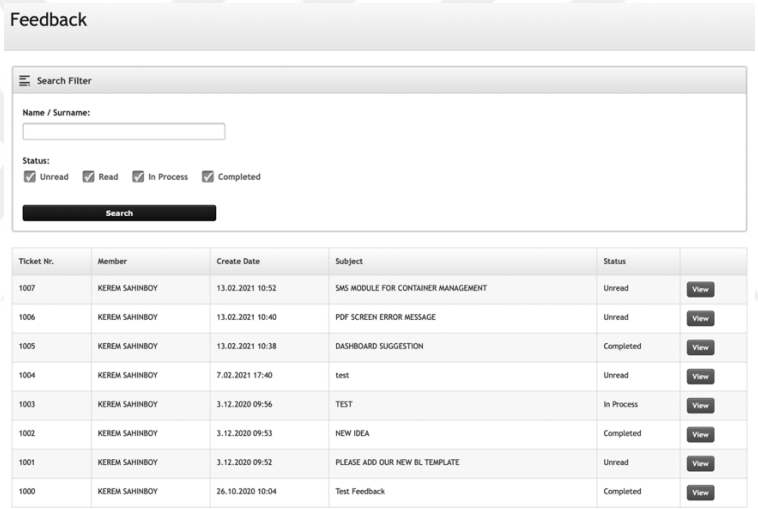
Once the customer submits a feedback message, KSHAL triggers an auto email to the project leader of the developing team and also the same ticket gets shown on the dashboard of the module. The user also can track it with its status that changes from 'Unread' to 'Completed' through time. Each message has a unique ticket number that makes assigning different tickets to different developers in the engineering team easier. The feedback module turns a complicated communication process between the software supplier and its hyperlocal customers into a hassle-free collaboration. This feature reduces the complexity of reaching the software developers, which may become a difficult job for the end customers in certain situations. As an extension to the subject, communicating through emails or mobile messaging are also ineffective methods that may cause inconvenience for both parties. Emails may get lost, mobile messages are not trackable, and most importantly, these options prevent us from measuring the KPI of KSHAL developers. The KPI of the KSHAL team is rendered by criteria such as responsiveness,

accuracy while solving the problems and timeliness. KSHAL's error and feedback handling module provide such benefits to us.

The super admin (user) assigns the tasks to whoever is capable of handling the issues properly. The dashboard shows ticket numbers, the name of the KSHAL user who submitted the ticket, date, subject of the ticket and status of the issue, as shown below.

Figure 132

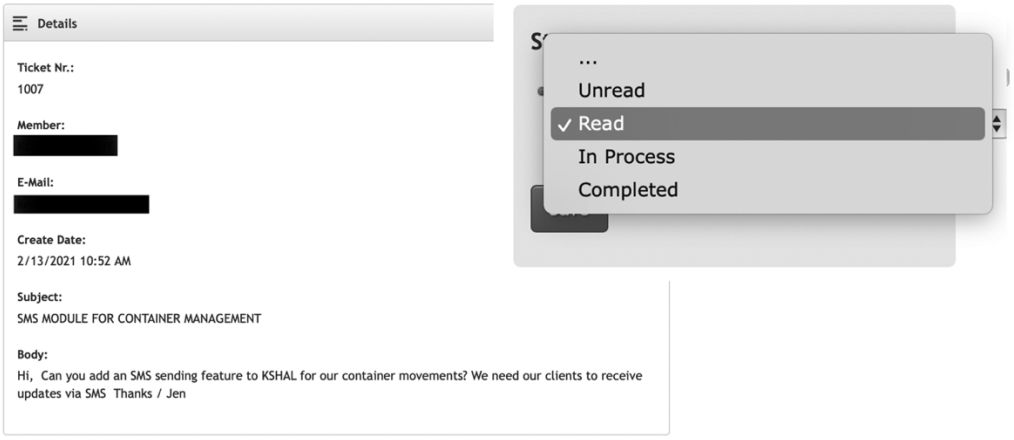
Feedback Module Dashboard



When developers click on “view”, the status of the ticket changes from Unread to Read as a sign that the question is now assigned an engineer from the developer team. The details page shows the content of the message. KSHAL’s customer contract indicates that this service is not chargeable and is offered as an integral part of the KSHAL. KSHAL does not charge a ‘maintenance fee’ to its customers, unlike its competitors shown in this paper. It is one of the critical differences which KSHAL offers to its local and international customers. Once the problem is solved, the same engineer updates the ticket’s status from the same page. The customer may observe that the ticket is closed by KSHAL, the request has resulted in a solution.

Figure 133

Status Update



KSHAL's error and feedback handling module represents how keen the platform was listening to its customers and hearing their voices. Old style software products and their producers were dull, gruelling to communicate with prosaic beings who lack efforts to build reciprocal, open communication channels between their customers. SaaS as a contemporary approach and an eye-opener business method has changed that ineffective style sprinkled with dead soil. The software is no longer a product body in the Saas method, but it is all about the cluster of services surrounding it. In the Saas method, the role of customers has been evolved from inactive and passive actors into active influencers of the primary UX. They take the initiative and get engaged with the developers on an almost daily basis. Thanks to this interactivity, web-based ERP programs such as KSHAL must have embedded feedback modules to keep this collaboration running smoothly. As a result, this module is more than an in-built simple messaging system. It is a tool of collaborative development.

3.12 Commercialization of KSHAL

What is the purpose of a commercial product if there are no buyers of it? A sales activity is one of the reliable certifications that verifies the product's possible commercial success. If the product is sold to a customer, most likely there are other sales opportunities around too. It must be an equipped and competent tool that convinces the buyer that it will respond to the customer's needs. On the one hand, the product itself must be good enough to be bought while the price and after-sales services sufficient for what the potential buyer expects. Therefore, selling software, having it officially commercialized are the actual breakpoints that lead it to other sales contracts.

KSHAL is a web-based maritime software, has been built to create a practical use or a compelling value in adding efficiency to the shipping operations of container merchants and freight forwarders. It was a commercial product from the beginning. It was designed for commercial purposes rather than having a supportive, substituted software backing up several in-house tasks. It is standalone and deployed ERP that works on the web and claims to successfully manage all container trade and container shipping operations for those who need such a tool at their organization single-handedly.

KSHAL had to offer a creative and efficient pricing method to gain customers. The program itself could be convincing in terms of operational competence. However, the pricing method of such products can be restrictive and coercive when it comes down to making a procurement decision. SaaS (Software as a Service) approach upholds such commercial products from a point where they are sold as conventional goods to a level which the software is just one of the services that the customer may buy from the supplier in next to back up services, data hosting, bandwidth management, overall cybersecurity,

consultancy, electronic integrations and maintenance. SaaS converts the software suppliers from a small grocery to one-stop I.T. shops that respond to all the needs of their potential and existing customers. Thus, KSHAL has narrowed its target market segment down to small and mid-sized freight forwarders, which are dealing with container merchanting and container shipping worldwide, who also need an integrated quotation module, billing module, reports features, a detailed company card management section and a fully functional container shipping & operations module which come in budget. Therefore, KSHAL had to have an affordable pricing strategy that makes it easy to be preferred by customers.

Table 99

KSHAL's Tariff Table

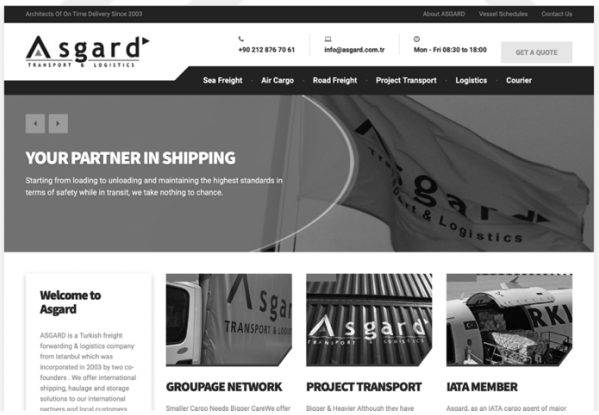
Set-Up Fee	One-Time	500 Usd	Billed for once for each company
CAL	Monthly	5 Usd	Billed for each CAL monthly
Development	On Demand	80 Usd	Billed hourly for each project
Bandwidth	Monthly	20 Usd	Billed monthly for each exceeding GB exceeds 1 GB.
Hosting	Monthly	3 Usd	Billed monthly for each 10 CALs/ company.
Backup Fee	Monthly	1 Usd	Billed monthly for 1GB/company
Custom Design	On Demand	10 Usd	Billed hourly for each project

The purpose of the above-mentioned pricing table of KSHAL is to create the possibility of a smooth transition from the old ERP of potential customers into KSHAL. Price is never the main criterion but always has an essential role in the process of decision. SaaS systems come budget-friendly with low costs and small membership fees. As many customers join the community, KSHAL's sustainable income gets larger while stable costs

such as salaries and office rent remain relatively the same. The start-up price of KSHAL can be as low as 500 Usd at the beginning for a one-time setup fee and a 9 Usd/CAL monthly fee if there is only one user for the program. Compared to the competitors mentioned in this thesis, this is an affordable price offer that remarkably reduces freight forwarders' tech budgets.The first customer of KSHAL became Asgard Transport Llc, which is a Turkish freight forwarding company based in Istanbul (Asgard Transport Llc, 2020). Currently, they use the software for their container trade business, freight quotations, container shipping operations and cost registry platform. They also create "bill of ladings", issue invoices through KSHAL. Asgard Transport has 18 users.

Figure 134

Asgard Transport Llc Website



Note. From www.asgard.com.tr

The second company which became a customer of KSHAL was Smart Logistics Llc, an Odessa-based Ukrainian shipping and logistics company that has its branches in both Odessa and Kiev. Total 42 users registered into the system and began using KSHAL for their daily routine shipping, container depot services in full aspects. Smart Logistics specialises in container storage services as they operate their facility 5 km away from the

container terminal in Odessa (Smart Logistics Llc, 2020). Smart Logistics Llc also operates their container trucks along with subcontracted hauliers. The company actively benefits from keeping KSHAL as their cost registry base for the named services.

Figure 135

Smart Logistics Llc Acceptance Letter

LLC «SMART LOGISTICS»
Reg No:39252018
VAT payer number 392520115538

Ref # ODS 89/20 dated 12th of May 2020

Odessa, Ukraine

Dear Kerem,

We accept your proposal as 500 Usd one time set-up fee and 5 Usd/user per month for KSHAL ERP. We will sign up your contract in a week and register for 25 users.

Yours faithfully,

Maxim Beretsky
Director
LLC "Smart Logistics"

The third customer that has begun using KSHAL was Savicon Transport and Forwarding Llc which is also from Ukraine (Savicon, 2020). The company has container shipping, oversize (out of gauge) transportation, customs clearance, flexitank services. It is a ten years old company that also has a sales team located at their Kiev branch. The overall quantity of Savicon staff using KSHAL is 33. The company actively uses the software for price quotations, cost registry, container shipments, trucking calculations.

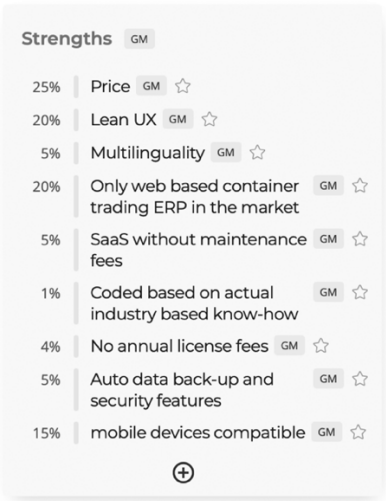
KSHAL is in contact with a number of domestic and international freight forwarders, container depots and container merchants from Israel, Russia, Turkey and Lithuania to expand its customer quantity.

3.13 S.W.O.T. Analysis of KSHAL

KSHAL, like many other similar ERP alternatives, have their strong points, weaknesses while it stands against several threats. These threats are mostly coming from the competitors but are not limited to this fact. However, there are also opportunities in front of KSHAL, which may lead the software into upper leagues or even assist it in creating its league. This section aims to identify, visualize and evaluate these strengths, weaknesses, threats and opportunities by SWOT Analysis. This analysis was performed by the participation of the developers and designer team of KSHAL. Once the parameters of each title are defined, a questionary has been sent to the same participants and the users of KSHAL to know their opinion of how each criterion is weighted. Overall 47 people voted for the weight distribution of each title.

Figure 136

Stengths of KSHAL

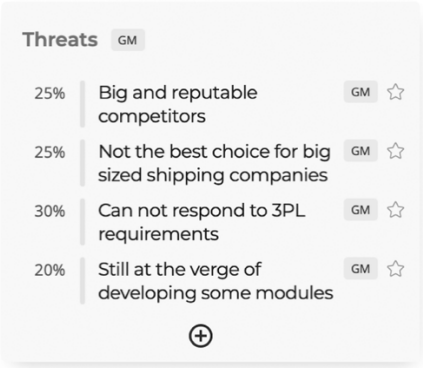


KSHAL's main advantage is its economic feasibility (price) and lean UX. Price is the leading advantage of the program while promoting it to potential customers. The lean and simple UX represents the technical advantage of the ERP, which receives a fast

acknowledgement and recognition from the users. Multilinguality feature is sold as an extension of the rival programs. With .PO files, KSHAL can speak any language at no cost, thanks to its parametric and dynamic back-end infrastructure. This criterion has 5% importance among the voters when they define the strengths of KSHAL. KSHAL is the only web-based container trading ERP in the Turkish maritime market. By this specific feature, it becomes a model providing solution rather than a simple I.T. tool. A SaaS product hosts the program and offers automatic backup and data maintenance services as an integral part of the main body. It simplifies complex tasks and aims to become a turnkey solution for its clients. Some opponent programs require buyers to bear annual license fees for DBMS. KSHAL asks for no license fees thanks to its B2B model, which runs the complete customer data in the same SQL built. KSHAL, thanks to its multiplatform friendly and compatible design, can be used on mobile devices without additional expenditures allocated.

Figure 137

Threats



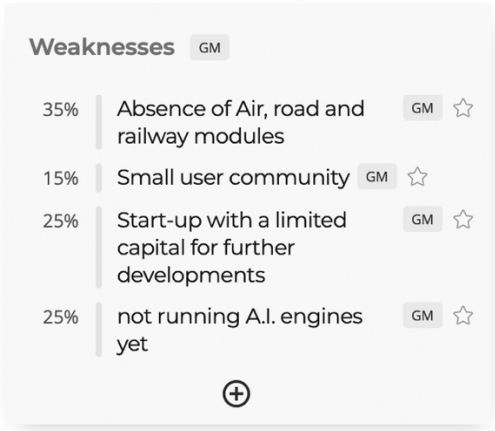
As for threats, KSHAL needs to answer specific questions which are open yet. There are big and reputable competitors which control the most considerable portion of the

market in Turkey. These companies are financially stable and capable of competing even in harsh market conditions. However, acquiring new customers from their portfolios is a challenging task. In addition to this threat, KSHAL is not the best choice for big-sized maritime companies in Turkey. Nevertheless, there is no contradiction to KSHAL's marketing policy that aims to provide reliable I.T. solutions for small and medium-sized freight forwarders, as indicated in the hypotheses of this paper.

Nevertheless, this fact is a threat to the program. KSHAL has its functional limitations, which currently respond to container merchanting, container shipping, sales and marketing. It is far from responding to the needs of 3PL companies yet. As the companies aim to have a single platform that handles their whole commercial flow, KSHAL is threatened by the lack of necessary logistics modules such as customs bonded warehousing, customs brokerage, air, road, rail freight modules.

Figure 138

Weaknesses of KSHAL



KSHAL is a maritime software alternative that focuses on container shipping divisions of the transportation industry. The absence of air, road and railway modules can be considered a weakness of the platform. Although these modules have slight differences

in design, they are not available for the customers dealing with multimodal freight deliveries. In response to this need, KSHAL is budgeting the development of a multimodal freight module that dynamically shifts shape based on the selected mode. This method is more feasible and applicable than having multiple modules for sea, air, road, multimodal, intermodal, oversize cargo, air chartering, vessel chartering, fuel transportation, courier services and such. KSHAL is one of the first web-based maritime software platforms that proposes SaaG as the future of maritime I.T. products. A.I. is an integral part of such structures, which renders big data in order to create recommendations or prescribe solutions. KSHAL lacks "big-data" due to the small community of users for the time being. It is a temporary instance that will/may progress and evolve into a more extensive community in time. The lack of a more extensive community is a weakness when we look at the program's current state. KSHAL is also a small venture with a tight budget compared to established competitors in the same market segment. The overall cost of KSHAL from the blueprints till deployment was 59100 Usd which is 900 Usd shorter than budgeted. Shortage of the start-up capital is an obstacle in front of mass promotions, marketing campaigns and further developments of KSHAL.

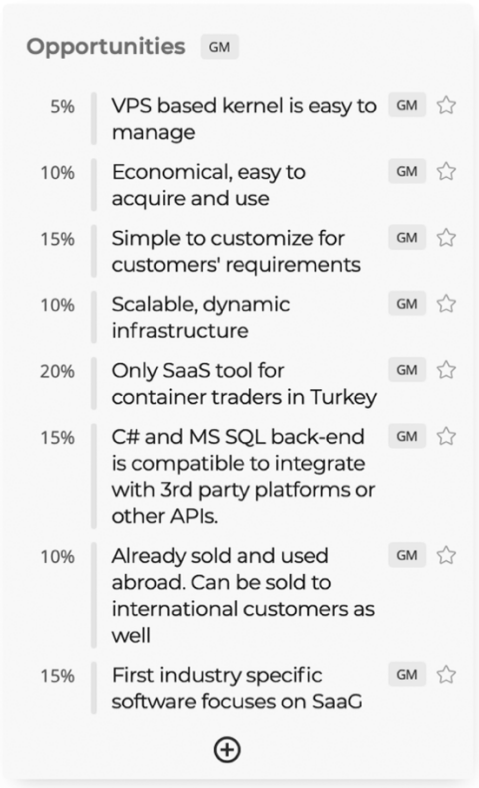
This fact pushes the KSHAL team to be more creative in finding alternative solutions to orthodox problems by using social media campaigns, hot sales by one-on-one contacts, and using the synergic effect of freight forwarder networks, like Universal Carriers' Alliance (www.unica-global.com).

Last but not least, A.I. is currently not in use on KSHAL. It is a specific target and destination where the program heads, but the lack of autonomous, decision-supporting tools is a weakness of KSHAL. This paper shows that it is not a comparison factor between

the platform and the other opponents, as none of the competitor products offers such tools to their customers. It is a weakness for an ERP alternative that is a candidate of being a futuristic solution for maritime corporations in Turkey.

Figure 139

Opportunities of KSHAL



KSHAL is easy to be purchased by small and medium-sized freight forwarders. It is one of the most affordable shipping ERP solutions in the Turkish maritime industry. KSHAL's mission is to deliver reliable solutions to complex problems by packing those solutions in simplicity. The lean design of KSHAL and its simple screen-flow rank the ERP as one of the most dynamic alternatives available for shipping companies. It is a customizable product for special requirements. KSHAL is the only SaaS tool for container traders in Turkey. Other programs are available, but they are installed products that do not

come as quickly as KSHAL. C# and MS SQL libraries are rich enough to have KSHAL collaborate with third-party applications through their APIs swimmingly. It can be integrated into/with accounting programs, customs portals or other software alternatives. KSHAL is the first industry-specific software that focuses on the SaaG system. As for SaaG, the aim is to deliver the software to whoever contracted in terms of having their company data harvested and processed. The data processing permission given by the product's users deliberately converts the ERP into a digital consultant that provides autonomous solution reports on demand. Consequently, the SWOT analysis highlights have shown us that the competitive pricing strategy of KSHAL is the most substantial advantage it has with 30% weight among the other criteria. Its most significant threat is not being able to offer enough solutions to 3PL-related tasks. In correlation with this threat, the most striking weakness of KSHAL is the absence of air, road and rail freight modules with 35% weight in the list. At last, it has an ample opportunity as being the only web-based SaaS alternative for container traders in the Turkish maritime industry.

KSHAL's future will be shaped through these indicators that have been aforementioned in our SWOT analysis. Software developers, product designers are in charge of creating tomorrow's tools by today's ingredients. KSHAL is no different from those aiming to solve problems, create innovative products while competing with the old habits of the customer, legal obstacles and financial boundaries. Like all companies putting out innovative products, one of the critical responsibilities of KSHAL is to convince the customers that this new tool that comes in a simple package can undertake significant responsibilities. As many customers get on board will enrich the possibilities of what KSHAL may be able to deliver.

4. RESEARCH METHODOLOGY

Research methodology constitutes the backbone of an academic paper. It is a numerical tool that explains or interprets the findings of the research by relative models. It touches on the discussion and concludes the particular methods picked up and used in a dissertation. Therefore it is the section where the theoretical foundations meet the practical examination results reciprocally.

An accomplished paper defines the problem, collects data, constructs the model, validates the model and solves the problem. Our study focuses on these four significant steps while visualizing the concept of the dissertation as well. First, we defined the problem in section 1 and expressed the hypotheses. Next, the data collected to examine throughout the thesis is evaluated, and two alternative products were benchmarked in section 2. Finally, KSHAL's solution model was constructed in section 3 with all technical details. In this section, our study will aim to determine whether that model constructed in section 3 is fit for validation and if it solves this dissertation's problem(s).

Research methodology must be a well-balanced compilation of statistical tools which must deliver a reliable, versatile, functional and understandable proposal for the solution of the problems indicated in the thesis. Thus, we have used four collaborating methods that each focused on the part of the main problem. This section aims to find the feasible coding language, DB platform, and digital ecosystem for KSHAL, applying necessary analyses. The budgeting, cost management, deployment, after-sales researches will also take into this part. Among the other research methods in this study, notably, Data Envelopment Analysis is expected to tie the knot and link the subject to the conclusion.

4.1 The Methodology and Research System Approach

A software project starts with an idea and proceeds to the blueprints step. It is a challenge to choose a proper DB infrastructure that suits the software is being designed. Each database alternatives have their strong and weak points. The same dilemma occurs while deciding on which coding language will be used. We will have to ask more questions like; where will be this ERP deployed? How efficient are our choices cost-wise? What is the agility and flexibility of our product based on chosen DB and coding technology? How compatible and collaborative are our tools with each other? What are the constraints or limitations of adopting these tools? How innovative are these tools, and what significant competitive value do we add to the maritime industry in Turkey?

The research system approach can be considered a unique mixture of tools that enlighten building a brand new software as an ERP. Many ERP products fail after deployment due to the lack of a proper feasibility study before starting the project. Any commercial product which can be made does not mean it is demanded and it can be sold. That is why "reliable research" must answer a series of questions, such as below.

1. **The shape of demand:** What is the type, source and shape of the demand for our software? Did we find any niche market segment for our product where no or a small number of competitors? Will we be able to answer the whole of the demand or a portion of it by our product?
2. **Innovation:** What is our difference comparing other ERP solutions in the market? Do we create any innovation technologically or user experience-wise? Has any other similar product got our software's features? Which problem do we solve better than our competitors by our ERP platform?

3. **Competitors and Market Structure:** Which are our main competitors and which companies are our secondary rivals? How tight and tough the competition in the market we are willing to sell our product is? What is the core competence of our opponents? How many companies may we be able to sell our product to? How regulated is the market by government instructions, third-party integrations such as customs, shipping lines, airline operators and other vendors?
4. **Target Geography and Brandishing:** Where shall we sell this ERP system? Is it for local maritime logistics companies or international freight forwarders located in various countries? What are the types, locations, quantity of potential clients which might purchase our ERP solution? If the product is sold internationally, can we respond to their localization, customization, and after-sales support needs?
5. **Human Resources:** Do we have enough amount of experts in our team for RD? Are we capable of supplying new personnel from the reserves in case of losing one or more team members? What is the distribution of staff between front-end development and back-end development? How solid and skilled is our RD team? Are there any architects or full-stack developers employed in-house? What will be their salaries and other legal expenses?
6. **Financial Applicability and Sustainability:** Based on our CPM/PERT analysis model, how long can we keep the project going based on the company's capital? How long is the company able to float without any sales? What is the break-even point? Are we handling the whole project with our capital, or need external sources such as fiscal injections from investors or bank credits?

Building up software from zero ground has three project parts: before the project starts, the development phase, and after completion. AHP is a famous and influential method while deciding between numerous alternatives by weighting their importance levels. It is also actively used in deciding which software or a software component will be used in that particular project. Companies have used AHP while choosing their ERP for over two decades. We will seek answers to our questions on which database platform is best for our software named KSHAL and which computer coding language we must use to create the best product.

This study will use the Critical Path Method (CPM) for scheduling the project steps and Project Evaluation and Review Technique (PERT) in conjunction with CPM to visualize the budget aspect of software development. CPM is a commonly used tool for construction, software, aerospace, engineering and product development projects. CPM requires us to compile all the activities to accomplish the KSHAL project and assign each station its unique time requirements. CPM will ask the project manager to create a map of dependencies between these stations (tasks) and measure the critical path effectively based on these milestones.

Both of these techniques are time-oriented methods, lead to the determination of a schedule for projects such as ours. When developing software, there are multiple serial and parallel activities. Developing DB relations, setting up a coding environment, distributing project segments between the developers and data analysts, creating the GUI, connecting back-end and front-end bus all important stations that run simultaneously or by sequence. The significant difference between these two methods is that the time estimates for the different activities. While CPM has a deterministic approach, PERT runs in a probabilistic

way. Both methods collaborate productively thanks to their compatible and full scoop synergy. This research will use CPM/PERT to understand and rationalize the planning, scheduling, resource allocating and controlling steps while transitioning the idea into a concrete product.

DEA will measure KSHAL's benefits at multiple hubs. This dissertation will evaluate how effective and efficient the software is at three different companies in two different countries: Turkey and Ukraine. There are medium-sized maritime logistics companies that have used the program in their shipping, container storage, container sales, CRM, documentation operations for over a year. *DEA* is an efficiency analysis that compares the relative efficiency level of participating units such as similar-sized companies that work in the same business field and different company branches. The participating units must have the same or similar inputs and generate the same or similar outputs.

As a nonparametric method in operations research, DEA focuses on decision-making units (DMU) and measures their efficiency by comparing the results with the most efficient DMU. Therefore, the DEA can be considered an after-sales feedback source that explains how effective KSHAL gets and how active it is in different companies in different countries. This paper aims to materialize the software building process with all aspects for maritime logistics companies, freight forwarders, and container warehousing, marketing merchants seeking a web-based ERP solution for their daily operational jobs by using the above methods. The essential premise of the Theory of Constraints is that all firms have at least one critical constraint that limits their production capacity.

A *constraint* is an element that occurs in a system, preventing it from achieving optimal performance (Pozo, Tachizawa, & Picchiai, 2009). Data Envelopment Analysis performed

at the participant's premises during this research has a role in defining these constraints that pull the participant companies back from using the KSHAL software as effective as the company that reaches the efficiency frontier. In this perspective, if these shipping companies overcome these constraints, they will/would benefit from increased productivity at their companies.

4.2 Defining The Feasible I.T. Infrastructure by A.H.P.

This dissertation will use Analytical Hierarchy Process (AHP) as a structured decision-making tool while picking up the feasible coding language, supportive technologies, relational database and the platform where KSHAL will function. AHP is a multi-criteria programming method developed by Thomas L. Saaty in partnership with Ernest Forman in the 1970s. This is a technique for coming to conclusions in complex environments where many parameters are considered in prioritising and selecting alternative options. AHP is widely used in cost/benefit analysis, strategic planning, RD priority setting and selection, technology choice, investment priority, and other alternatives. AHP provides measures of judgment consistency and derives priorities among criteria and alternatives, so; it simplifies preference ratings among decision criteria using pair-wise comparisons.

With AHP, we can measure the degree of consistency, and if unacceptable, we can revise pair-wise comparisons. If the results are perfectly consistent, then the consistency measures will equal *n,* and that is why the Consistency Index ratio will be equal to zero. So, will the consistency ratio. Saaty proposes that if that ratio exceeds 0.1, the set of judgments may be too inconsistent to be reliable. If the resulting ratio is high, literally any scale higher than 10% or *0.10,* we are inconsistent with our choices. The study needs a revisal approach by getting back to the figures. While using AHP, the main objective or the goal is decomposed into a hierarchy. Logistics organisations benefit from AHP when they take managerial decisions on investment plans such as buying vehicles, a new warehouse, or choosing new markets to deal with. AHP should be taken as a decision support tool that utilises the process of eliminating weaker alternatives.

According to Perera and Costa, "ERP systems are implemented as a total business solution that supports significant business functionalities. However, many of the implementations are not success stories. Most post-implementation problems are due to the inappropriate selection of systems. As a quantitative analysis method, AHP with Expert Choice software tool can be used in numerous ways to analyse ERP selection problems and carry out the sensitivity analysis easily before concluding on any ERP software." therefore, AHP is a decision support method that is frequently used in the ERP component selection process (Perera & Costa, 2008).

According to Czekster, et al., selecting ERP (Enterprise Resource Planning) software is crucial to enhance productivity because it provides high-quality services for end-users (Czesker, Webber, Jadrey, Augusto, & Marcon, 2019). However, selecting components such as database, coding language, deployment platform, and pricing strategy for an ERP is a problem that should under-take deeper scrutiny. For example, several criteria are usually present, having different tradeoffs as one targets usability the other focuses on economic competitiveness. Therefore, analysts and research participants have serious considerations to address when deciding which ERP component to select when facing the myriad available technologic assets with market presence. This fact illuminates the importance of multicriteria decision-making modelling to help decision-makers select accurate components, such as in this research. One commonly used technique for assisting the addressing such barriers is AHP.

Semih and Özel have used the AHP analysis for a similar research topic as this dissertation has, in their empirical study documented on "***Comparison of ERP and Defining the Optimum ERP System Using AHP Method.***" (Özel & Türkel, 2018).

Pourvali et al., in their article titled "***Investigation of Criteria and Selection of Efficient ERP System Using AHP Tools in Persian Electronic Commerce Company.***" have mentioned the practical benefits of AHP, particularly while deciding on which ERP environment to be selected (Pourvali, Fathollahi, Aghaei, & Babapour, 2016). An almost identical experiment can be seen in an article published in the Journal of KSI Transactions on Knowledge Society, titled "***Using Analytic Hierarchy Process Method in ERP system selection process***." co-authored by Rima Tamošiūnienė and Anna Marcinkevič (Tamošiūnienė & Marcinkevič , 2018). Oyku Alanbay mentions in her article titled "***ERP Selection Using Expert Choice Software***" that "Analytic hierarchy process (AHP) is a method widely used for this kind of complex decision-making problems." precisely points out the benefits and practicability of using AHP in the decision-making process of ERP related components (Alanbay, 2005). Hanine et al. have used **cost, stability, reputation and security** criteria (also the same criteria included in this dissertation); their article titled "Application of an Integrated Multi-Criteria Decision Making AHP-TOPSIS Methodology for ETL Software Selection" to illuminate the remarkable contribution of the AHP method for ERP selection process (Hanine, Boutkhoum, Tikniouine, & Agouti, 2016). The same set of criteria used in this thesis was also used by Silva et al. in their paper titled "Criteria for ERP Selection Using an AHP Approach." proposing their model for selecting a feasible ERP programme for the subject company (Silva, Gonçalves, Fernandes, & Cruz-Cunha, 2013). With the support of the references cited above, AHP is considered an ideal tool to gain a deeper understanding of the research problem aiming to decide which I.T. design components are best for building up a web-based ERP alternative for maritime logistics companies.

4.2.1 Applications Steps

In the first step, the goal of the project, selection of the criteria set and alternatives are identified. The KSHAL system is predefined as a web-based platform that will allow users to access it via the internet. In the following step of the AHP analysis, we justified the judgment matrix for each criterion. This deterministic step enlightens the pathway towards the third station, where we justify the judgment matrix for the alternative options. In the last step, we will reach the results for the final ranking and conclude a decision. Each matrix will be normalized and checked if they are consistently based on Consistency Index (CI). A correct Consistency Ratio is calculated by dividing the Consistency Index for the set of judgments by the Index for the corresponding random matrix. The standard AHP uses linear ratio scales. To derive priorities, *verbal statements* (comparisons) are converted into integers from 1 to 9. This "fundamental AHP scale" has been discussed, as there is no theoretical reason to be restricted to these numbers and verbal gradations. The other scales are the logarithmic scale, root square scale, inverse linear scale, balanced scale, balanced-n scale, adaptive-bal scale, adaptive scale, power scale and geometric scale. Although there are different scaling methods, this study will use the classical, standard, linear scaling method to reach the results.

In order to build up an ERP, we have to define which relational DB will we use. This study will focus on five of them, which are IBM-DB2, MS-SQL, POSTGRE-DB, PROGRESS, MySQL. These alternatives are also used by IT companies cited above while developing their maritime logistics software products. Secondly, the coding language must be chosen. The computer programming language must communicate with the DB. It must be rich in sources and libraries. Finally, a strong company or a community must back it up

and provide us with what we need. This paper takes the five most common and known computer programming languages in its focus as follows; Java, C# (or as known as C Sharp), Python, C and C ++. Following this step, this research will try to determine which platform will this software be running. ERPs can be deployed on different platforms. They can be installed on the servers hosted locally at the user company or kept on virtual private servers (VPS) on the cloud. Then, the software can be loaded into the servers of the customer. Those particular servers can be kept at private hosting locations called co-hosting. Finally, the customer hires a dedicated server from the hosting company to install the ERP they have paid for. This method is called dedicated server hosting or shortly as "dedicated". The last step of the AHP study will focus on the pricing methodology of the ERP, which will be built. There are four different alternative pricing methods in the market: a one-time fee, SAAS, an annual billing system, and pay per usage option. This AHP study aims to find out which pricing modality suits better for our ERP project. During this study, the importance of each criterion will be ranked from 1 to 9 based on their necessities, as shown in the below table.

Figure 140

The Fundamental Scale for Pair-wise Comparison

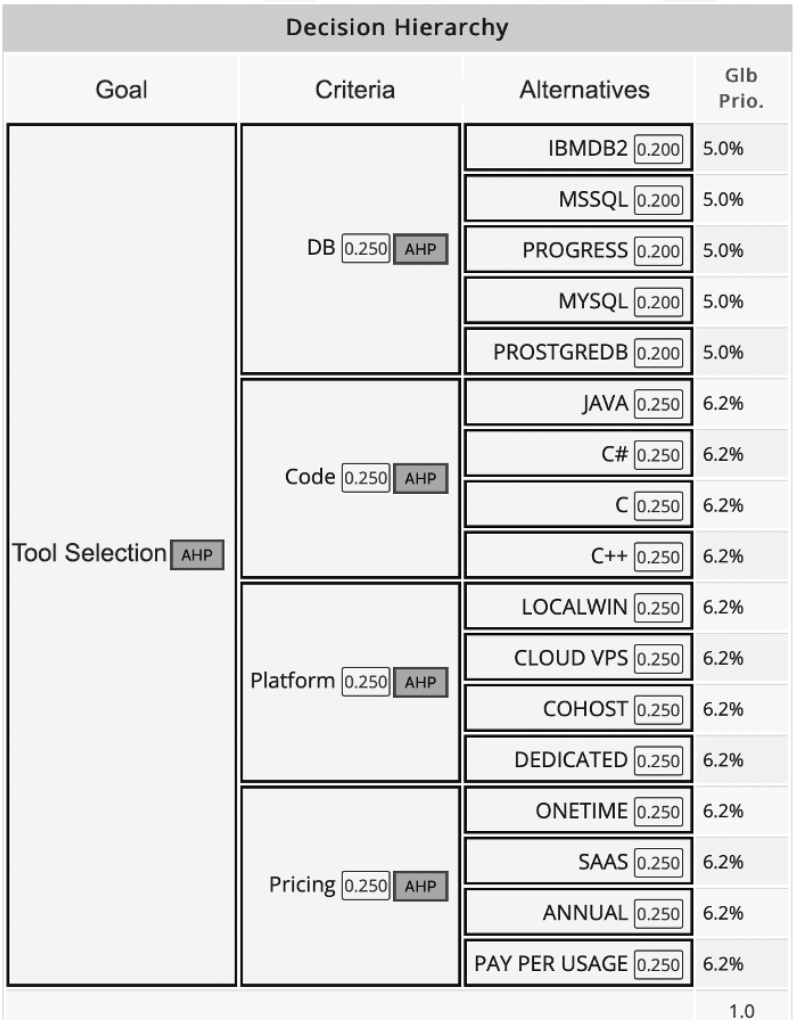
The Fundamental Scale for Pairwise Comparisons		
Intensity of Importance	**Definition**	**Explanation**
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation
Intensities of 2, 4, 6, and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.		

4.2.2 Results of the AHP Analysis

The AHP model was constructed based on four main criteria that shaped our decision to start building up the KSHAL project: the type of database, coding language, working platform, and pricing methodology.

Figure 141

Decision Tree



While the ERP gets ready, the producer must choose a method of pricing the product. First, it can be sold as a one-time invoiced product which the customer buys and owns the software, just like in the example of 1Ci. It can be sold as a SaaS solution that

SELECT and LOJISOFT use. Third, it can be sold as a product that the customer pays for and annually pays for additional standard services such as database license, maintenance fee, and such, as SOFT uses this method. Also, the customer may pay for the software whenever they use it. This method has become popular among many SaaS platforms worldwide.

Figure 142

Weight Comparison of Criteria

	A - wrt **ERP DB Choice** - or B?		Equal	How much more?
1	○ DB	◉ Code	○ 1	◉ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9
2	◉ DB	○ Platform	○ 1	○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ◉ 9
3	◉ DB	○ Pricing	○ 1	○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ◉ 7 ○ 8 ○ 9
4	◉ Code	○ Platform	○ 1	○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ◉ 8 ○ 9
5	◉ Code	○ Pricing	○ 1	○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ◉ 7 ○ 8 ○ 9
6	○ Platform	◉ Pricing	○ 1	○ 2 ◉ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9
CR = 6.5% OK				
Calculate				Submit

Resulting Priorities

Cat		Priority	Rank
1	DB	37.0%	2
2	Code	51.0%	1
3	Platform	4.1%	4
4	Pricing	7.9%	3

In the first step, we must weigh the priorities of criteria while choosing the necessary tools to build up and deploy the ERP. The coding language defines the ability space of the program. The DB gets ranked as second right after the coding language. An

efficient partnership and a strong collaboration between the programming language and the database are the foundation of an innovative ERP solution for maritime logistics companies. Choosing the most feasible DB is the foundation of a successful ERP. When this analysis decided on preferable DB, there were the following criteria taken into consideration;

1. **Cost / Roi:** The degree of how affordable the DB platform is while acquiring it. While some DB products come in four digits in USD, the others are entirely free of charge. The final cost of an ERP is immensely related to the cost of assembling elements, and DB is one and an important of them.
2. **Stability (Performance):** Relational databases have their segments of expertise based on some criteria. One of the essential criteria is keeping their integrity and stability under heavy data flow. As queries increase, some DB platforms fail to handle such bilateral information exchange and temporarily switch into service mode. If a web-based ERP has a service commitment, such as handling thousands of CALs simultaneously, the DB performance becomes critically prominent.
3. **Reputation:** The number of available libraries, extensions, data containers, support packages, articles, references represents the resourcefulness scale of that particular DB product. Suppose a DB is backed up by a reputable company that provides many online features to set their product reachable by software engineers. In that case, it certainly has a better impact on resourcefulness. On the other hand, if a DB comes with its limitations, narrowing the capabilities of the final product, it is no doubt an uncompetitive option among the others on the list. If a DB can not provide

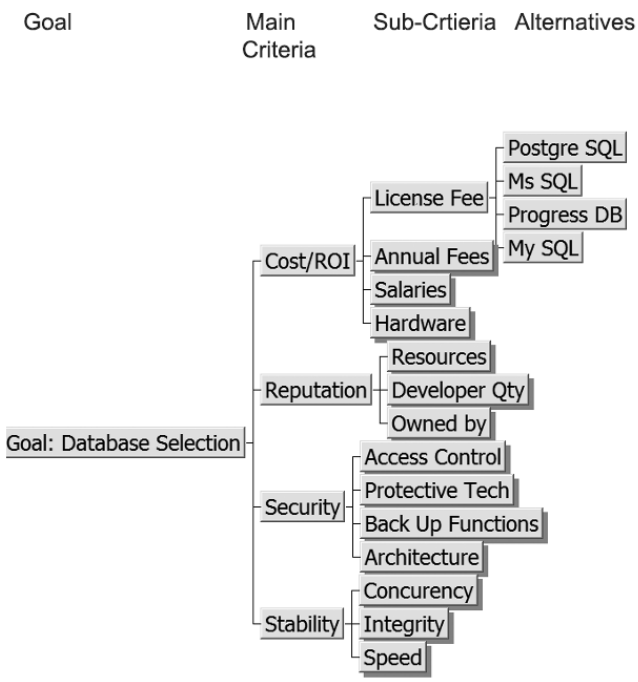
what the coding part or the overall perspective of the ERP requires, it also means that DB is not as competitive as the other alternative goods.

4. **Security:** The data becomes an inseparable part of a company's capital. It has value, and it must be securely protected. In specific experiences, hackers attack right into DB's by using various methods to steal this valuable set and use it for illegal purposes. In this respect, the DB which will be chosen must be more secure than the other alternatives.

The model was constructed on the **Expert Choice** program, with two layers by adding sub-criteria to the above criteria as follows;

Figure 143

AHP Model For DB Selection



It is critically important to decide on which DB will be used for our software. Each of these database platforms is strong, reliable, sophisticated and able to respond to our needs. Anyhow, they come with their strong and weak points. For example, MS SQL is far more effective for KSHAL as a DB as it is backed up by a strong company such as Microsoft. In addition, it has no language or alphabet restrictions such as Progress or high licensing fees such as IBM DB2.

On the other hand, there are two free of charge GNU licensed database alternatives considered MySQL and PostgreDB, which Xinergy uses. MySQL has no company behind it. It is publicly supported and reasonably reliable for websites or web-based small applications. However, it is weaker than MS SQL while handling heavy-duty tasks such as responding to six-figure queries at once. Furthermore, based on online penetration tests, MySQL is less secure than MS SQL. PostgreDB is also a free licensed product. Unfortunately, it has fewer libraries to utilize faster programming, while Microsoft provides a cloud-based one-stop shop named Azure for all the answers to what a developer needs. That is why MS SQL becomes our database choice while building KSHAL.

The AHP analysis questions were sent to twenty different members of the Universal Carriers' Alliance Network (UNICA, 2020). The purpose of collecting deterministic opinions from different geographies and companies enriched the compiled findings of the decision-making process. UNICA is a freight forwarders' network founded in 2008 by the joint initiative of five mid-sized international freight companies. As of today, it has 68 countries covered by 84 member companies that have 244 offices combined.

Our study aimed to send our questionnaire to companies of similar size that employ between 25 to 40 staff members in one hub. In addition to this, the participants are selected from different continents of the world. Following companies have contributed to this study:

Table 100

AHP Analysis Participants

	Company Name	Location
1	Brightway Ltd	Vietnam
2	Fast Forward Freight	Belgium
3	All in One Services S.A.	Mexico
4	Transconsult	Czechia
5	Noble Cargo Care	Egypt
6	RIM Logistics	Germany
7	Saba Marine Services	Iraq
8	Ojs Swift Ventures	Nigeria
9	Bin Qutab International	Pakistan
10	Translogistics Solution S.A.C.	Peru
11	Kw Speed Logistics Ltd	Ghana
12	Best Express	Saudi Arabia
13	Smart Logistics	Ukraine
14	Asgard Transport Llc	Turkey
15	East Logistics A/S	Denmark
16	1 Triple A Logistics	Israel
17	Dahnay Logistics	India
18	Avits Ltd	Russia
19	Atlantic Overseas Express	the USA
20	Multitrans Logistics	Uzbekistan

The first step was comparing the main criteria: Cost/Roi, Reputation of the DB, Security of the database, and Stability of the product. In the Cost/Roi criterion, the child

nodes were License Fee of the DB which is paid for one-time when buying the software, Annual Fees that are charged per year to buyers, Salaries of developers who engaged in these alternative DB platforms and Hardware requirements, particularly processor and RAM demand of DB alternatives.

Figure 144

Weights of Main Criteria

Matrix: Main (Row = 1, Column = 1)

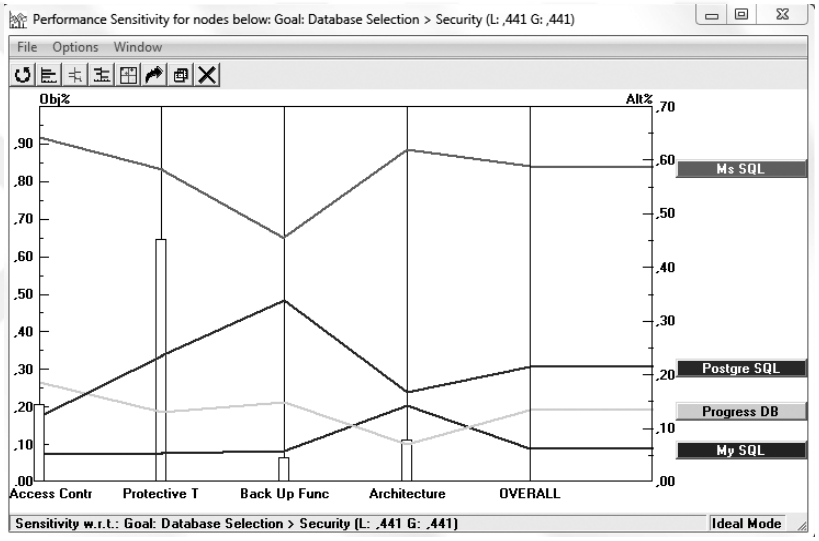
	COST	REPUTATION	SECURITY	STABILITY	Priority
COST	1	7	1	5	40,4%
REPUTATION	1/7	1	1/8	1/5	4,2%
SECURITY	1	8	1	6	44,1%
STABILITY	1/5	5	1/6	1	11,3%
Consistency Ratio	0,082				

Security is the crucial factor while selecting the DB for our ERP project with 44,1% of importance. A 40,4% ratio follows the Cost / ROI (Return of İnvestment) criterion. Security criterion was also measured by Access Control, Protective Tech, Backup Functions and Architecture aspects. Access Control represents the stages and control functions of the DB while the users try to access the DB. Protective Tech, such as Captcha control, IP filtering, MAC Address checking, wrong password submitting limitations, date, time, location filtered restrictions, are positive features while ranking a database management system. Backup Functions represent multiple methods of backup features of the DB, including manual backup, self-sustained autonomous cron jobs or macro tasks.

Finally, the architecture of DB represents all coding, building, relational aspects of the platform. The DB we will select must inhibit unwanted access to our mainframe and must be unyielding against brute force attacks, sudden and unexpected heavy data queries, which may slow down our service speed or altogether disable the whole structure.

Figure 145

DB Selection Based on Security Criteria



According to the Security aspect, MS SQL is weighted far better than its rivals. PostgreSQL is our second alternative when we mind security thanks to its native support of SSL (Secure Socket Layers) that encrypts all in and out data traffic. Postgre is supported by relatively limited but dedicated, independent software engineers who call themselves "Postgre Global Development Group" that voluntarily penetrates the DB to test its vulnerability levels. They scan the sockets, send heavy data requests, and possibly apply various injection methods to infiltrate the database. However, these efforts are too little compared to the massive amount of software security staff solely working on the security features of MS SQL, which Microsoft supports.

In the following step, we focused on the child nodes of the Cost/ROI criterion. This is the second most crucial choice factor while deciding which database to use for the KSHAL project. Progress is by far the most expensive database alternative on our list. Public licensed, free GNU products are also powerful products such as MySQL and PostgreSQL. One of the challenges is finding and recruiting skilled developers who are experienced in specific database alternatives. Hot selling products usually attract more developers because they create more projects and more jobs to get into. In this respect, it is not just about a simple decision to conclude with one criterion. For example, MS SQL comes with a three-figure license fee and two-figure if used in the Azure cloud. It has more projects than others shown on web platforms such as Github and Stack Overflow. It is actively used by over 211,000 big-sized companies (INFOCLUTCH, 2020). It is the second biggest database product in the market right after Oracle which is also nearly three times more expensive than MS SQL. It is used by Nasdaq, Accenture, Stack Overflow, Hepsiburada and MIT (Stackshare, 2020).

Figure 146

Sub-Criteria Based on Cost/Roi

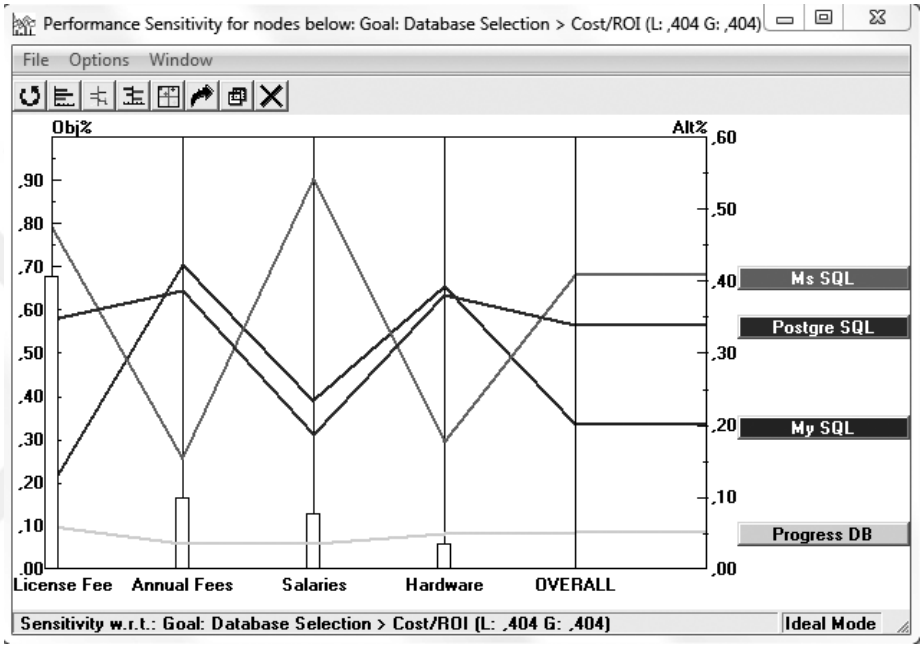
Matrix: Main (Row = 1, Column = 1)

	LICENSE FEE	ANNUAL FEES	SALARIES	HARDWARE	Priority
LICENSE FEE	1	7	5	9	67,0%
ANNUAL FEES	1/7	1	1	6	15,9%
SALARIES	1/5	1	1	2	12,1%
HARDWARE	1/9	1/6	1/2	1	5,0%
Consistency Ratio	0,089				

According to the Cost / ROI segment of our study, Microsoft SQL becomes the first with 40.8% results and it is followed by PostgreSQL that scored 33.9%.

Figure 147

Weight of Child Nodes Based on Cost/ROI



PostgreSQL is a free licensed product that is more powerful than MySQL that is widely used by small to medium-sized websites which do not handle continuous, heavy data requests. Therefore, PostgreSQL is a better choice when it comes to running an ERP on the cloud.

The third step is measuring the criteria related to the reputation of alternatives. The reputation title consisted of three child nodes as, amount of resources available for the alternative. How many integrated development environments (IDE) alternatives do we have while developing the database structure? Most of the IDEs come in three parts as a source code editor, a build automation tool that helps to compile what is coded and a debugger to fix possible flaws and syntax errors. In addition to this, how many coding

libraries are available is a significant influence on the decision. These libraries have compiled packages of codes set for developers to utilize specific loops or tasks shorter than performing them manually. A resourceful DB is always the top priority for building up brand new software that seeks solid grounds, less hassle and complete stability.

Figure 148

Wight Distribution of Alternatives for the Reputation/Resources Node

Matrix: Main (Row = 1, Column = 1)

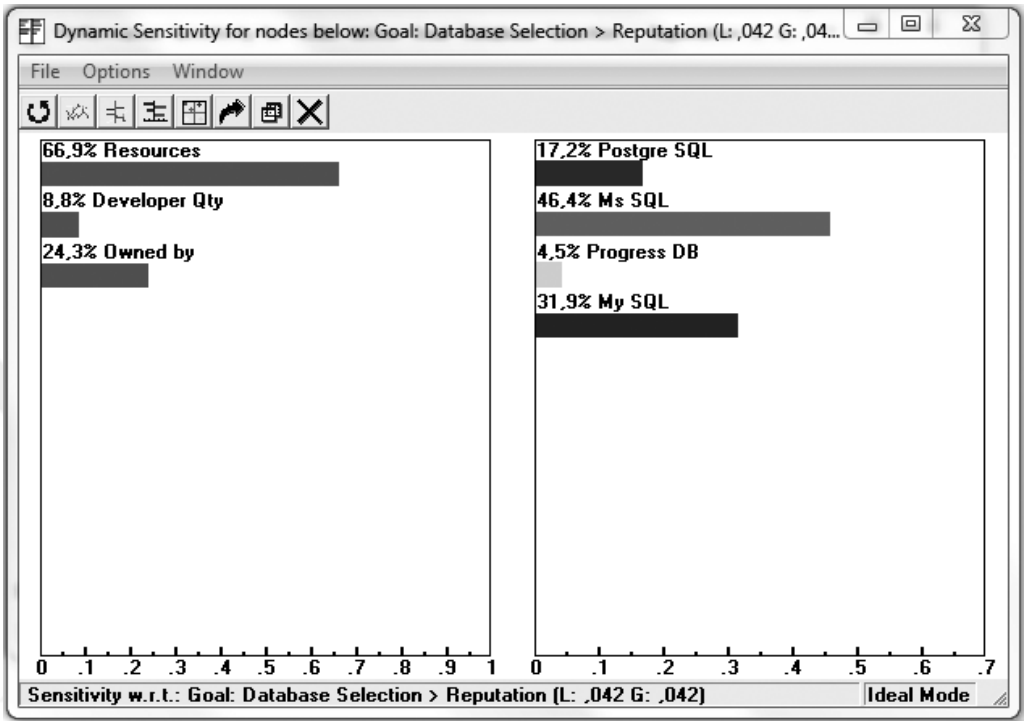
	POSTGRE SQL	MICROSOFT SQL	PROGRESS	MYSQL	**Priority**
POSTGRE SQL	1	1/3	4	1/2	16,7%
MICROSOFT SQL	3	1	9	1	42,1%
PROGRESS	1/4	1/9	1	1/8	4,5%
MYSQL	2	1	8	1	36,8%
Consistency Ratio	0,006				

It is a primary criterion to know-how many developers are there in case of staying on safe grounds while developing an ERP. Furthermore, it is a requirement to be sure that the project will not be neglected or fail due to the lack of developers we need. Last but not least, how that DB is backed up or by whom is one of the essential criteria while concluding. Since we seek security, which is our key criterion, a database we will select must have a reliable enterprise backing it up managerially, fiscally, and technologically.

Public GNU alternatives such as MySQL and PostgreSQL should come as secondary when making a choice. We will also pick Microsoft SQL in this section.

Figure 149

DB Selection Based on Reputation



The third step is to measure the sub-criteria under security criteria to visualize their weight and importance while selecting alternative database platforms. Data, especially in the era of Big Data, is the most valuable inventory of companies. It is as essential as the rest of their capital, namely all kinds of estates, funds, know-how and market value. If their data is not secured, companies may run out of business or face difficult legal or operational consequences. In order to develop a reliable web-based ERP alternative for maritime logistics companies in Turkey, the DB platform which will be used must fulfil all security measures shown in our experiment successfully. Our hands might be more unrestrained to pick among the alternatives if KSHAL would work locally without an internet connection. In such scenarios, the threat comes within the company and can be prevented much more effortless than publishing the data online through a web-based software platform. When

the whole project is taken up to the web, it requires dedication and expertise to run it safely. In this aspect, we must be keen on focusing on which alternative platforms supply protective technologies.

Figure 150

Weight of Security Related Nodes

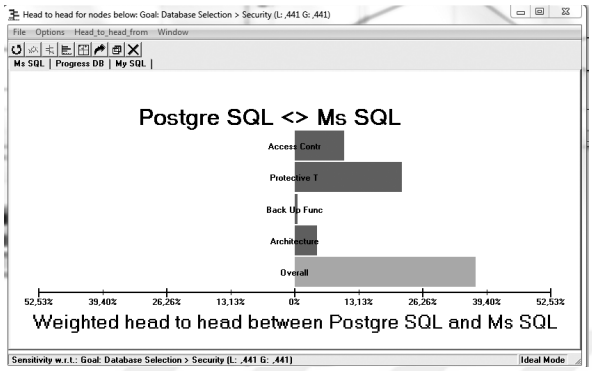
Matrix: Main (Row = 1, Column = 1)

	ACCESS CONTROL	PROTECTIVE TECH	BACK UP FUNCTIONS	ARCHITECTURE	Priority
ACCESS CONTROL	1	1/4	4	2	20,3%
PROTECTIVE TECH	4	1	9	6	63,4%
BACK UP FUNCTIONS	1/4	1/9	1	2	8,6%
ARCHITECTURE	1/2	1/6	1/2	1	7,7%
Consistency Ratio	0,084				

Here, we observe that Protective Tech scores the top importance and Access Control comes in second. Both of these criteria significantly borderlines almost the whole common expectations we could anticipate from a reliable database. All of our alternatives are self-proven products in their fields; however, our research must concentrate on selecting the top-notch product for the KSHAL project. At this point, PostgreSQL is far beyond MySQL in terms of having a solid built that simultaneously handles the data flow and data protection. In this light, Microsoft SQL Server is a superior database when it comes to select a DB for an ERP, e-commerce, a web-based platform. It has an auto-update feature that PostgreSQL does not (Educba, 2020). MS SQL Server provides computed columns view while PostgreSQL does not provide this service. MS SQL is capable of replicating all sorts of data. It can be log shipping, mirroring, snapshot or data verging. PostgreSQL has limited ability to replicate the data. It is available only v.8.4 and after.

Figure 151

Head to Head Weighting Between the Alternatives by Security Criterion

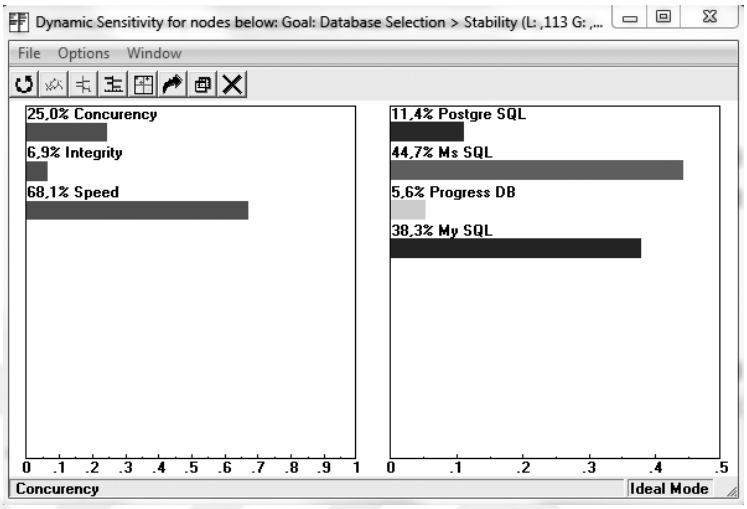


Regarding the Security measures, our study takes us to pinpoint Microsoft SQL Server as a selected DB alternative compared to PostgreSQL, MySQL and ProgressDB.

At the final step of the AHP analysis, the stability criterion is inspected. The stability criterion identifies the general outlook of how the ready product functions in all digital terrains and occasions. It is the degree of trust when it comes to handing our company data to the tables of a particular database. Three child nodes segmented the stability section as Concurrency, Integrity and Speed. Concurrency represents the ability to function simultaneously while handling data, writing, posting, sorting in multiple coding languages better than the other alternatives. It is expected to have a DB that is immune to technical difficulties. This immunity comes from the integrity of the product. Integrity criterion represents how well built the database platform is. If we consider the DB as a bank, it must have a thief-proof case, humidity-free, under the supervision of several skilled professionals and must serve each client in a way that the client asks. Speed is also one of the significant expectations from a database. If it does not serve in required speed scales, the database will have no use at companies, mainly shipping companies that are literally racing against the time.

Figure 152

Stability Weight Distribution Between the Nodes



The speed factor scores 68.1% weight among the other two criteria. Progress DB, which is also known as "Open Edge" remains as a marginal example comparing the other database management systems as it is used only by one supplier in Turkey. In addition to this, it is ranked as 75th on db-engines.com (db-engines.com, 2020).

Figure 153

Database Ranking Chart

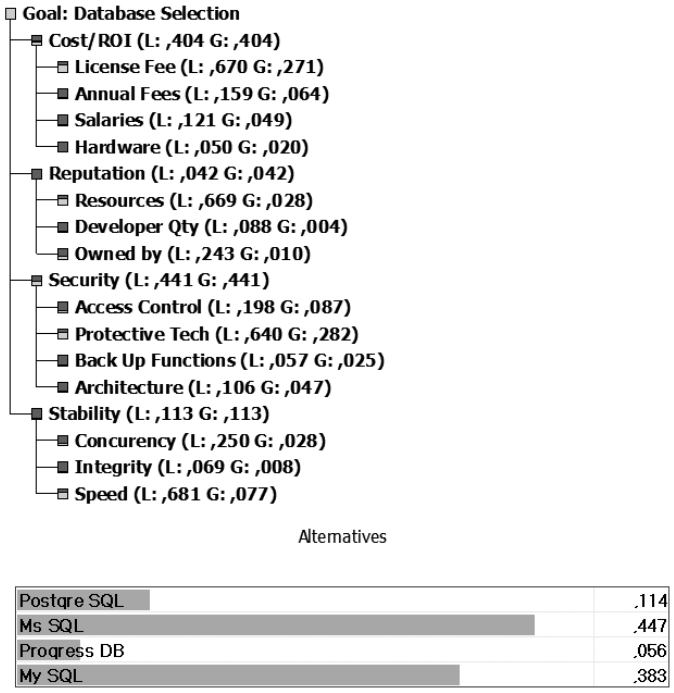
69.	↑ 70.	↓ 64.	ArangoDB	Multi-model	5.51	+0.14	+0.64
70.	↓ 67.	↓ 68.	Google Cloud Datastore	Document	5.51	+0.00	+0.87
71.	↑ 72.	↓ 62.	Ignite	Multi-model	5.32	+0.02	+0.38
72.	↓ 71.	↓ 63.	OrientDB	Multi-model	5.29	-0.01	+0.36
73.	↑ 75.	↑ 75.	OpenEdge	Relational	5.22	+0.11	+1.56
74.	↑ 77.	↓ 60.	SAP IQ	Relational	5.21	+0.25	+0.21
75.	↓ 73.	↓ 70.	Adabas	Multivalue	5.11	-0.13	+0.77
76.	↓ 74.	↓ 69.	Jackrabbit	Content	5.10	-0.08	+0.64
77.	↓ 76.	↓ 74.	MaxDB	Relational	4.75	-0.30	+1.02
78.	↑ 80.	↑ 107.	Microsoft Azure Data Explorer	Relational, Multi-model	4.70	+0.50	+2.58

Note. From db-engines.com

In the final step, MS SQL Server is also scored the highest ranking by surpassing its rivals with a 44.7% ratio. If we show the treeview of our AHP analysis;

Figure 154

The Treeview of Decision Table



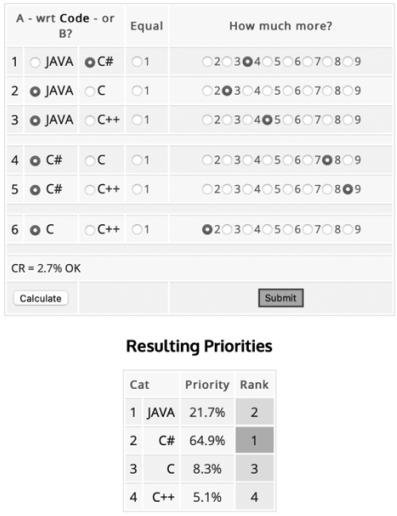
As a conclusion and as the result of this section, Microsoft SQL Server will be selected as a database of the built software. Microsoft SQL Server is a dynamic, robust, feasible and reliable solution capable of responding to our relational database needs when designing a web-based alternative software solution for maritime logistics companies in Turkey.

Processors work on a binary system that runs on "1"s and "0"s to accomplish computing tasks. In this respect, programming languages can be easily considered formal languages with decent grammar, called "syntax". In order to "talk to" the processors in the most communicable way, our error-free codes must be interpreted accurately by compilers that convert our codes into assembly-scale simple signals. Any computer language positioned virtually closer to machine language codes is considered a low-level language. Assembly is one of them. A low-level programming language is a programming language

that provides little or no abstraction from a computer's instruction set architecture commands or functions in the language map closely to processor instructions. Generally, this refers to either machine code or assembly language.

Figure 155

Coding Language Selection



To do things faster with the support of ready-made code containers, libraries, additional sources, we must pick up a medium-level language such as Java or C#. C and C++ are also medium-level languages, but C is somewhat aligned to the lower side of the classification. According to Northeastern University's recent study, Java and C# share the crown of most actively used languages. All programming languages provide abstractions (Eckel, 2006). Java is the programming language performing such abstractions effectively, no different from the others, most commonly associated with developing client-server applications, which large businesses use worldwide. Java is designed to be a loosely coupled programming language, meaning that an application written in Java can run on any platform that supports Java. As a result, Java is described as the “write once, run

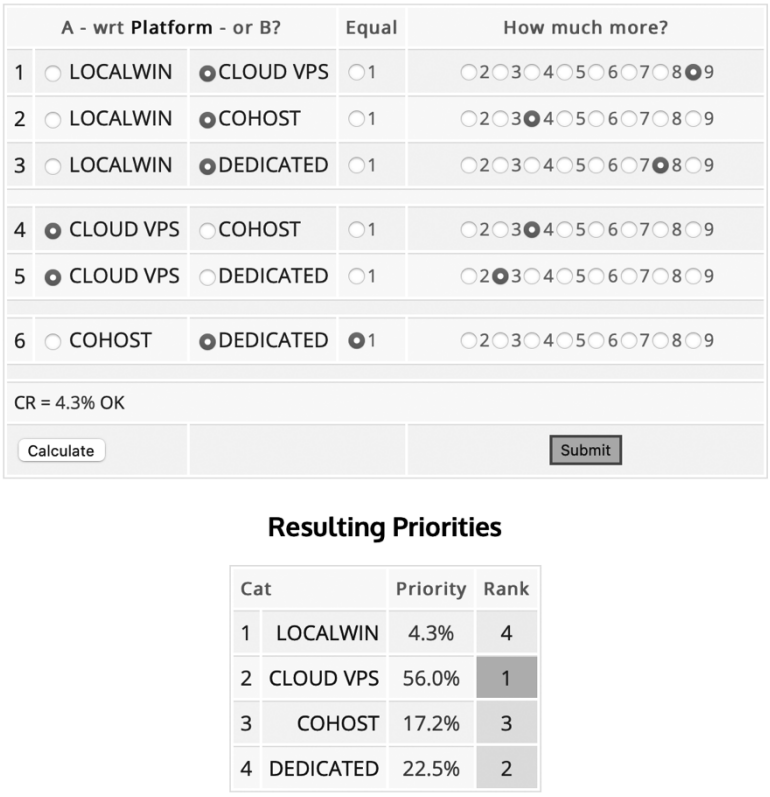
anywhere" programming language. As a drawback, Java is not ideal for applications that run on the cloud instead of the server (which is typical for business applications). Microsoft's C# is fully integrated with Microsoft's .NET software framework, which supports the development of applications for Windows, browser plug-ins, and mobile devices. It has more expansive capabilities for cloud computing than Oracle's Java. C# offers shared codebases, an extensive code library, and a variety of data types. Also, MS SQL and C# both products belong to Microsoft. This harmony triggers several advantages, such as using common digital grounds to develop applications that make web-based ERP development much more straightforward than others like the .Net framework and Azure services.

In this connection, C# becomes our programming language choice as a result of AHP analysis. The database and the coding language were two fundamental requirements, to begin with, an ERP development process.

In connection with developing an ERP in Microsoft supported digital environment, there will be additional benefits such as using the .Net platform. It is a platform that provides a collection of ready-made tools that help developers to create agile web or mobile applications. With .Net support, C# boasts type-safety, garbage collection, simplified type declarations, versioning and scalability support, and other features that make developing solutions faster and easier.

Figure 156

Application Environment Selection



	A - wrt **Platform** - or B?		Equal	How much more?
1	○ LOCALWIN	◉ CLOUD VPS	○1	○2○3○4○5○6○7○8◉9
2	○ LOCALWIN	◉ COHOST	○1	○2○3◉4○5○6○7○8○9
3	○ LOCALWIN	◉ DEDICATED	○1	○2○3○4○5○6○7◉8○9
4	◉ CLOUD VPS	○ COHOST	○1	○2○3◉4○5○6○7○8○9
5	◉ CLOUD VPS	○ DEDICATED	○1	○2◉3○4○5○6○7○8○9
6	○ COHOST	◉ DEDICATED	◉1	○2○3○4○5○6○7○8○9

CR = 4.3% OK

Calculate Submit

Resulting Priorities

Cat		Priority	Rank
1	LOCALWIN	4.3%	4
2	CLOUD VPS	56.0%	1
3	COHOST	17.2%	3
4	DEDICATED	22.5%	2

An ERP can be deployed and can be set for use in different environments and locations. One of the most known and orthodox methods is installing the program into a locally hosted server(s) at the customer's premises. Then, all the CALs log into that local server(s) through their LAN. In this method, the connection is fast. There are none or few lags, and as long as the connection is blocked for outsiders and the data is completely secure from the attentions of unwanted parties.

On the other hand, the customer must secure the server's location against the damages which might occur due to fire, water leakage, theft, electricity voltage fluctuations, irregularity and dust. Also, taking hourly, daily, and weekly data backups must be coordinated by the customer. This method is suitable for small maritime logistics

companies with one office location without any or a handful of data integrations with third parties. However, this method will challenge posting shipment data onto the web for cargo tracking, e-accounting or digital reports for end customers.

Storing the ERP as a turnkey solution on cloud-based virtual private servers is a new trend. Hosting companies provide virtual private server segments for those who want to create software that will have users, end customers and vendors from multiple locations of the country or even the world. In this method, the data is stored in a cloud at one of the remote locations of the hosting company. It is estimated that by the end of 2020, 95% of all workloads will be cloud-based (BDM Publications, 2019).

The customer will use the space they paid for without knowing who their digital neighbours are and whose physical server their data is. The data is securely hosted, and the hosting company supplies all basic requirements to secure it. It sets the product reachable by permitted users. It sets the product ready for reading-writing-modifying (AKA r-w-m) for developers and third parties. Cloud VPS option requires relatively more minor setting up fees compared to buying servers as hardware. It is scalable when we need more space or larger bandwidth.

Co-hosting is the term to define how to open an ERP for the customer's access. The co-hosting method can be summarized as a hotel for servers. The software is installed into the customer's server(s) as in the LOCALWIN method, but it is placed into a rack space at a preferred hosting company. The hosting company secures the server(s), provide(s) all necessary tools to keep the server(s) up and running. The customer rents the facility and all the additional services based on the monthly fees they pay to the hosting company. In this method, the customer still has to invest a large amount of money for the server computers.

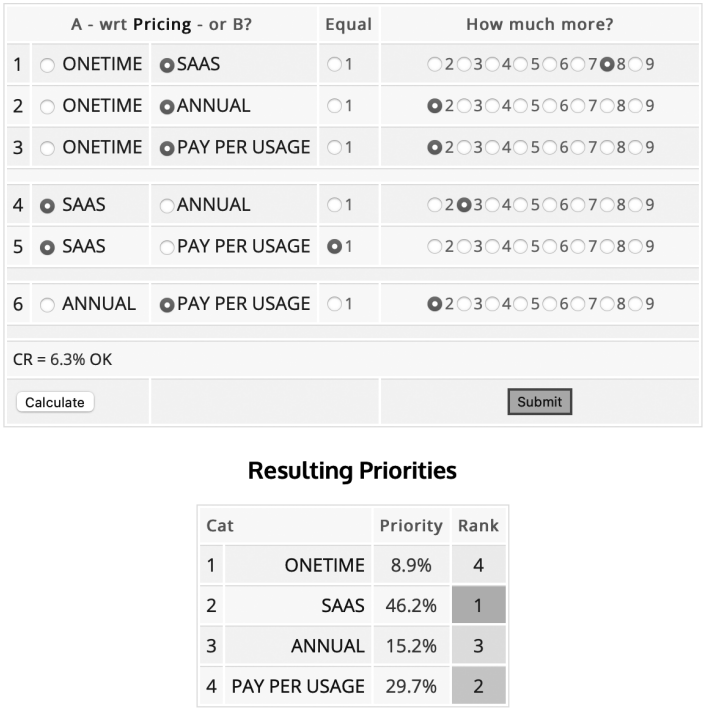
Although this method is a more expensive alternative than LOCALWIN, the data is secured professionally. The customer minds their own core business rather than worry about securing their server(s) hosted in-house. Also, thanks to the faster internet capacity that the hosting company may provide, the ERP can be used more effectively by multiple hubs, remote offices, international branches.

As last alternative method of deploying the software for the customer's disposal is a dedicated hosting solution. In this structure, the customer does not purchase any hardware or relative operation system licenses but leases it all for long terms from the hosting company. The hosting company allocates the whole server, which is solely dedicated to the customer's applications. The customer pays for the hardware and software-related services to the hosting company monthly or annually. In this model, amortization becomes no longer an issue at the customer's budget plans. The contracted plan is flexible enough to go for the other ram, hard disk, backup units, additional software upgrades. These costs, which may, from time to time, become unbearable for the maritime companies, are spread over the years with the dedicated hosting model.

As the result shows, we will be picking up the Cloud VPS alternative as a place where we will deploy KSHAL and put it to use for our potential customers. The cloud environment will be both our development periphery and the digital habitat where KSHAL is available for customers to log in and use as a web-based ERP solution. These correlated decisions automatically identify KSHAL as a turnkey solution for maritime logistics companies. It will be an ERP that functions for the tasks on the web.

Figure 157

ERP Sales Method Selection



	A - wrt Pricing - or B?		Equal	How much more?
1	○ ONETIME	◉ SAAS	○ 1	○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ◉ 8 ○ 9
2	○ ONETIME	◉ ANNUAL	○ 1	◉ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9
3	○ ONETIME	◉ PAY PER USAGE	○ 1	◉ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9
4	◉ SAAS	○ ANNUAL	○ 1	○ 2 ◉ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9
5	◉ SAAS	○ PAY PER USAGE	◉ 1	○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9
6	○ ANNUAL	◉ PAY PER USAGE	○ 1	◉ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9

CR = 6.3% OK

Calculate Submit

Resulting Priorities

Cat		Priority	Rank
1	ONETIME	8.9%	4
2	SAAS	46.2%	1
3	ANNUAL	15.2%	3
4	PAY PER USAGE	29.7%	2

It will not be an installed product. It will not require hardware investments, backup units, voltage regulators. In order to use KSHAL, the customer will not need to install dust-free, secured, high-floor hosting rooms. With this chain of choices, the whole process aims to get things more simple, more dynamic, more scalable for the customers managerially, economically and operationally. Anyhow, such a project can not be complete without defining a feasible pricing method. How should we put a price tag on the program? Which pricing strategy makes it more competitive than its rivals?

It may be thought that pricing strategy has nothing to do with the development process of an ERP, but it certainly influences it. As shown in Section 2, several alternative programs are sold as in one-time payment terms. In this method, the customer pays for the goods, and the economic connection ends with the vendor right at that spot, just like in

1Ci's pricing strategy. This is a limiting relationship between IT companies and customers. It has its challenges that coop up the customers with their new development requirements. A profitable and valuable commercial relationship must be a long-lasting and sustainable one. It is possible to observe that the one-time fee method is popular among small package programs sold to small trucking companies or freight forwarders. These programs are challenging to modify. They come and are installed "as-is" basis.

The annual payment system is one of the standard pricing strategies in Turkey. For example, the software company sells their ERP for a price. Additionally, it keeps invoicing the customer for annual (or monthly) maintenance fees, support desk charges, database licensing fees, CAL license fees.

Although the customer does not ask for technical support or does not demand any development in the ERP, in this method, the customer is asked to pay for a standard and a continuous fee in regular periods to the IT company. Despite many objections from the customer's side, this method is obligated for the buyers by IT companies that use this pricing method. These fees increase as the amount of CALs increases. At specific points, these fees become unbearable for the maritime companies. It is observed that shipping companies had to change their ERPs to an affordable alternative just because of these expenses. The customer is asked to pay for engineering fees when they observe and report errors or crash downs, which is unfair. The customer is asked to pay for support desk fees even though they did not apply for support services. This system might be a win for the IT company, but it certainly is not for the customer.

The software as a Service (SaaS) method represents multiple parameters related to the ERP systems. It identifies the relationship concept between the parties, including

pricing methodology and the type of deployment place where the program is supplied. SaaS is a single stop shopping for all the ERP needs of the buyers; by this identification, it is possible to call it a real turnkey solution comparing the other pricing methods available in the market up to now. In the SaaS approach, the customer pays a monthly fee for a basket it holds. The basket can be filled with one or more products and services parametrically. In SaaS, we observe that concrete products and services merged. The customers pay for an agreed monthly fee for all its requirements to have a sufficient technological infrastructure like hardware and software to run an ERP, including the ERP's itself. Their data is hosted, secured, backed up, maintained by the contractor in the SaaS system. The ERP is deployed, supplied, developed continuously by the same contractor as part of their agreement. Once the ERP gets developed and updated, the new version is automatically applied to all the customers unless otherwise requested. Some SaaS companies ask for a one-time set-up fee from their customer in addition to monthly fees, while some SaaS companies, which from our point of view, how it should be, start it all up straight from zero payment ground and billing monthly fees. However, these minor variations do not change that SaaS is a practical, simple, applicable, feasible, dynamic pricing method for selling an ERP to maritime companies.

The last alternative, Pay Per Usage (PPU) method, was unavailable in Turkey while this dissertation was being scripted. In this contemporary method, the software company asks the customers to pay as much as they use the software based on the amount of bill of lading they issue through the software or SKU they used to handle a pallet in and out. PPU is such an effective practice that acts as a bridge between SAAS and SAAG methods. PPU ranked as 2nd, right after the SAAS system in our AHP research.

In conclusion, we decide to use MS SQL as our database infrastructure, C# as our coding language, CLOUD VPS as our deployment environment and SaaS as our service, pricing commitment while developing KSHAL. Among these four criteria, the choice of coding language had the heavier weight than a database, platform and pricing methodology, as shown below. Suppose we observe secondary alternatives, particularly for software language choice. In that case, Java comes as second without a surprise as it is one of the powerful and dynamic languages that can be used, particularly for the back end.

Thanks to the above study, it has been decided to run KSHAL on Microsoft's SQL Server Suite. C#, collaborates with the other Microsoft family products in utmost compatibility, in harmony. Therefore, C# empowers the code flow of KSHAL. It is a SaaS-based ERP, and it has been both designed and deployed on the cloud VPS, using Microsoft's Azure environment. KSHAL will achieve its goals with the advantages of the cloud. These advantages are varied, such as flexibility, automatic updates, disaster recovery features, reduced costs, effective collaboration with 3rd part applications, access from anywhere with an internet connection, efficient document control, increased security, competitiveness and green computing (BDM Publications, 2019).

4.3 Building a CPM/PERT Model for Project Optimization

The Critical Path Method (CPM) is a project modelling technique developed in the late '50s by a group of researchers to visualize the project management process and define time-critical obstacles to reach the best application steps. The critical path method is used to estimate the minimum project duration. This will help determine the amount of scheduling flexibility available on network paths. It calculates the early start, early finish, late start, and late finish dates for all tasks. These do not consider any resource limitations by performing a forward and backward pass analysis through the schedule network, shown in our research.

Project Evaluation and Review Technique (PERT) is also a project management tool that works with CPM in harmony. While CPM focuses on critical application steps, PERT measures, deadlines, budget fits, project delivery obstacles based on optimistic(O), most likely(M) and pessimistic(P) time projections. It analyzes the time required to complete each task and its associated dependencies to determine the minimum time to complete a project. It estimates the shortest possible time each activity will take, the most likely length of time, and the longest time that might be taken if the activity takes longer than expected. Boushaala comments that CPM/PERT are powerful tools for project management (Boushaala, 2014). These tools are suitable when researchers or project managers work on software development operations such as the experiment documented in this thesis. Nguyen has successfully applied CPM/PERT methods in designing the software development process (Nguyen, 2006). From a general point of view, we can see that CPM/PERT applications are primarily used to optimise projects in the construction sector. However, some studies diverge from this observation. For example, Fahimifard et

al. applied CPM/PERT methodology to an agricultural project (Fahimifard & Kehkha, 2009). Lermen et al., on the other hand, utilized the CPM/PERT method efficiently and effectively in a laminate production line optimization project (Lermen, Morais, Matos, Röder, & Röder, 2016). When we search the literature, it is possible to determine that the CPM/PERT methodology finds creative uses. For example, Yuniarti et al., in their article, performed the optimization of the book printing process with the method mentioned above (Yuniarti & Djonaedi, 2019). This is another proof of how up-to-date and successful the CPM/PERT project planning and optimization algorithm is. Ashkenazi et al., used the CPM/PERT method in the design of control and management steps in a software development process (Ashkenazi, Shmilovici, & Ben-Gal, 2010). Razdan et al. successfully and creatively applied the CPM method to the development project of ATV type motorized vehicles and proved that the project completion time can be reduced by 9.1% (Razdan, Pirgal, Hanchate, Rajhans, & Sardar, 2017). Damle et al. applied the CPM algorithm to process optimization in a shoe factory (Damle, Rautela, Pandey, & Garg, 2015). As can be seen, the CPM/PERT method is a technique that can respond to a wide range of demands, from software to the defence industry, from manufacturing companies to organizations of the construction industry, in large-scale or small-scale projects.

The main difference between these two project management techniques is that CPM creates a deterministic model while PERT functions on a probabilistic structure. In a way, this difference can be considered a foundation of why they complete each other to reach reliable conclusions. In addition to this, CPM has one-time estimations, but PERT needs three times estimations as O, M and P variables. Therefore, the PERT method can be classified as an inductive technique, and CPM is a deductive method to illuminate the goals.

Table 101

Differences Between Cpm and Pert

Criteria	PERT	CPM
Abbreviation	PERT- Program (Project) Evaluation and Review Technique	CPM-Critical Path Method
Purpose	PERT is a technique, used to manage the uncertain task of a project	CPM is a statistical technique used to manage the tasks of a project
Use	To control time	To control cost and time
Suitable for which projects?	Research and development project	Construction project, Projects of repeatable nature like residential construction, rollouts, etc.
Manage	Unpredictable activities	Predictable activities
Basis	Performance is calculated on the basis of Events	Performance is calculated on the basis of activities
Model	Probabilistic Model	Deterministic Model
Crashing Concept	Not applicable	Applicable
Critical & Non-Critical Activities	No differentiation	Differentiated
Nature of Jobs	Non-repetitive nature	Repetitive nature
Appropriate for	High precision time estimate	Reasonable time estimate
Estimates	Three times estimates	One-time estimate
Orientation	Event Oriented	Activity Oriented
Focuses on	Time	Time-cost trade-off

Our research will apply these tools to determine the best project timeline, budget evaluation, and technical constraints. The KSHAL Project is a construction project that also has research and development segments in it. Especially projects like this change and evolve during the product's construction as new tools, libraries, updates, software development packages are released along the way. Unlike constructing a factory building or a machine, any parameter within the coding habitat changes faster than other industries. Due to/thanks to this fact, we must use these synergic methods to visualize our project goals.

4.3.1 Application Steps

KSHAL Project has a budget of 60000.- USD, and it is planned to be completed within 36 weeks or less. While forecasting project duration, *working days* are defined as Monday to Friday and working hours have been set between 08:30 AM to 17:00, including a 1-hour launch break between 12:00 AM to 1:00 PM. Gross salaries scaled monthly, including team members' social security, insurance expenses, daily meal tickets and mobile communication fees. The project budgeted three developers as follows;

1. **Architect:** The leading designer and the team leader are responsible for the project with all aspects, end to end. His duties were designing the software structure, transferring the ideas to blueprints, recruiting skilled developers, assigning their tasks and controlling whether they comply to project schedules or not, applying system and ERP analyses, and deciding when the ERP is completed and ready to run. The monthly gross salary is 2500 USD.
2. **Senior Developer:** The person is responsible for developing the database structure, relaying relational links between the tables, coding the back-end section of the software that is the core of the KSHAL platform. The senior developer is an engineer experienced in MSSQL Server and C# language, with decade-long experience developing web-based ERP projects. The monthly gross salary is 2200 USD.
3. **Junior Developer:** The person in charge of developing the front-end of the software by using .NET infrastructure and ASP, JSON languages and creating a simple yet powerful GUI by using HTML and CSS (Cascading Style Sheets) that is working with the back-end without flaws. The person who has five years long

active coding experience and who completed several similar projects. The monthly gross salary is 1600 USD.

The project activity nodes have been shown below, starting from the project's draft till deployment of the finished product. The test sequence is from Alfa to Beta.

Table 102 - *Activity Nodes*

ACTIVITY	**ACTIVITY DESCRIPTION**	**PRD**	**Estimated Duration (Weeks)**
A	Designing the software screens, screen flow, setting up server	-	2
B	Blueprints to Database Design Phase	A	2
C	Database Management System Building	B	3
D	Back-End Coding - Phase 1: Mainframe	C	3
E	Back-End Coding - Phase 2: Location Management Module	D	2
F	Front-End Coding - Phase 1: Design to Code Dashboard, Css	C	2
G	Back-End Coding - Phase 3: Company Management Module	E	3
H	Back-End Coding - Phase 4: Container Management Module	G	3
I	Front-End Coding - Phase 2: Adding Ready Modules	B, H	1
J	Beta Test - 1 (DB, Bugs, Flaws, Speed, Code, Screens)	I, H	1
K	Back-End Coding - Phase 5: Quotation Management Module	J	3
L	Back-End Coding - Phase 6: Billing & Reports Modules	K	2
M	Front-End Coding - Phase 3 : User Screens, Left Bar Menu	J	1
N	Back-End Coding - Phase 7: Shipping Module	L	3
O	Back-End Coding - Phase 8: Feedback Module	N	2
P	Front-End Coding - Phase 4: Adding Final Screens	O	1
R	Beta Test - 2 (End to End Complete User Experience Test)	O,P	1
S	Deploying the Software Online	R	1
Finish	Dummy Activity to close the Diagram	F, M & S	0

4.3.2 Results of CPM/PERT Model

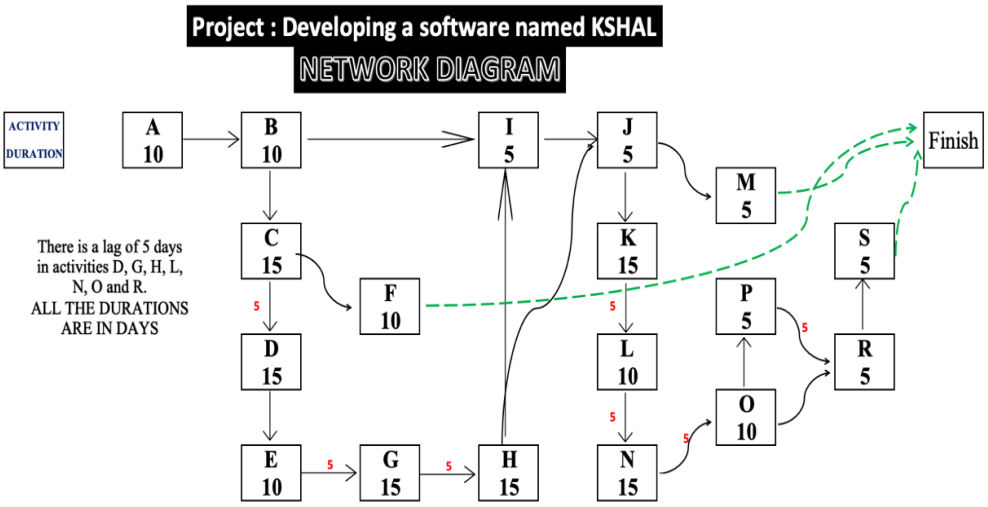
A network arrow or a node indicates activities. The arrow's tail displays the activity starting while the head suggests/points to the end of an activity. A single arrow is used to reflect the given time of operation. Operation periods are shown along with the arrows. **Dummy Activity** represents the task that uses no money or time to finish the project. The **Event** is the stage or the location where all previous jobs started and the jobs are yet to be done. The project's first event is the start of the project. Circles or nodes at the intersection of arrows are usually symbolic events.

Events in their sequential order are serially numbered. The **Network Diagram** is the diagram of the whole project. Different jobs are shown in this diagram to visualize the step-by-step flow of the process. **Earliest Start Time (ES)** is the earliest possible time at which an activity may start. **Earliest Finish Time (EF)** represents the earliest possible time to complete the assigned job. **Latest Start Time (LS)** is the latest possible time at which an activity may start without delaying the date of the project. **Latest Finishing Time (LF)** is when the project in whole or a node can be finished at the latest time. **Total Float (TF)** is the difference between the maximum time allowed for activity and its estimated duration. It is the duration of time when the activity can be started late without disturbing the project schedule. **Free Float (FF)** is the duration of time by which the completion time of an activity can be delayed without affecting succeeding jobs. **Interfering Float (INTF)** is the amount of time a scheduled activity can be delayed or extended from its **ES** date without delaying the project finish date. **Independent Float (INDF)** is the maximum amount of time an activity can be delayed without postponing the **ES** of the succeeding activities and without being affected by the allowable delay of the preceding

activities. **Preceding Activity** represents the activities that are performed before future jobs. **Succeeding Activity** represents the activities that are performed after the predecessors. **Critical Activities** are events that have no floats. The critical events are required to be completed on schedule. **Critical Path** is the path in the network joining the critical events.Based on KSHAL Project, the cumulative duration of the project is planned as nine months. Anyhow, a logical network diagram has revealed that the activities D and F are parallel, and F has no succeeding activity. Similarly, activities M and K are parallel jobs, and M has no next task. Thanks to this, the duration of the project is reduced to 33 weeks in these conditions. In addition to aspect the whole project in-depth, we applied a scenario as if our project will be completed after the 40th week. To complete the project requirements, we have to provide a lag of 1 week (5 working days) before these activities; D, G, H, L, N, O and R. Based on the revised table of activities, the network diagram is as follows;

Figure 158

CPM Network Diagram of KSHAL



As we observe, back-end related modules are the most time-consuming tasks which require 3 weeks each, namely nodes C, D, G, H, K and N. These are also the most important modules of KSHAL.

Accordingly, our new network diagram will be updated as follows;

Table 103

Updated Activity Table

ACTIVITY	PRD	Duration (Weeks)	Duration (Days)	Lag
A	-	2	10	
B	A	2	10	
C	B	3	15	
D	C	3	15	5
E	D	2	10	
F	C	2	10	
G	E	3	15	5
H	G	3	15	5
I	B, H	1	5	
J	I, H	1	5	
K	J	3	15	
L	K	2	10	5
M	J	1	5	
N	L	3	15	5
O	N	2	10	5
P	O	1	5	
R	O,P	1	5	5
S	R	1	5	
Finish			0	

CPM calculations have been applied both ways as forward and backwards. By this calculation, we assure ourselves that the consistency of the critical path is accurately designed. As a result, we will add ES and EF time stamps that show us how we re-graph and utilize the project completion steps.

In total, there are 35 days of slack time which is shown in the Lag column. Slacks are caused by the fact that the front-end developer needs to wait for the back-end developer

to show some progress in specific modules to integrate the back-end and front-end codes. Regarding this issue, we have proposed that our front-end developer work on a project basis rather than working on payroll. In the end, it brought him alternative income sources while reducing our salary figures in the total budget. The aim was, save the project from paying for the slack times.

Table 104

Forward Path Calculations

ACTIVITY	PRD	Duration (Weeks)	(Days)	Lag	ES	EF
A	-	2	10		0	10
B	A	2	10		10	20
C	B	3	15		20	35
D	C	3	15	5	40	55
E	D	2	10		55	65
F	C	2	10		35	45
G	E	3	15	5	70	85
H	G	3	15	5	90	105
I	B, H	1	5		105	110
J	I, H	1	5		110	115
K	J	3	15		115	130
L	K	2	10	5	135	145
M	J	1	5		115	120
N	L	3	15	5	150	165
O	N	2	10	5	170	180
P	O	1	5		180	185
R	O,P	1	5	5	190	195
S	R	1	5		195	200
Finish			0		200	200

Figure 159

Forward Path Diagram

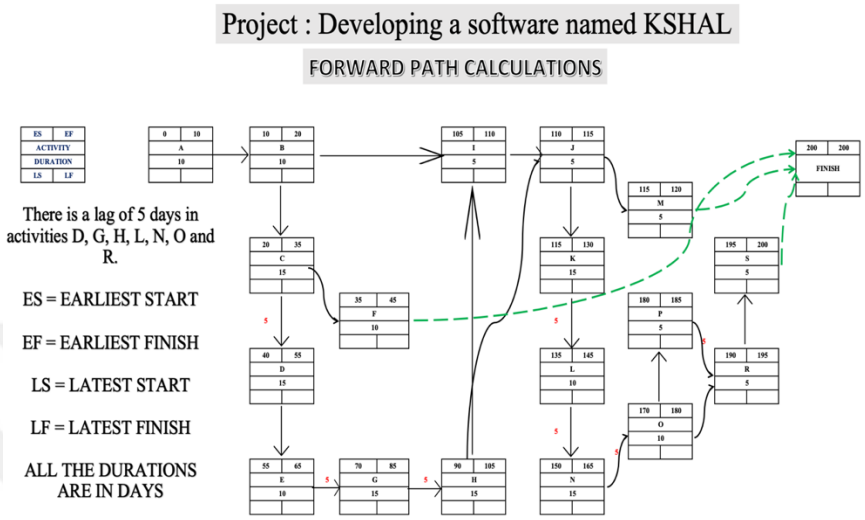


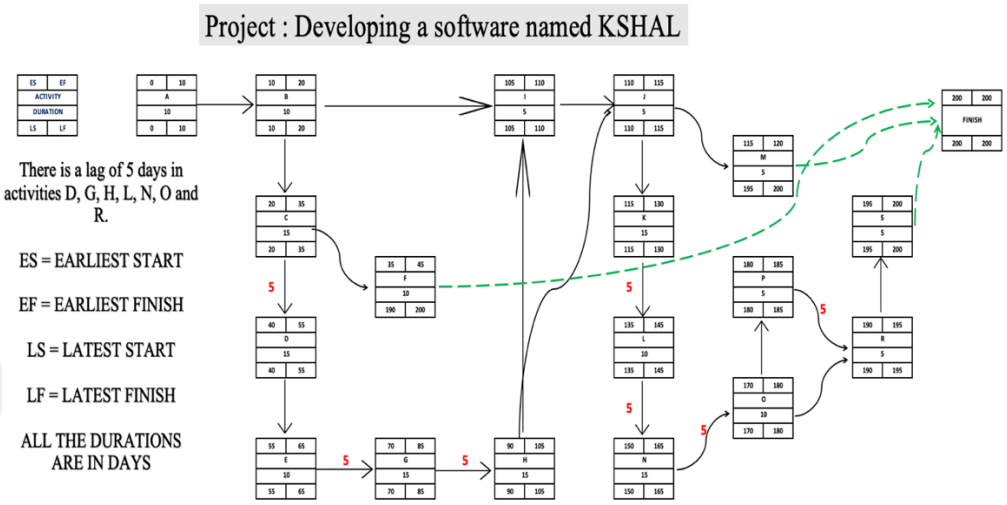
Table 105

Backwards Path Calculations

ACTIVITY	PRD	Duration (Weeks)	Duration (Days)	Lag	LS	LF
A	-	2	10		0	10
B	A	2	10		10	20
C	B	3	15		20	35
D	C	3	15	5	40	55
E	D	2	10		55	65
F	C	2	10		190	200
G	E	3	15	5	70	85
H	G	3	15	5	90	105
I	B, H	1	5		105	110
J	I, H	1	5		110	115
K	J	3	15		115	130
L	K	2	10	5	135	145
M	J	1	5		195	200
N	L	3	15	5	150	165
O	N	2	10	5	170	180
P	O	1	5		180	185
R	O,P	1	5	5	190	195
S	R	1	5		195	200
Finish			0		200	200

Figure 160

Backwards Path Calculation



At this stage, we are able to create our critical path as it is shown in the figure underneath. The **critical path** is consisted of A - B - C - D - E - G - H - I - J - K - L - N - O - P - R - S steps.

Figure 161

The Critical Path of KSHAL Project

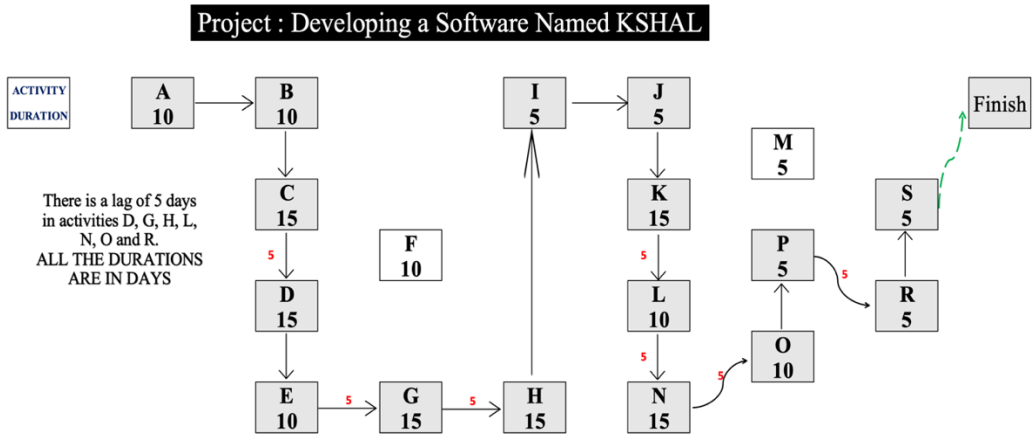


Table 106

Calculation Formulas of Parameters

Sr. No	Task	Abbreviations	Formula
1	Early Start	ES	ES = Max. (EF of Preceding Activities)
2	Late Start	LS	LS = LF - Duration
3	Early Finish	EF	EF = ES + Duration
4	Late Finish	LF	LF = Min (LS of Succeeding Activities)
			LF = Min (LS of Succeeding Activities) – Lag*
5	Total Float	TF	TF = LF – EF
			or
			TF = LS – ES
6	Free Float	FF	FF = ES of Next Activity – EF of Present Activity
			FF = ES of Next Activity – EF of Present Activity – lag*
7	Interfere Float	INTF	INTF = TF - FF
8	Independent Float	IndF	IndF = MIN. ES of Next Activity – MAX. LF of Previous Activity – Duration of Present Activity
			IndF = MIN. ES of Next Activity – MAX. LF of Previous Activity – Duration of Present Activity – lag*

Table 107

Activity Calendar

ACTIVITY	PRD	Duration (Days)	Lag	ES	EF	LS	LF
A	-	10		2-Jan	15-Jan	2-Jan	15-Jan
B	A	10		16-Jan	29-Jan	16-Jan	29-Jan
C	B	15		30-Jan	19-Feb	30-Jan	19-Feb
D	C	15	5	27-Feb	18.Mar	27-Feb	18.Mar
E	D	10		19.Mar	1-Apr	19.Mar	1-Apr
F	C	10		20-Feb	4.Mar	24-Sep	7-Oct
G	E	15	5	9-Apr	29-Apr	9-Apr	29-Apr
H	G	15	5	7.May	27.May	7.May	27.May
I	B, H	5		28.May	3-Jun	28.May	3-Jun
J	I, H	5		4-Jun	10-Jun	4-Jun	10-Jun
K	J	15		11-Jun	1-Jul	11-Jun	1-Jul
L	K	10	5	9-Jul	22-Jul	9-Jul	22-Jul
M	J	5		11-Jun	17-Jun	1-Oct	7-Oct
N	L	15	5	30-Jul	19-Aug	30-Jul	19-Aug
O	N	10	5	27-Aug	9-Sep	27-Aug	9-Sep
P	O	5		10-Sep	16-Sep	10-Sep	16-Sep
R	O,P	5	5	24-Sep	30-Sep	24-Sep	30-Sep
S	R	5		1-Oct	7-Oct	1-Oct	7-Oct
Finish		0		7-Oct	7-Oct	7-Oct	7-Oct

According to our CPM calculations, by defining the critical path, the first leg of the study has shown that it is possible to start the project at the beginning of January and complete it by the beginning of October. Best practices in the software development business predict that there is always a gap between the plan and realized timelines. Financial shortages, technical difficulties, human resources related changes, even weather conditions influence such projects. Thus, we should use a probabilistic method such as PERT to statistically find out whether the project will have a chance to get embodied within planned deadlines. PERT is a convenient tool for relatively more minor projects such as

ours, but it is hard to apply to bigger projects with thousands of node inflow. PERT has defined four types of time required to accomplish an activity:

- ***optimistic time*:** the minimum possible time required to accomplish an activity (o) or a path (O), assuming everything proceeds better than is normally expected
- *pessimistic time*: the maximum possible time required to accomplish an activity (p) or a path (P), assuming everything goes wrong (but excluding major catastrophes).
- ***most likely time*:** the best estimate of the time required to accomplish an activity (m) or a path (M), assuming everything proceeds as normal.
- ***expected time*:** the best estimate of the time required to accomplish an activity (te) or a path (TE), accounting for the fact that things don't always proceed as normal (the implication being that the expected time is the average time the task would require if the task were repeated on a number of occasions over an extended time).

$$te = \frac{o + 4m + p}{6}$$

$$TE = \sum_{i=1}^{n} te_i$$

Formula 1 - Expected Time

- ***standard deviation of time* :** the variability of the time for accomplishing an activity (σ_{te}) or a path (σ_{TE})

$$\sigma_{te} = \frac{p - o}{6}$$

$$\sigma_{TE} = \sqrt{\sum_{i=1}^{n} {\sigma_{te_i}}^2}$$

Formula 2 - Standard Deviation of Time

Standard Deviation (**SD**) will measure the discrepancy between the mean and the average. The weighted average determined by the PERT formula is interpreted in the current context. A low SD value shows that data points are similar to the average. **Variance** is the average of the squared differences from the mean. We shall be applying the following formulas as follows;

1. Expected Time (T_e) = $\frac{O + 4M + P}{6}$
2. Standard Deviation (SD) = $\frac{P-O}{6}$
3. Variance = $(\frac{P-O}{6})^2$

Where,

O = Optimistic Time

M = Most Likely Time

P = Pessimistic Time

4. Z = $\frac{X - T_e}{S.D}$

Where,

X = The Desired day at which we want to check probability.

T_e = Expected Duration of Critical Path

SD = Standard Deviation of Critical Path

For this part, we will be using the same data we have for the study's CPM leg and refining the whole project timeline based on optimistic, most likely and pessimistic deadline expectations. Naturally, the optimistic approach indicates the shortest possible time expectation that our software developers accomplish the completion, while the pessimistic estimation approach forecasts a more extended calendar for project completion. Concerning the above definitions, our activity estimation table is re-constructed for PERT analysis.

Table 108

Activity Calendar (Days)

ACTIVITY	ACTIVITY DESCRIPTION	PRD	O	M	P
A	Designing the software screens, screen flow, setting up server	-	5	10	15
B	Blueprints to Database Design Phase	A	5	10	15
C	Database Management System Building	B	10	15	20
D	Back-End Coding - Phase 1: Mainframe	C	10	15	20
E	Back-End Coding - Phase 2: Location Management Module	D	5	10	15
F	Front-End Coding - Phase 1: Design to Code Dashboard, Css	C	5	10	15
G	Back-End Coding - Phase 3: Company Management Module	E	10	15	20
H	Back-End Coding - Phase 4: Container Management Module	G	10	15	20
I	Front-End Coding - Phase 2: Adding Ready Modules	B, H	5	10	15
J	Beta Test - 1 (DB, Bugs, Flaws, Speed, Code, Screens)	I, H	5	10	15
K	Back-End Coding - Phase 5: Quotation Management Module	J	10	15	20
L	Back-End Coding - Phase 6: Billing & Reports Modules	K	5	10	15
M	Front-End Coding - Phase 3 : User Screens, Left Bar Menu	J	5	10	15
N	Back-End Coding - Phase 7: Shipping Module	L	10	15	20
O	Back-End Coding - Phase 8: Feedback Module	N	5	10	15
P	Front-End Coding - Phase 4: Adding Final Screens	O	5	10	15
R	Beta Test - 2 (End to End Complete User Experience Test)	O,P	5	10	15
S	Deploying the Software Online	R	5	10	15
Finish					

Several activities are comparatively more complex to complete due to the nature of those tasks. Particularly back-end related steps contain dual activities while, on the one hand, the developer deals with the database relations and, on the other hand, scripts the code for the modules.

Table 109

PERT Calculation Table

ACT	PRD	Optimistic Estimate (O)	Most Likely Estimate (M)	Pessimistic Estimate (P)	Expected Duration (Te)	Standard Deviation (S.D)	Variance (V)
A	-	5	10	15	10	1. 66667	27.777.778
B	A	5	10	15	10	1.666.667	27.777.778
C	B	10	15	20	15	1.666.667	27.777.778
D	C	10	15	20	15	1.666.667	27.777.778
E	D	5	10	15	10	1.666.667	27.777.778
F	C	5	10	15	10	1.666.667	27.777.778
G	E	10	15	20	15	1.666.667	27.777.778
H	G	10	15	20	15	1.666.667	27.777.778
I	B, H	5	10	15	10	1.666.667	27.777.778
J	I, H	5	10	15	10	1.666.667	27.777.778
K	J	10	15	20	15	1.666.667	27.777.778
L	K	5	10	15	10	1.666.667	27.777.778
M	J	5	10	15	10	1.666.667	27.777.778
N	L	10	15	20	15	1.666.667	27.777.778
O	N	5	10	15	10	1.666.667	27.777.778
P	O	5	10	15	10	1.666.667	27.777.778
R	O,P	5	10	15	10	1.666.667	27.777.778
S	R	5	10	15	10	1.666.667	27.777.778
Finish						0	0

Table 110

Project Duration

Sr. No	Expected Path	å Expected Duration	å Variance (V)	Standard Deviation (S.D)
1	A-B-C-F-Finish	45	1.111.111.111	3.333.333.333
2	A-B-I-J-M-Finish	50	1.388.888.889	3.726.779.962
3	A-B-I-J-K-L-N-O-R-S-Finish	110	2.777.777.778	5.270.462.767
4	A-B-I-J-K-L-N-O-P-R-S-Finish	120	3.055.555.556	5.527.707.984
5	A-B-C-D-E-G-H-J-K-L-N-O-R-S-Finish	170	3.888.888.889	6.236.095.645
6	A-B-C-D-E-G-H-I-J-K-L-N-O-R-S-Finish	180	4.166.666.667	6.454.972.244
7	A-B-C-D-E-G-H-J-K-L-N-O-P-R-S-Finish	180	4.166.666.667	6.454.972.244
8	**A-B-C-D-E-G-H-I-J-K-L-N-O-P-R-S-Finish**	**190**	**4.444.444.444**	**6.666.666.667**

There are eight paths out to finish and number eight was detected as the critical path as shown in the above table. By considering the critical path we have to calculate total project duration, variance and standard deviation as follows;

$\sum T_e$ = 190 Days

∑Variance = 44. 444444

S.D = $\sqrt{\sum Variance}$ = $\sqrt{44.444444}$

S.D = 6.66666667 ≅ 6.7

General Normal Distribution Graph under conditions T_e = 190 Days and S.D = 6.7 Days.

Figure 162

SD of Project Days

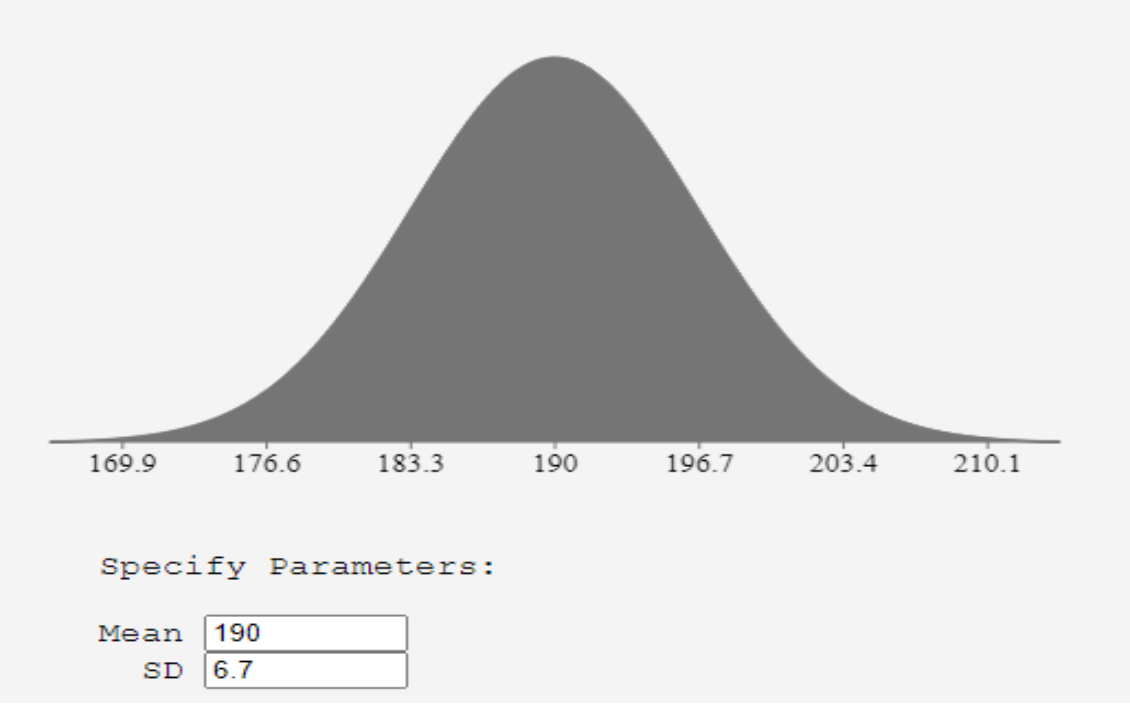


Figure 163

Probability of Finishing The Project in Less Than 180 Days

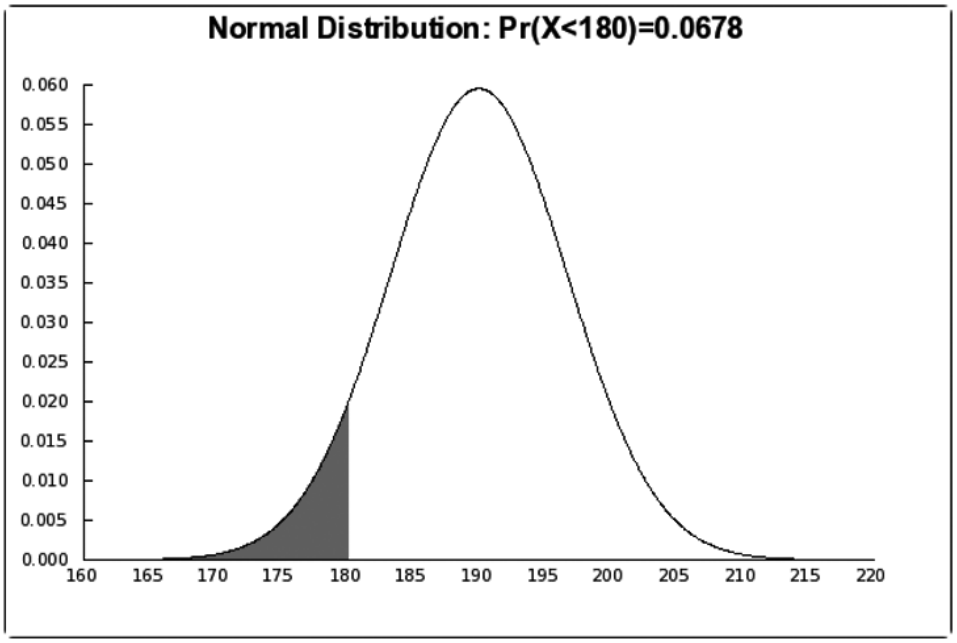


Figure 164

Probability of Completing the Project After 180 Days

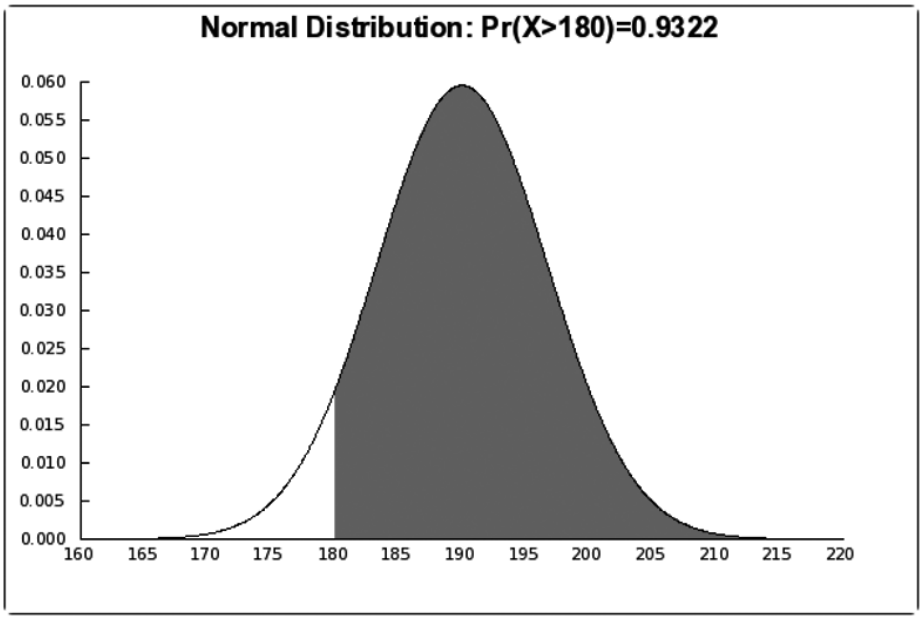


Figure 165

Probabilty of Completion in 200 Days

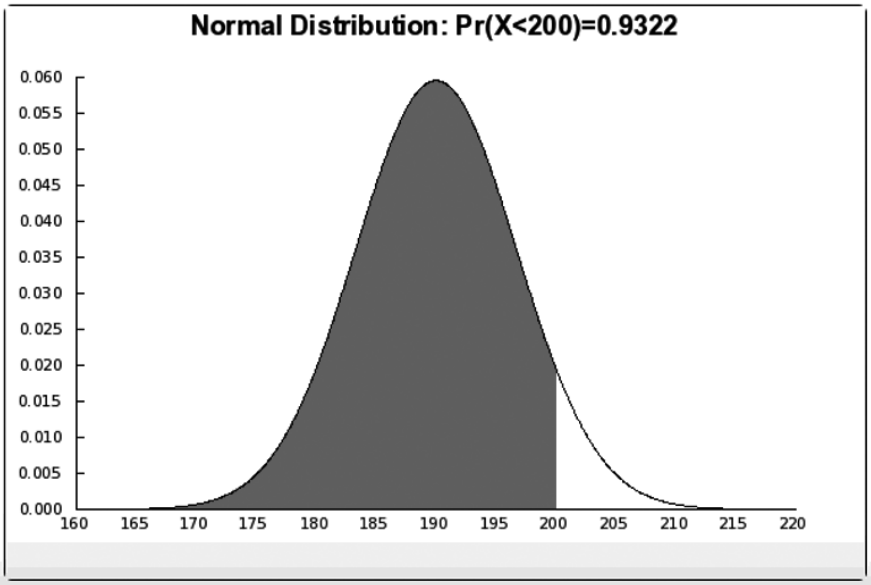


Figure 166

Probability of Completion in 210 Days

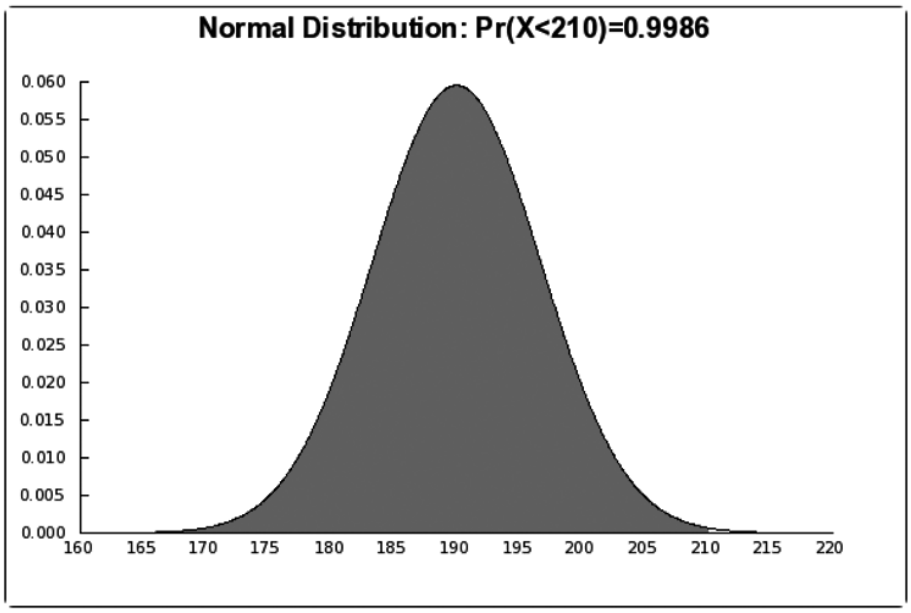
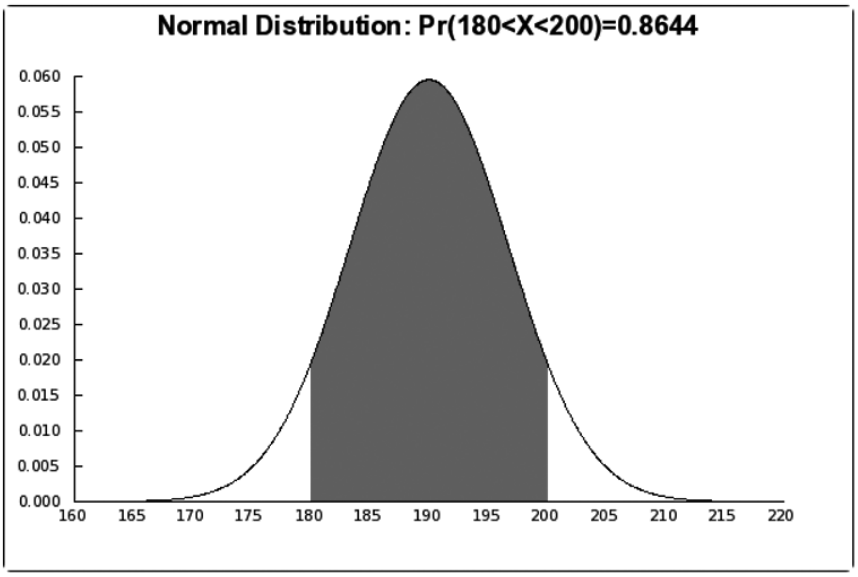


Figure 167

Probability of Completion Between 180 and 200 Days



The findings of our calculations will be referenced on Z-Table which is shown at the end of this paper. The probability calculation of completion days will be as follows;

Probability of Completing the Project in Less Than 180 Days

$Z = \frac{X - T_e}{S.D}$

$Z = \frac{180-190}{6.7} = -1.49$

From Table against Z = -1.49 Probability is 0.0681 or 6.81%

Probability of Completing the Project After 180 Days

Total Probability = 1

Probability on 180 Days = 0.0681

Probability after 180 Days = 1 – 0.0681 = 0.9319 or 93.19%

Probability of Completing the Project in 200 Days

$Z = \frac{X - T_e}{S.D}$

$Z = \frac{200-190}{6.7} = 1.49$

From Table against Z = 1.49 Probability is 0.9319 or 93.19%

Probability of Completing the Project After 200 Days

Total Probability = 1

Probability on 200 Days = 0.9319

Probability after 200 Days = 1 – 0.9319 = 0.0681 or 6.81%

Probability of Completing the Project Between 180 and 200 Days

Total Probability = 1

Probability on 180 Days = 0.0681

Probability after 200 Days = 0.0681

Probability between 180 & 200 Days = 1 – 0.0681 – 0.0681

Probability between 180 & 200 Days = 0.8638 or 86.38%

Table 111

Results Table

Sr. No	Probability Condition	Z-Table	Beta Distribution Graph
1	Probability of Completing Project in 180 Days	6.81%	6.78%
2	Probability of Completing Project after 180 Days	93.19%	93.22%
3	Probability of Completing Project in 200 Days	93.19%	93.22%
4	Probability of Completing Project after 200 Days	6.81%	6.78%
5	Probability of Completing Project Bet 180&200 Days	86.38%	86.44%

As the conclusion of this section, KSHAL Project was completed by the end of September 2020 as planned within the budget and timeline. The project took an evident 38 weeks, and the cost of the software was realized as 59100.- USD.

4.4 Evaluating Effectiveness by Data Envelopment Analysis

Evaluating the effectiveness level of deployed programs is often a neglected task. Software companies, particularly ones supplying programs for commercial entities, must compile user feedback and customer experience data to analyze them. The purpose of these analyzes, particularly for bleeding-edge products in the software industry, is necessary to measure customer satisfaction and product efficiency. There is a common reaction for newer ERP solutions at companies. The average user maintains his/her lifespan by building up the work habits that keep him/her on the safe side of the operational flow. One of those habits is internalizing the ERP screens and menus, which are often used within his/her daily routines. A new ERP, new screen flow, new menu structure are, from time to time, creating hardships for both the software supplier and the software user while installing the new ERP to the customer company.

The average user must adapt to the new IT structure without sacrificing well-earned workspace comfort. On the other hand, getting oriented to new technology is a challenging task for conservative users. It might take longer to break the ice for them, and on certain occasions, projects delay or receive negative feedback. Thus, these users must be convinced that the new product will not cause long working hours, extra shifts while accomplishing routine tasks. In any case, such user rejection and sometimes negative impact are partially unavoidable while applying a new ERP system to maritime logistics companies. Therefore, such "after-sales" analyzes must be made occasionally every year at several customer branches for measuring the ERP's acceptance ratio among the users and scaling whether there are any noticeable improvements in their daily routines.

4.4.1 Definition of Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a mathematical programming-based method to evaluate the relative performance of organizations (SANTOS, 2013). DEA is a method of benchmarking between a number of variables that are compared based on several types of inputs and outputs. DEA is a mathematical tool that helps us to measure the efficiency of limited resources and guides us on how to improve their efficiency. This method provides necessary opportunities for analyzing the productivity of organizations by considering the large type and amount of inputs and outputs at different departments (Özcan, Örde, & Tüfekçi, 2019). DEA is actively used in organizations that have multiple branches as it helps to identify efficient and inefficient units (a.k.a DMUs: Decision Making Units) in a framework where results are considered in their particular context.

DEA was firstly presented by an American statistician Abraham Charnes, in 1978 as a non-parametric model of forecast that is defining EF's (Efficiency Frontiers) to identify the best possible solution for either maximizing or minimizing the targets. Particularly, the article that was published by A. Charnes, W.Cooper and E.Rohades in 1978 was titled "*Measuring the Efficiency of Decision Making Units*" has brought this method to sight. In fact, its roots may be found as early as 1957 in Farrel's seminal work or even to Debreu's, which introduced in the early fifties the "coefficient of resource utilization" (Santos, Negas, & Cavique, 2013). Nowadays DEA is used in both profit and non-profit organizations. Banks are using this technique to measure the efficiency of their branches. Supermarkets are using it to measure market space/ customer ratio efficiency and maritime logistics companies use it to visualize the effectiveness of their sales team by comparing how many customers they serve at multiple locations.

In this respect, DEA is a cooperative tool that can be used in combination with several other mathematical methods such as AHP (Analytic Hierarchy Process) or MCDA (Multi Criteria Data Analysis) (Korpela, Lehmusvaara, & Nisonen, 2007). There are academic researches that significantly approve that DEA is one of the useful tools while choosing investment locations for banks, hospitals, warehouses and such.

Russo and Rindone applied DEA on productivity comparison between Mediterranean Container Terminals in their paper titled "Container Maritime Transport on an International Scale: Data Envelopment Analysis for Transhipment Port." by adding that DEA has taken a leading role through their research to identify competitive superiority of the container terminals (Russo & Rindone, 2011). Their paper can be classified as a real example of using DEA as a tool to measure productivity between several different branches or entities in an akin periphery of our study. Golany et al. have also used DEA in their article titled "A Data Envelopment Analysis of the Operational Efficiency of Bank Branches." to rank efficiency levels of different bank branches (Golany & Storbeck, 1999). In our research, DEA was used for a similar purpose. An another research conducted by attributing the advantages of DEA by Chao et al. to evaluate and compare the efficiency of major container shipping companies (Chao, Yu, & Hsieh, 2018).

In their research, Bray et al. explain that using DEA to measure transport systems efficiency, as "In transportation management, the measure of systems efficiency is a critical issue in verifying the performances and proposing the best countermeasure to achieve the prefixed goals. Many efforts have been made in this field to provide a satisfactory answer to this problem. One of the most used methodologies is the Data Envelopment Analysis (DEA) that has been in many areas. The DEA technique is helpful as a non-parametric

method that allows handling many outputs and input simultaneously."; this statement is an influencing reference for us to consider the DEA methodology fit for the research space of this thesis (Bray, Caggiani, & Ottomanelli, 2015).

Data Envelopment Analysis technique, as in the study of Saxena et al., has been a method that has found widespread use in the transportation, maritime and logistics-related sectors, especially in the performance, productivity and efficiency measurements of different branches (Saxena, Dewan, & Mustafa, 2013). In addition, the data envelopment method, as a competent 'benchmark' technique, is also a reliable way to compare different transport corridors, as seen in the study of Melo et al (Melo, Alves, Perico, Guzman, & Rebelatto, 2018). Campaniello benefits from what DEA can offer in a perfectly matching research field, measuring the efficiency of different container shipping lines in his article titled "Liner Companies' Container Shipping Efficiency Using Data Envelopment Analysis." (Campaniello, 2017).Another academic perspective is to use the data envelopment analysis method to measure customer relationship performance evolution in supply chains. As used in this thesis, the research conducted by Chen et al. also describes the application areas of data envelopment method towards customer relations activities in transportation, logistics and maritime (Chen, Chiang, Hsieh, & Zeng, 2018). This fact can prove how versatile the data envelopment analysis method is and how it can cover a wide range of research areas. Performance measuring is one of the main objectives of DEA applications in academic researches. For example, Tonanto et al. have been using DEA to visualise the performance indicators of logistics companies in their paper and mention that "...apply the concept of Balanced Scorecard (BSC), Analytic Hierarchy Process (AHP) and Data Envelopment Analysis (DEA) together to create a new performance measurement

framework to analyse the performance of reverse channels." shows that DEA in collaboration with AHP is a valuable asset to study on such benchmarks in maritime and logistics industries (Tonanto, Yimsiri, Jitpitaklert, & Rogers, 2008). Razei and Adressi have worked on the supply chain performance problems by applying data envelopment analysis. They have defined one of the remarkable advantages of DEA as the possibility of simultaneous usage of different inputs and outputs with other measuring criteria (Rezaei & Adressi, 2015). Lepcak and Voese have used data envelopment analysis in a theoretical framework were composed of the logistics efficiency and the discussion of the characteristics of modes of transport and variables related to efficiency (Lepchak & Voese, 2020). Lee et al. applied the DEA method to evaluate and improve the efficiency of logistics companies' problems. The researchers have used debt to assets ratio and debt to equity ratio as inputs and earnings per share and return on asset as outputs while visualising the findings (Lee, Lam, & Lam, 2021).

Data envelopment analysis is not only used to compare the performance of service sector companies. It is also a frequently used method in optimizing the workflows of manufacturing companies, as seen in the work of van Volsem and van Landeghem (van Volsem & van Landeghem, 2009). The Malmquist index (MI) evaluates the efficiency change over time. The non-parametric framework is measured as the product of catch-up (or recovery) and frontier-shift (or innovation) terms, both coming from the DEA technologies (Tone, 2016). In their conference paper, researchers visualized the development of logistics companies through the DEA method, adhering to the Malmquist Index (Chandraprakaikul & Suebpongsakorn, 2012). Similar studies with a research space related to our subject are also given in the table below with their sources.

Table 112

Supporting Resources

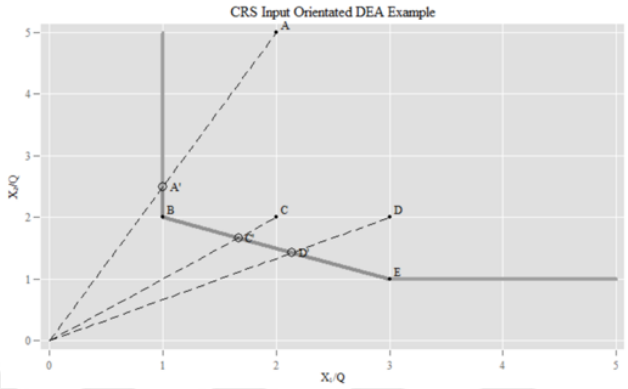
	Discussion Area	Supporting Literature
1	Fiscal Comparison of Logistics Companies	Aliyev & Onurlu (2021) https://doi.org/10.35408/comuybd.877092
2	ERP Implementation using DEA	Koch (2006) DOI: 10.1007/1-4020-5634-6_11
3	Information System Appraisals	Bernroider & Stix (2006) http://scholarworks.lib.csusb.edu/ciima/vol6/iss2/13
4	ERP Systems Related Benchmarks	Tashev & Angelova (2011) https://www.wseas.org/multimedia/books/2011/Tenerife/CSCC.pdf
5	ERP Programme Evaluation	Ghapanchi & Jafarzadeh & Khakbaz (2008) http://aisel.aisnet.org/icis2008
6	Supplier Evaluation & Innovation	Diouf & Kwak (2018) doi:10.3390/su10103779
7	Subcontrator Analysis using DEA	Kazançoplu (2008)
8	Port Activities Measurement with DEA	Acer (2016)

The power of DEA is based on comparability. We are able to compare the best DMU with the following DMUs in their scales. To allow for applications to a wide variety of activities, we use the term Decision Making Unit (=DMU) to refer to any entity that is to be evaluated in terms of its abilities to convert inputs into outputs. These evaluations can involve governmental agencies and not-for-profit organizations as well as business firms. The evaluation can also be directed to educational institutions and hospitals as well as police forces (or subdivision thereof) or army units for which comparative evaluations of their performance are to be made (Seiford & Zhu, 2011).

1. Simple DEA with one type of input and one type of output for DMU's : This primitive option is used for small chains where there is a single type of input and output for the analysis.
2. Convex Curved DEA (Minimization Comparisions): In convex curved DEA charts lower values define better efficiencies (Efficiency Frontiers) whereas it is used for visualizing minimization models when a company aims to reach the best possible cost management occasions or minimum level of whichever source budgeted for efficient production.

Figure 168

Convex DEA Graphic Example

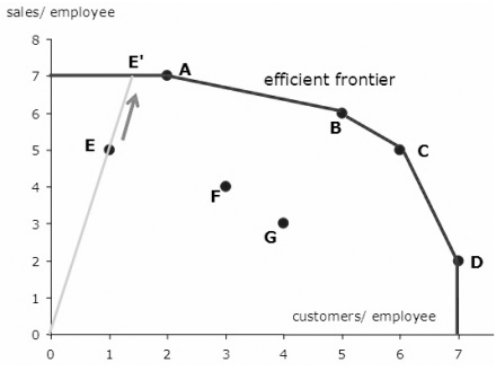


Note. From statalist.org

3. Concave Curved DEA - Single input and multiple outputs (Maximization Comparisons): In concave curved charts larger the value of DMU's better the results. So, we can say that EF's are the curves that envelope all the DMUs. All the charts help us to visualize the Relative Efficiency (RE) and get them optimized with the help of Virtual DMUs.

Figure 169

Concave Curved DEA Graph Example



RE can be considered as efficiency ratio of all the other non efficient DMUs. In certain examples the most efficient DMU is enveloped as 1 (Literally 100% match of data compared), so RE is;

$$0 \leq RE \leq 1$$

4.4.2 Application Steps and Outcome

KSHAL is in use of three companies that are controlling five branches in two countries, consolidated. All these companies have worked in the same freight network called UNICA, and they all are medium-sized freight forwarding entities. These three companies co-operate with each other for their shipping and logistics activities. Company A is located in Istanbul, Company B and C are located in Ukraine. Company B and C have their offices in Odessa and Kiev. Company A employs 18 white shirt workers (DMU1), company B employs 22 people in Odessa (DMU2) and 20 people in Kiev (DMU3), company C employs 24 people in Odessa (DMU4) and nine people in Kiev (DMU5). The core business of these three companies is container shipping, selling second-hand containers, air cargo deliveries. They all have their sales teams that call and visit customers constantly. Each of these hubs will be numbered as DMU1 to DMU5. The analysis aims to determine how effectively these DMUs use KSHAL while issuing BLs, offering prices and submitting sales and marketing reports. We will begin with one input and one output sample and carry it on to multiple inputs and multiple outputs experiments. The research focuses on their half-a-year-long activity.

Table 113

One Input - One Output DEA Table

ISSUED BLS ON KSHAL	IN / OUT	DMU1	DMU2	DMU3	DMU4	DMU5
NR. OF BLS	OUTPUT	516	410	207	342	189
NR. OF EMPLOYEES	INPUT	18	22	20	24	9

According to above mention table, we can observe how productive each branch was when it comes to issuing the marine bill of ladings using KSHAL. It is a piece of supportive

information to visualize how keen these branches carrying their activities onto the KSHAL platform. Table 6 is dividing the quantity of issued bill of ladings by each DMU's employee quantity;

Table 114

The Most Efficienct DMU

ISSUED BLS ON KSHAL	IN / OUT	DMU1	DMU2	DMU3	DMU4	DMU5
NR. OF BLS	OUTPUT	516	410	207	342	189
NR. OF EMPLOYEES	INPUT	18	22	20	24	9
BL PER EMPLOYEE	EFFICIENCY	**28,7**	18,6	10,4	14,3	21,0

$$Efficiency = \frac{\text{No of Employees}}{\text{No of BLs}}$$

As we can see here, DMU1 is the most efficient DMU based on the comparison between the BL's (Output) produced by employees (Input) of different DMU's. At this stage, it is necessary to calculate the RE (Relative Efficiency) of the other inefficient DMU's. RE is the ratio of inefficient DMU's compared to the efficient DMU, which is;

Table 115

Relative Efficiency

RELATIVE EFFICIENCY		**DMU1**	DMU2	DMU3	DMU4	DMU5
NO OF BLS	OUTPUT	**516**	410	207	342	189
NO OF EMPLOYEES	INPUT	**18**	22	20	24	9
BL per EMPLOYEE	EFFICIENCY	**28,7**	18,6	10,4	14,3	21,0
REL. EFFICIENCY	RE	**1,00**	0,65	0,36	0,50	0,73

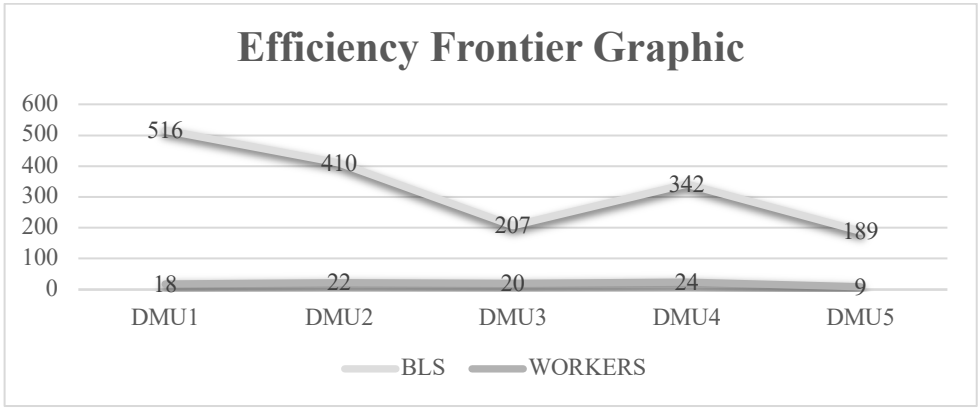
$$RE = \frac{\text{DMU}_\text{i}}{DMUe}$$

DMU_i is identifying inefficient DMUs while *DMUe* is the efficient DMU (It is Company A in our example). Relevant efficiencies sequenced in between 1 and 0 as indicated on the first page. On the following graph, we will be showing the Efficient Frontier (EF) that shows the best solution while enveloping all DMUs. At this first stage, we can see which branch of our experiments is the most efficient one by using KSHAL software. The rank is;

1st	DMU1 : 28.7 BLs produced by or per employee	(RE 1)
2nd	DMU5 : 21.0 BLs produced by or per employee	(RE 0,73)
3rd	DMU2 : 18,6 BLs produced by or per employee	(RE 0,65)
4th	DMU4 : 14,3 BLs produced by or per employee	(RE 0,50)
5th	DMU3 : 10,4 BLs produced by or per employee	(RE 0,36)

Figure 170

Efficiency Frontier



It is proved that DMU1 is the most efficient branch comparing the results of the other DMU's. The line between the origin of the graphic to the X, Y-axis determines the efficiency frontier. We can classify the rest of the DMUs as inefficient. The gap (or the distance) between their position to EF shows their amount of improvement to become an

efficient DMU. So, practically these branches must push their stats all the way left to the efficiency frontier.

The number of parameters (inputs and outputs) can be umpteen based on various requirements depending on what researchers would like to measure.

While modelling our DEA questionary, it was necessary to study other parameters such as running costs, turnover of the participant DMUs and turnover by an employee of each participating DMU. In this step, our DEA study will take multiple inputs and one output into consideration to visualize the efficiency level of KSHAL at DMUs.

Table 116

Multiple Inputs and Single Output

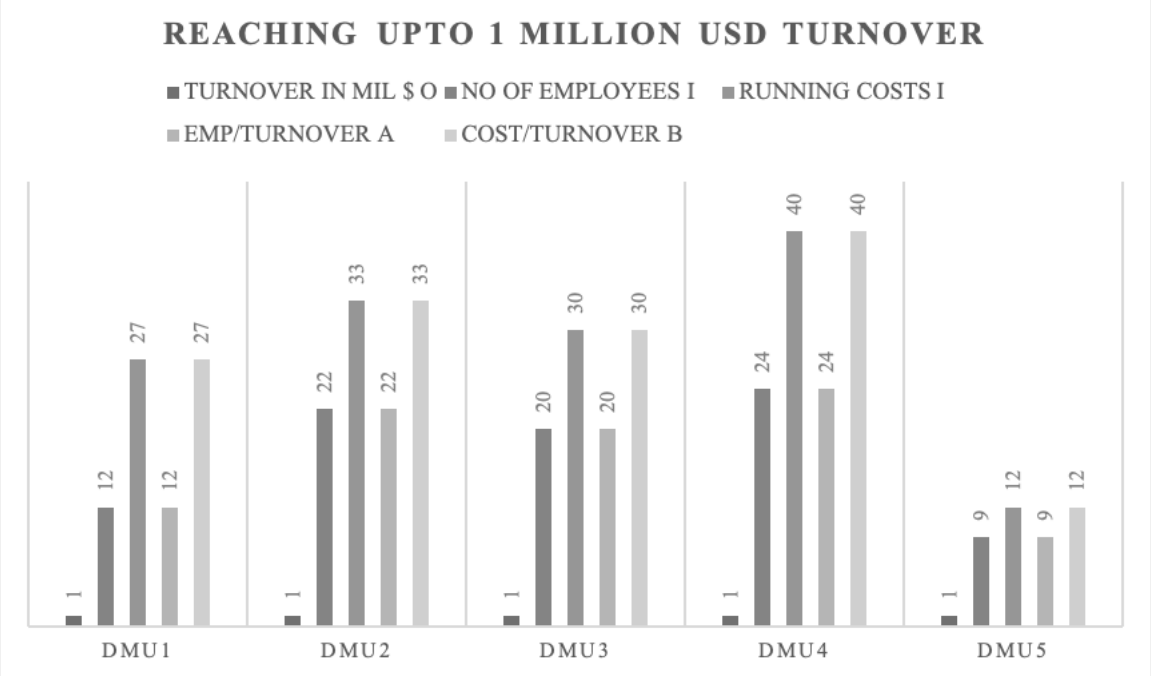
		DMU1	DMU2	DMU3	DMU4	DMU5
TURNOVER MIL $	O	1	1	1	1	1
NO OF WORKERS	I	12	22	20	24	9
RUNNING COSTS	I	27	33	30	40	12
EMP/TURNOVER	A	12	22	20	24	**9**
COST/TURNOVER	B	27	33	30	40	**12**

We measure at which scale our DMUs reach up to 1 million Usd turnover based on two inputs as a number of employees and running costs. It is shown that DMU5 makes one mil Usd turnover with nine employees while DMU4 does the same with 24 personnel. While Cost/Turnover and Employee/Turnover comparisons seek much lower values, the graph will show a convex graphic as shown below. Cost minimization aiming models should push variables (DMUs) down to zero, and this is why our graphic will picture the efficiency frontier downwards. We can indicate the opposite in maximization models as the push-up of data expands the efficiency frontier far from zero (origin of the graphic). Here on our below graphic, we can see some DMUs are located far from our efficiency border

(the efficiency frontier). It is getting more straightforward to find out the amount of improvement, which is also called Technical Inefficiency (TI), by applying the RE formula. This is supportive data for our paper when it comes down to acknowledging the efficiency that KSHAL adjusted to the daily tasks of these DMUs in shipping operations. Any software capable of offering fast response times with simple screen flow and sufficient security preventions will be one of the driving forces of maritime companies to score higher turnovers and profit margins.

Figure 171

Efficiency Frontier



To set all DMUs efficient, we must propose the participants, which are also KSHAL users. These solutions may bring their activity results closer to the efficiency curve, which is clustered around DMU5. DMU5 represents our EF line on the above graphic. We can see that the curve slope is convex as we try to create a model that provides the best

efficiency with minimum inputs. DMU2 and DMU4 are inefficient participants who need to revise their strategies, while DMU5,1,3 are efficient ones. Here, on this table, we may tag the distance from the origin to EF on the line to DMU1 as yDMUi, and a comparison of that value over yDMU gives us the Relative Efficiency. The visual distance between DMU1 and EF shows the amount of improvement, by another name, the technical inefficiency ratio. In case we calculate the new scale for inefficient branches, we will have virtual decision-making units. They are suggestive 'stations' for these branches about to where they should lead to. Simply, it indicates that all participants must catch the EF level of the most efficient DMU.

In the final step, we will examine one input and multiple outputs variant of the DEA data, a practical example for maximization (profit, shipment quantity, new customers acquired, sales statistics, Etc.) purposes.

Table 117

One Input and Multiple Output

		DMU1	DMU2	DMU3	DMU4	DMU5
VISITS PERFORMED	O	240	**336**	216	168	125
QUOTATIONS MADE	O	178	**284**	221	126	110
KSHAL USERS	I	18	**22**	20	24	9
VISIT/USER	A	13	**15**	11	7	14
QUOTATIONS/USER	B	10	**13**	11	5	12

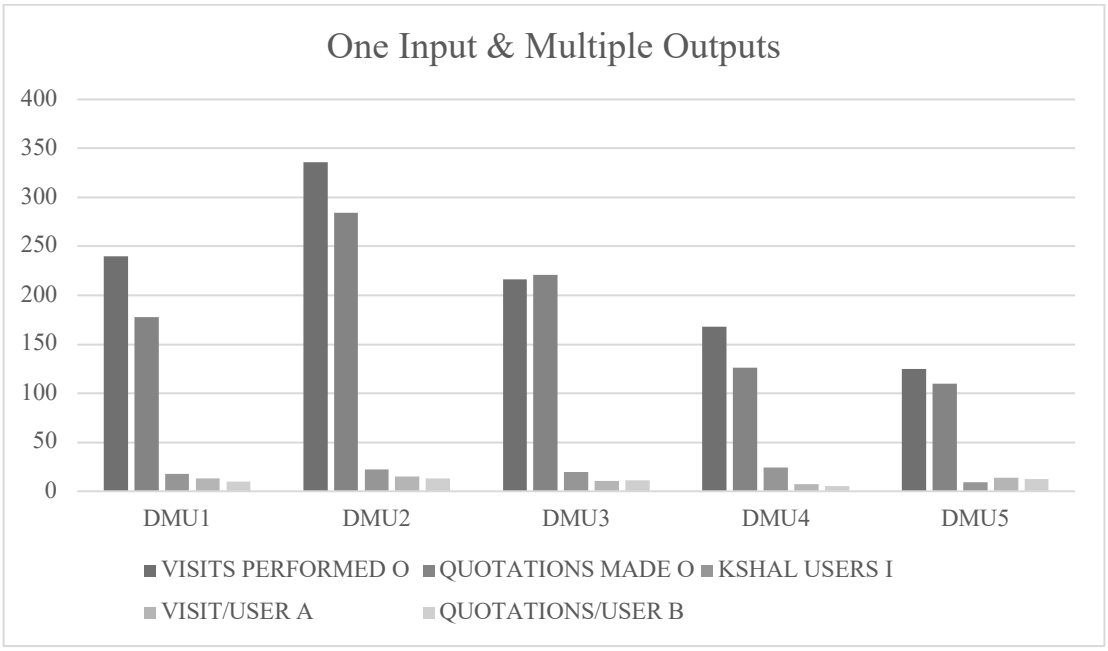
Different branches have different scores of customer visits, where they meet with potential customers for their services. It is possible to observe that each DMU has its core activity; while one is active operationally, the other is keen on sales and marketing campaigns. In the above table, two output variables are compiled. One is the quantity of

how many customers associated with KSHAL users visited and how many freight quotations had been made through the KSHAL system.

These two output indicators are enveloped by the quantity of KSHAL users working at each DMU. The simple benchmark was applied by comparing customer visits per CAL and quotations sent per CAL. KSHAL system allows all users to provide freight quotations to customers, disregarding whether they are sales personnel. Therefore, we do not seek the highest score of each. Instead, we seek the highest comparison result of variables to define our EF as a maximization task. In our example, DMU2 scores the most efficient result compared to the other DMUs in this study. DMU4 is the least efficient participant of this analysis that must improve their activity results upwards to match and even surpass the EF.

Figure 172

One Input and Multiple Outputs



KSHAL users visit customers based on their CRM Module activity using the software. They submit their phone calls, email communication and visit & meeting

scheduling into the program. The table shows how active the employees use the quotation module per each worker of the branches. Here we can observe that the least active customer visiting branch per CAL is DMU4. As shown on this graphic, the aim of participants must boost up sales and quotations by numbers. The boost, in the way of an explosion that scatters from origin to outside so, the visualization of the graphic will be a concave curve. As a conclusion of this section, we could identify the most efficient spots and weakest links of the network with the support of data envelopment analysis. DEA assisted our research to visualize the possible directions that companies must head to for increasing or decreasing their activity results for reaching their efficiency frontiers.

5. RESULTS AND CONCLUSION

According to Porter's Value Chain Theory, we must focus on the company activities by breaking them down into separate divisions to observe one monolithic image as a Value Chain. Each division has its fingerprint on overall expenses, directly influencing our efficiency, turnover and, naturally, our profit margins. From inbound logistics, operations, outbound logistics, marketing & sales, and other services, each department is driving forces of the company productivity. Each department must contribute to the goal of achieving sustainable efficiency and profitability. Most organizations engage in hundreds, even thousands, of activities to convert inputs to outputs. These activities can be classified generally as either primary or support activities that all businesses must undertake in some form (Porter's Value Chain Theory, 2020).

Therefore, the role of a robust ERP infrastructure that communicates with each of those departments interlinks them through and helps them all to carry the goals on are components of the engine of this strategy. Nowadays, value chains can not be considered without I.T. systems such as KSHAL. KSHAL also structurally divides the tasks into several divisions as if it creates its Value Chain. All of its modules both, individually and collaboratively, are fully dedicated to the profitability of the user companies. In this respect, it was evident that KSHAL approached maritime companies and their activities by how Porter's Value Chain Theory approaches companies strategically. KSHAL segments the activities as container trade, shipping operations, inbound cost controlling, outbound quotations, marketing & sales and other services.

A value chain is a powerful tool for disaggregating a company into its strategically relevant activities in order to focus on the sources of competitive advantage, that is, the

specific activities that result in higher prices or lower costs (The Value Chain, 2019). One of this paper's research questions (Q6) asks whether web-based maritime software provides a noticeable decrease in operational software-related expenditures of small and midsized freight forwarders and supply chain companies or not. Thus, this research, mainly the research question number 6, walks hand in hand with Porter's Value Chain Theory along the path of decreasing the costs while heading towards increasing the efficiency and profitability of companies.

The evolution of big data technologies has introduced us to the concept of data visualization. The data owners are required to have these figures visually expressed, which they think will be a more straightforward method to work through big heaps of data clusters. Data visualization has its roots in statistics and is therefore generally considered a branch of descriptive statistics. However, because both design skills and statistical and computing skills are required to visualize effectively, it is argued by some authors that it is both an art and science (Gershon, 2001). According to theories cited in section 1.2 of this dissertation, specially Kiyoyasu Tanaka's "Time in Transit Theory" needs data visualization to solve the complex transportation problems. According to Tanaka's theory, shippers pay proportionally higher freight for short routes than longer routes.

Tanaka, adds that "Individual freight transactions are characterized by timely, frequent, and small-batch shipping." and with this explanation, we realize the challenge of making the right decisions for which shipping option, service provider, the tariff will be used gets perplexing subject for the shippers (Tanaka, 2010). One of the obstacles in this issue is how to display meaningful results to decision-makers screens visually. Tanaka’s theory aims to analyze freight and distance (route) alternatives while finding affordable

solutions without compromising delivery times and the safety and reliability of selected service options. This perspective is also owned by KSHAL's UX while compiling costs, shipping line alternatives, surcharge derivatives and visualizing them all in the most convenient way for its users. KSHAL's price quotation module brings freight variations on screens by revealing the names of the shipping lines and their transit times. KSHAL users can see all the freight and route alternatives in the same module consecutively, so they may be equipped to take the right decision for that specific shipment. At this step, with the support of Tanaka's "Time in Transit Theory", we may observe that one of the hypotheses of this paper (H5), that manifests "A web-based maritime software triggers a remarkable progress for good on data handling of small and midsized freight forwarders and shipping companies." is definitely in use on KSHAL while cost storing and freight quoting.

In this paragraph of this section, we should cite the Theory of Constraints (TOC) that will ask us several questions "Where will you focus your attention in your company for increasing productivity?" The overwhelming popularity of Dr Eliyahu Goldratt's bestselling business novel "The Goal" (set in a manufacturing company) has led some to believe that the Theory of Constraints applies primarily to the manufacturing environment. Although initially developed in response to specific challenges in this sector, other TOC applications have been developed for a wide variety of industries using the TOC Thinking Processes.

According to Goldratt's book titled "What is This TOC and How Should It Be Implemented", there are five steps to diagnose the constraints at companies as defining the constraints, deciding how to exploit them, subordinate everything to this decision, elevate (improve) the flow, go back to the first step and create a perpetual cycle (Goldratt, 1990).

These constraints obstruct the companies reach up to their efficiency peaks. In this study, one of the main constraints observed at shipping companies was the economic difficulties of having a complete shipping ERP solution.

These are successfully implemented in sectors like Heavy Capital Equipment, Retail, Banking, FMCG, Logistics, Job Shops, Mining, Healthcare, etc (Theory of Constraints, 2020). The correlation of this theory with our study appears in finding the right tools to apply effective management models for eliminating constraints from maritime companies. These constraints suppress companies from achieving higher productivity levels vary.

As per our paper, economic constraints hold freight companies back from recruiting more professionals when considering CAL fees applied by the cited software companies. Technical difficulties such as the impossibility of applying the Cyrillic alphabet, not being able to provide access to users via the web, delaying feedback times, expensive pricing strategies literally became constraints. KSHAL's UX has been designed by focusing on these constraints and aiming to solve these issues using alternative methods to improve productivity and profitability. Research question 4 of the paper asks; if a web-based maritime software delivers an essential refinement effect on the operational documentation process of small and midsized freight forwarders and supply chain companies or not. KSHAL achieves this goal by simplifying data submitting steps sternly. It also solves many other constraints observed in rival programs, such as the complexity of the quotation sending process, recording shipping costs, tracking demurrage expenses, having third-party partners involved with the business flow, and tracking company credibility online.

As Simatupang, Wright and Sridharan indicated in their article titled " *Applying the Theory of Constraints to Supply Chain Collaboration*", only those initiatives that focus on the constraint(s) and result in improvement in its performance will have a significant positive effect on supply chain performance (Simatupang, Wright, & Sridharan, 2004). Hence, TOC leads KSHAL's primary approach through this research. Pricy software prices, burdensome hardware investment requirements, complicated screen architecture were among a few other constraints discussed in this research that KSHAL proposed alternative solutions to come through.

According to our research among the maritime ERP alternatives already being used in Turkey, we observed their innovative tendency to evolve from being conventional software products towards web or cloud-based SaaS platforms. During our research, we have determined four major software suppliers in Turkey: SOFT, SELECT, XINERJI, and DOA. Three of these companies offer their products as SaaS solutions but SOFT. According to SOFT's 2021-23 business strategy, which was revealed during one-on-one interviews with Ergin Kargalıoğlu, CEO of the company, SOFT also moves its product(ion) environment to the cloud. Also, according to statistics, using cloud technologies over traditional servers can cut company I.T. costs by up to 65% (BDM Publications, 2019). This fact expresses that the contemporary structure of shipping ERP alternatives will be inhabited on the web or the cloud environments, just like KSHAL was persistently offering these options for its customers since day one.

In a statistical comparison of two major industry-specific software alternatives, we had meaningful results showing that a SaaS platform that runs on the cloud environment affects company efficiency better than software that runs "on-premise". Cameron Fisher

from the Massachusetts Institute of Technology conducted similar research comparing the advantages and disadvantages of cloud-based computing versus on-premise technologies in his paper published in the American Journal of Industrial and Business Management in 2018. According to his paper, the significance of cost control and governance has been pointed out when deciding on Cloud versus On-Premise computing. However, he added, if an organization has high confidence in the capacity of internal I.T. resources and high confidence in their ability to deliver necessary results, then the On-Premise cost structure can be expected to save money over the long term when compared to Cloud. If, instead, the convenience and flexibility of Cloud are sought, with the extra hand-holding for upgrades and guidance services, and the operating budget can afford an ongoing multi-year Cloud subscription, then relying on the external centralized hosted solution could be more compelling (Fisher, 2018). From this perspective, cloud-based ERP solutions help shipping and logistics companies focus on their core business. They will be handled and managed by third-party contractors and save efforts that may occupy them with technical problems that need to be solved on-premise.

We have applied the Kruskal-Wallis test, a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more independent variables on a continuous or ordinal dependent variable. We have applied Spearman's Correlation Analysis in addition to Pearson Correlation Test. These tests are applied to find out whether there are any linear or monotonic relationships between two variables. Finally, we have applied Mann-Whitney U Test, which compares whether there is a difference in the dependent variable for two independent groups. It compares whether

the distribution of the dependent variable is the same for the two groups and, therefore, from the same population.

Last but not least, the Independent Sample t-Test was applied to the dataset for testing a probability that two populations are the same regarding their means. The results showed us a visible increase in productivity and a remarkable decrease in constraints such as costs when the freight forwarder used the SaaS-based system. Thus, we can state that a web-based maritime ERP offers a more affordable, dynamic, reliable, productive, rich digital environment for freight companies.

Our research showed that the number of quotations and shipping orders increased when the company was using a web-based, SaaS-oriented, comparatively lean ERP product. In following this, the users have submitted more visit reports into the SaaS system. Also, their average screen time has been increased. These findings showed us the supremacy of lean design over complex design. These results showed us SaaS systems' preponderance that comes with the lean design over conventional and orthodox ERP programs, which are bulky and stodgy. It is no surprise that leading software providers move their ERP solutions to the cloud faster every day. According to the research report of Panorama Consulting published on "2022 Top 10 ERP Systems Report", Oracle, Sap, Infor, Ifs, Syspro and Acumatica were leading software service providers that announced their comprehensive cloud-based ERP solutions (Panorama Consulting Group, 2021).

The repercussion of the results takes us to our hypothesis, indicating that web-based maritime software creates an effective use or a compelling value in terms of adding efficiency to their shipping operations. During this study, one of the concrete facts we observed was the tendency of both fronts of the industry as developers and users heading

towards lean designs, simple interfaces, and affordable pricing systems by abandoning locally installed ERP solutions unaffordable for small and medium-sized freight forwarders or maritime companies. In case of a simple comparison, KSHAL has certain advantages over two major ERP product suppliers even when we consider their basic product packages.

Table 118

Price Comparison

	Company A	Company B	KSHAL
Sales Price	$$$$$	$$$$	$$
DBMS License	$$$	$$	-
Maintenance Fee	$$$	$$$	-
CAL License	$$$	$$	$

In this research, we aimed to test the benefits of SaaS systems for the shipping industry. The guideline of developing a competent software alternative for the maritime industry has been experimented with and revealed in detail through section 4 with all aspects. According to our approach, each is vitally important when inventors create such a detailed project and carry it commercially. An industry-specific software requires know-how of business performed in that particular industry before having technical skills and financial possibilities. This know-how triggers the creation of a unique, feasible, applicable and useable UX, the project's engine. The kernel of the product is not its coding architecture but its UX, which carries its philosophical flag. Nevertheless, this research has shown us that no matter how the idea is practically applicable, it depends on physical factors such as selecting proper DB and coding language for our future product. In addition to this, it has been approved that it is essential to have a solid project plan that visualizes the expenses from start to end.

Figure 173

Letter of Acceptance - Savicon

SAVICON

Ukraine, 65005, Odessa, 21 Bugaevskaya str, off. 310, tel/fax 34-90-58

06 July, 2020

Mr. Sahinboy,

As Savicon Logistics, we reviewed your offer and decided to subscribe to KSHAL platform. Your contract was signed and payment of 500 Usd set up expense for once and 5 usd monthly fee for each user will be wired to your bank accounts shown on the proforma invoice. Please provide us passwords for 20 users

Vladimir Savitskyi
CEO - Savicon Logistics LLC

ПРИВАТНЕ ПІДПРИЄМСТВО "САВІКОН" ІДЕНТ. КОД 36288832

www.savicon.com.ua
e-mail: office@savicon.com.ua

The purpose of the "Savicon" is to help your business grow!

We achieved to express the project's runtime and fiscal grounds by using CPM/PERT. Keeping the budget in line through the project was partially played a vital role in the successful result. This experiment is essential in its space to show how software can be built from blueprints up to the commercial product. It provides a complete manual of performing tasks, building up the team, designing UX, and selling the product. Howbeit, deploying a completed product should not represent the finish line. We had to analyze the whereabouts of the application's acceptance ratios after sales contracts. Therefore, we have

applied DEA to see which user company engages more into KSHAL and uses it in its full performance. This experiment was also important since not many software providers analyze their users' performance to such an extent. In fact, having scalar feedback of users is a piece of valuable information for software developing parties. The DEA study has two crucial points. Besides the findings, it represents a behaviour from the software supplier towards its clients. It is a sign that we care about our product and your satisfaction ratio, sincerely. Another aspect is the importance of actively embedding such feedback statistics into the product development process as they are solid guidelines for designers.

Besides KSHAL's innovative business models, especially for container trading jobs, it has been proven that the program has a commercial value as it has been contracted to three freight forwarding companies. This fact figuratively answers the research problem 3, asking; if a web-based maritime software engenders a momentous improvement in sales and marketing activities of small and midsized freight forwarders and supply chain companies.

In conclusion, we have a fully functional, self-proven, commercialized, innovative, industry-specific, new models proposing, dynamic, affordable ERP alternative program named KSHAL that serves small and medium-sized maritime logistics, freight forwarding, shipping companies in complete competence, at the end of this research. The dissertation contributes to science by creating a full-scale outlook including an ERP design from blueprints, measuring the start-up motives before the project starts and analyzing the outputs. It also proposes a futuristic approach titled SaaG that collaborates with XaaS (Everything as a Service) infrastructure in harmony.

6. DISCUSSION

In this section, the paper will seek futuristic destinations ahead of the SCM industry. The shape of the discussion will be given by making reasonable forecasts trying to find answers to questions such as "What will be beyond SaaS?". What type of automation will we experience at SCM companies? What will be the role of humans in the shipping industry in the forthcoming years? What is the role of A.I. going to be among these developments? The discussion part is also essential to describe the obstacles that SCM companies will face in the future. Challenges and hardships are coming along the technological developments. It would be too naive to acknowledge the fact that all these revolutionary changes have come in handy conditions. Just like today's world witnesses the change of monetary paradigms from conventional currencies into crypto-digital currencies, almost all the business models have been restructured in order to fit into these habitats. We were printing Bill of Ladings until not a long time ago. For the last four decades, we have issued Telex Releases without asking for originally printed documents. For the last two decades, we have performed cargo releases by electronic confirmations named as e-Seawaybill. While these digitalization steps save us from piles of paperwork, digital infrastructures became electricity-consuming monsters threatening the environment. The average energy consumption for one single Bitcoin transaction in 2020 was 741 kilowatt-hours. This was significantly more compared to the cumulative 100,000 VISA transactions with only energy consumption of 149 kilowatt-hours (Bitcoin Vs Visa Transactions, 2021). There will be positive and negative consequences of each move we take. So, the discussion section will serve the purpose of illuminating the facts which may empower the findings of this dissertation.

6.1 Thesis Contribution to the Current State of Knowledge

Much public debate about science and technology policy has been implicitly dominated by a ‘pipeline’ model of the innovation process in which new technological ideas emerge as a result of discoveries in science and move through a progression from applied research, design, manufacturing and, finally, commercialization and marketing (Brooks, 1996).

It is essential to observe that technology is not just things but also embodies a degree of generic understanding, making it seem more like science. Nevertheless, it is an understanding that relates to a specific artefact, which distinguishes it from ordinary scientific understanding, although there may be a close correspondence. Not far from the above statement, this dissertation sincerely contributes to scientific knowledge by supplying verified data based on its empirical research model results. The progress comes in small steps with minor achievements. The degree of the overall scientific contribution to the knowledge of this dissertation might be remarkable in its research space (Wuelser & Pohl, 2016).

However, it is a small step forward in the academic sphere when observed from the broader perspective. There were three frameworks attributed to this research, guiding the illuminate the indicated contributions below. First, project framing was crucial because defining questions implies constraining possible answers. The research questions were the main driving force of this paper. Second, disciplinary perspectives were crucial. The research methodology and particularly the quantitive methods used in this study were paramount. Consequently third, connecting science to real-world challenges was crucial.

This thesis aimed to achieve this goal through the case study of commercializing process of the developed product.

This research contributes to the current state of science from several angles as;

- Technological and operational contribution to knowledge
- Methodological contribution to academia
- A theoretical contribution to science.

6.1.1 Technological Contribution

Second hand and brand new container trade are some of the members of the supply chain management industry. This niche business segment often runs as a stand-alone commercial activity without getting involved with the shipping part of the flow. The container traders sell their inventory but keep themselves distinct from shipping these containers with cargo in them. Nonetheless, as freight markets become diversified and the competition heats up, the peculiarities of performed tasks in the freight forwarding industry also evolve and become enriched.

The logistics market uses definitions such as flexibility, integration capacity, sustainability, affordability every day. Therefore, any ERP tool offers a unique opportunity that others do not gain both; an advantageous market position and innovative brand image. Nowadays, it is not as hard as in the past to spot freight forwarding companies active in shipping container services and act as container selling traders. As for KSHAL, the container sales module that successfully blends shipping and container trading operations in the same business model is the only web-based ERP alternative in the Turkish logistics industry. According to KSHAL's business model proposed in its container module, a freight forwarding company may expand its shipping business and seamlessly connect with

the container trading business. This innovative method is a unique contribution to current operational knowledge where no other alternative ERP programs offer the same in the same model to date.

With this unique feature, KSHAL's container trading module allows freight forwarders, shipping, and logistics companies to access container trading activities with the traditional business model. A freight forwarder ships containers to and from specific hubs of international trade. They are contractors to shipping lines as cargo operators and decision-makers on which shipping method to be used. While performing the container shipping operations, an ERP should deliver beyond its limited -a.k.a. dull services- features and offer extended possibilities to its users. KSHAL's container trading module opens the path for freight forwarders to gain more profits by trading second hand or brand new shipping containers for their contractual cargo. In addition to container-buying and selling activities, KSHAL users will also benefit from extended free demurrage and detention time since they will own these containers. Howbeit, with this business model proposal, a typical cost factor such as container demurrage usually paid by freight forwarders to shipping lines (the container owner entity) becomes a profit centre billed to end customers in case of demurrage occurs.

Freight related payments are usually the topics related to the finance and bookkeeping division of the business. Therefore, as another technical and operational asset, KSHAL's deposit payment feature is an embedded component in operational and financial departments. This feature, where customers can pay deposits for containers or freight services upfront and deduct these payments from their current statement of accounts whenever they digitally purchase a container or a logistics service on the KSHAL portal,

is one of a kind invention that automatizes the payment collections in a nutshell. With this innovative tool, customers act known roles of B2B customers by using portal features in accessibility limits defined for their accounts by the system administrators. However, beyond that, they can choose the type of containers to buy, the number of units to purchase in one digital order and monitor their deposit levels in real-time. Furthermore, at the back office, where KSHAL operators monitor commercial activities in multiple container depots through the same ERP infrastructure, they can also visually observe which customer has limits to buy more units and warn them in case of a need. The payment collection feature that allows customers to purchase second-hand or brand new containers seamlessly on the ERP is another innovative tool contributing to current knowledge.

Accordingly, this research is one of the unique examples in literature when research fields are filtered by words such as logistics, container, shipping, web-based, ERP. There is no published doctoral thesis matching the research space and title, research techniques used (as combined and compiled), innovative development process such as this paper, once checked on the Thesis Center Database of the Council of Higher Education (YÖK) in Turkey by filtering years between 2010 to 2021 (YÖK Tez Merkezi, 2021).

6.1.2 Methodological Contribution

The research documents a full scope of the start-to-end process of how business-centric know-how can be converted into a comprehensive finished product by its aspects, including economic feasibility and affordability, technical applicability and usability. Developing a web-based application for the shipping and logistics industry might be classified as a technical obstacle and a software engineering job. Still, this paper aims to underline that the know-how behind such projects is the primary driving force of

innovation. Without knowing what to invent, develop, optimize, and carry the idea from blueprints to "live", it is impossible to discuss how successful such projects will ever get. This research investigated the core of the shipping and logistics-oriented I.T. market to picture the current level of Turkey's ERP products and software companies. The study achieved to get access to a freight forwarding company's operational data and applied statistical analyzes. Based on the results of those analyzes, the development of a web-based enterprise resource planning software was documented module by module.

Moreover, the CPM/PERT section of the research transparently shows the actual cost-house when developing a programme designed for shipping, freight forwarding, and logistics. This thesis is the first and only scientific text in which the CPM/PERT method is used in scaling an ERP software project as of October 2021, among doctoral theses published in Turkey. Last but not least, the "DEA application" is one of the rare and accomplished examples in academia which focuses on the experimental aftermath of industry-specific software performed at international freight forwarding companies from Turkey and Ukraine. These are the straightforward assets of this study and methodological contribution titles to knowledge.

6.1.3 Theoretical Contribution

The SaaS offering transforms operations and the receiver/sender experience across working facilities, universities, corporate offices, virtual offices, warehouses and more. In addition, it helps operators stand out by enabling intelligent operations and logistics automation while delivering the best possible experience and convenience for their occupants (Parcel and Postal Technology International, 2021). The SaaS digital habitat has deep roots in the on-premise environment; it can be considered a successor by definition.

Hence, it is possible to call it a natural leap of today's on-premise-based ERP solutions. Anyhow, SaaS is also a temporary station for the progress and evolution of I.T. platforms today and tomorrow. Today, we observe an exhilarating transition of individual service types named SaaS (Software as a Service), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) becoming XaaS (Everything as a Service).

Decades ago, all the available services such as logistics, shipping, warehousing, procurement, planning, manufacturing, and customs were gathered in the supply chain management sphere. This movement triggered several inventions and improvements in the freight industry, including new optimisation models, IoT tools, sustainability-related changes and more. While production and service companies contract all these tasks to third party logistics networks, a similar trend became imminent and reachable in the I.T. as XaaS. Nowadays, organisations are increasingly moving the computing infrastructure supporting their manufacturing and enacting the entire supply chain from traditional on-premise environments to current cloud computing platforms. That way, ubiquitous networking service management and application opens the way to the reuse of services, cost reduction, flexibility, and increasing collaboration opportunities. Furthermore, migrating to cloud deployments and using cloud-based services generate additional value due to the amount of data coming from different data sources. Organisations adopting the Industry 4.0 concepts have unique requirements tailored to their highly complex systems. They can profit from the selection of particular cloud offerings at different levels of the cloud deployment stack (Juan-Verdejo & Surajbali, 2016).

The current service model assumes that Cloud data centres mainly provision cloud services. However, in most cases, especially for public Clouds, end users can only consume

Cloud services by accessing the infrastructure resources in data centres through some kinds of wide-area networks, typically the Internet. Therefore, the services eventually received by end-users are a composition of Internet service and Cloud service. Furthermore, the performance of network services greatly influences the service quality perceived by end-users. Therefore, it will be desirable to have end-to-end services delivered through a unified platform, including Internet and Cloud services. The latest progress in both networking and Cloud computing technologies has indicated that the XaaS paradigm offers a promising approach toward this objective (Duan, Duan, Sun, & Narendra, 2016).

This thesis aims to look beyond the efficiency and productivity horizon with the proposal of the SaaG (Software as a Gateway) approach in extension to the XaaS environment. Today, data has become the principal capital of companies. As a result, the pricing policy of a software company becomes a barrier to gaining new customers and their data. Moreover, as data becomes highly valuable, the cost of accessing it increases. Therefore, ERP software acts as a gateway between the software company and customer data. With this viewpoint, SaaG can be called a contemporary economic and technological approach to data valuation instead of a digital environment architecture as XaaS. In the near future, it can be predicted that the income obtained from the valuation of company data will exceed the income that can be earned from the sale of ERP, especially with the development of artificial intelligence applications and deep learning methods. The main factors behind these developments are economies of scale and scope, network externalities, and the rising economic significance of data, which are precious commodities in an online economy. While being indispensable to the development of potential game-changers – such as artificial intelligence – data are also a crucial input to many online services, production

processes, and logistics – making it a critical element in the value chain of many different industries. The use and importance of data have risen substantially with the emergence of the digital economy. As a result, the amount of data generated in the constantly evolving digital economy is increasing. In 2016, IBM reportedly noted that 90 % of the data in the world today had been created in the past two years alone. Data will become even more critical because they are increasingly generated by networked end-user devices and the Internet of Things (IoT). The economy is inevitably moving towards the broader production of new products and services based on general-purpose technologies, such as artificial intelligence (AI), machine learning, and other similar high-performance computer-driven processes whose real utility and value are impossible to estimate today. These technologies all depend on availability and access to data. Data may be the new most valuable asset in the modern economy. As such, they will play an increasingly fundamental role as a parameter of competition, with many consequences for today's businesses. While being indispensable to the development of potential game-changers such as AI, data are also a crucial input to many online services, production processes, and logistics, making them a critical element of the value chain of numerous industries. Data can also create innovative business models and entirely new markets (such as fintech). As a result, and perhaps unsurprisingly, the phrase 'data are the new oil.' (Szczepanski, 2020).

In this respect, the SaaG approach/proposal that prioritizes the value of proper and effective data handling is an advanced iteration of the XaaS based ERP solutions. It offers ERP suppliers a broader horizon to upgrade and expand their mission and vision from conventional engineering to full-stack management consultancy organizations. Today, data is no longer "the result" of logistics operations at freight companies but is also one of the

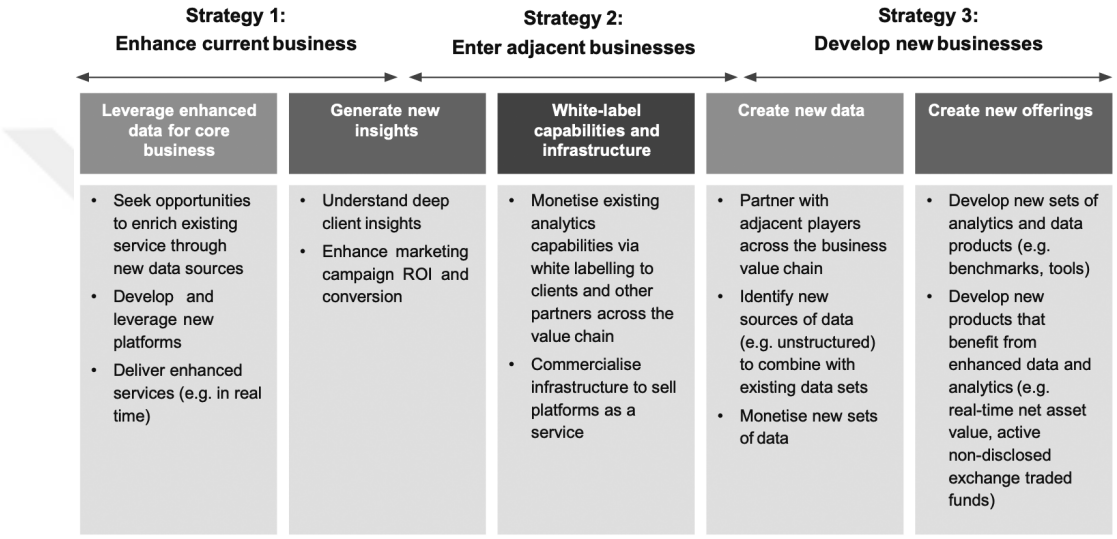
causes of sustainable profitability and competitive advantage at these organizations if it gets harvested, stored, categorized, validated, and evaluated efficiently. Thus, it is obvious to expect a permanent shift of ERP alternatives from dull systems to innovative platforms collaborating with several artificial intelligence tools. SaaG method proposes that software companies provide their ERP tools to shipping companies without asking for the software license fee. In return, the software company gets authorization to process the client's data confidentially and create innovative, prescribing reports that will be sold at a fraction of a cost compared to conventional ERP license fees. One of the drastic changes in this scheme is that ERP supplier deepens their industry-specific know-how to interpret the findings accurately. The other gain is that the results and interpretations of the same data are valuable for potential customers. Multiple customers can use these outputs without creating any business conflict in several markets.

Progressive and efficient revaluation of data at freight and logistics companies, especially with the assistance of cloud-based ERP tools, shows that every bit of information has a commercial value. Customer information, market information, freight-related variables, fixed and dynamic costs, shipping routes suggestions (faster, cheaper, safer alternatives), human resources, vehicles, warehouses related performance data and optimisation suggestions represent significant improvements at logistics companies. The price of an ERP should not prevent parties on both sides of the desk to miss the chance to access continuous improvement and sustainable profitability. The SaaG proposal, in this connection, is an intriguing alternative to increase the possible benefits of XaaS based ERP programmes. Assuming an organisation invests the time to create an inventory of its data, its value lies in its ability to allow an organisation to generate future economic benefits

('data monetisation') (Rea & Sutton, 2020). Some examples of data monetisation strategies are shown below;

Figure 174

Typical Data Monetisation Strategies



Note. From Price Waterhouse Coopers, The UK

As data evolves from being an archival asset to a driving source of income, the impact of ideas that may emerge from companies' innovative approaches will grow. The expectations from data will be accustomed to predicting emerging trends in the supply chain industry, identifying and responding to organisational disruption, exploring new markets, revealing competitor strategies, stalking opportunities and sourcing innovative ideas. To manage this process fruitfully, technical concepts such as SaaG and DaaS (Data as a Service) will become common and almost habit-formed methods and a permanent part of the freight and logistics industries. The computing power required to process enormous volumes of data can quickly overwhelm a single server, leading to the rise of 'The Cloud'. Offered by third-party firms, these servers can mine vast quantities of

information as a means of providing logistical insights that management can subsequently act upon. This growth has seen supply chain management professionals allocating an increasing amount of funds to exploit the potential of big data analysis. This trend is expected to be continued in the foreseeable future as a critical way of improving company efficiency and customer personalisation while reducing expenses across the chain (Frolova, Eichstadt, & Shestova, 2020).

The world is creating and storing data at a rapid pace, much faster than in the past. The data is getting captured and distributed across multiple nodes in real-time. With significant improvements in analytics capabilities, analysing big data will provide critical insights and develop innovations that lead to competitive advantages. Supply chain managers will be well-positioned to benefit from big data; they can make business decisions based on real-time data across the entire supply chain. The ability to capture and analyse data is better than ever before. So, supply chain management will become real-time. New methods to capture data will evolve, the data analytics process will be automated, and critical decisions can be made in real-time (Alicke & Iyer, 2020).

At this stage, it is natural to foresee the transition of supply chains to data-driven value chains. As a result, Porter's Value Chain Analysis becomes vital to understanding how critical data is for the freight and logistics industries. As mentioned in section 1.3, Michael Porter had defined ten cost drivers that have a strong influence on a company's profitability. Each of his cost drivers communicates on and between each other by using data. Data is a binder or a gateway between these constraints. For example, Porter argued that if the value a company was offering its customers outweighed the cost of producing it, the result would be a more significant profit. Thus, data is the main crossroads for his

analysis's five primary activities: inbound logistics, operations, outbound logistics, sales and marketing, and other services. Primarily, technological development is used during research and development and can include designing and developing manufacturing techniques and automating processes (Porter, 1985). Overall, technological development is a business working to reduce technology costs, such as shifting from a hardware storage system to the cloud.

The role of data is crucial to administrate Porter's cost drivers such as learning, the timing of market entry, degree of vertical integration and linkages among activities. Therefore, such as in the SaaG proposal targeting data as a source of sustainable income is a positive game-changer. According to Porter's Value Chain Analysis, technology development supports a firm's technology infrastructure and use. Effective and efficient use of technology contributes positively to the impact of the value chain on the competition. Technology (data) orientation makes it possible to change operations that use technology in the value chain and produce output by combining inputs with human resources. It is observed that the technology included in the received input and associated with other sub-technology increases the operational performance.

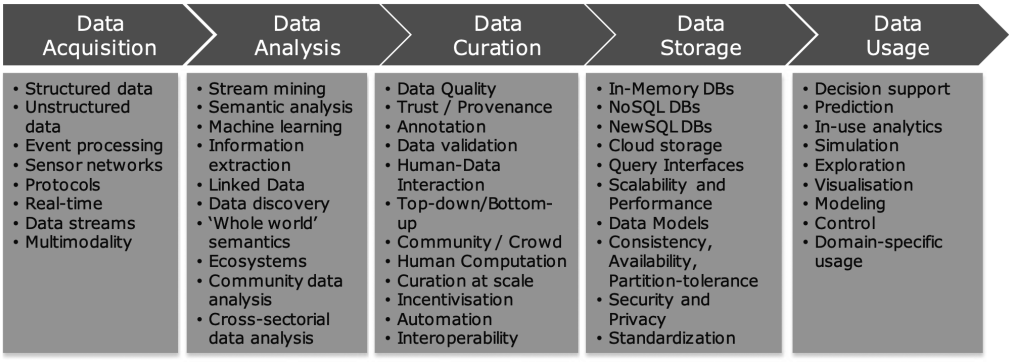
Technology development and data revaluation have processes designed to develop a product, all R&D efforts, process automation and other technologies that support the value chain. Technology and data handling are the most critical source of competitive advantage, reducing costs and increasing added value in new product production. The ability of companies to apply and adapt innovative methods on how to interpret their data accurately is of great importance in achieving sustainable competitive advantage and

reducing their costs. As a result, data plays a decisive role in competitiveness in the freight and logistics industries.

As data experimenting, analysis, and visualisations improve, Porter's Value Chain Analysis will evolve to the Big Data Value Chain Analysis approach. The value chain method can be applied to information flows to understand the value creation of data technology. In a Data Value Chain, information flow is described as a series of steps needed to generate value and valuable insights from data. The European Commission sees the data value chain as the "centre of the future knowledge economy, bringing the opportunities of the digital developments to the more traditional sectors (e.g. transport, financial services, health, manufacturing, retail)." Value Chains and Business Ecosystems can be used to model big data systems and the big data business environments. Big Data Value Chains can describe the information flow within a big data system as a series of steps needed to generate valuable insights from data, such as acquisition, analysis, curation, storage, and usage (Curry, 2015).

Figure 175

Big Data Value Chain



Note. From Curry et al. 2014

In conclusion, this research, particularly SaaG as a data revaluation approach, contributes to the digital transformation of the entire logistics and freight industries by providing the required know-how. The software suppliers should provide their ERP tools to logistics companies at no cost or at the lowest possible fees to accelerate the reach to data and process it actively. This managerial approach will improve supply chain services and increase efficiency by optimising operations, sales, and logistics. Data is no longer an information asset but a strategic asset that has the potential to generate sustainable profit at logistics companies. Therefore, software and S.C.M. companies should realise the economic value inherent in the data and the potential to monetise or capitalise when combined with data analysis through revenue-generating practices.

Common to all contingency approaches is the proposition that performance is a consequence of the fit between several factors: structure, people, technology, strategy, and culture (Tosi & Slocum, 1984). Anyhow, the paradigm shift in data prioritisation and revaluation will be administrated by leaders at logistics companies. Shipping activities and logistics operations are becoming more and more I.T. oriented services. Leaders, directors and managers of logistics companies are expected to be active in the technological fields of supply chains to create innovative solutions that make a competitive advantage for their companies. Therefore, applying contingency theory in the context of ERP implementation, ERP systems can be seen to possess characteristics that relate to external environment uncertainty and the internal environment. Examples of these are organisational structure, business process reengineering, organisational culture, I.T. readiness, and other organisational characteristics. The fit between corporate environments and features of ERP systems has a significant role in the success of ERP implementation within organisations.

For example, an organisational culture in which sub-units are interdependent can better fit a company with an ERP with global operation needs (Hong & Kim, 2002).

The role of extensive ERP integration at shipping and logistics organisations is one of the critical attributes measured, planned, and applied by top management's decisions. According to Contingency Theory, there is no best method to make accurate decisions for the company. Corporate decisions and actions are contingent on internal and external situations. As a rephrase, the organisational decisions and applications are dependent on their endogenous and exogenous business environments. When a company's data revenue is significant, more tremendous efforts are required to categorise, validate, process and interpret it. In addition, technological changes are undeniable contingency factors at logistics companies. During this challenging environment, management should aim to benefit more from data processing and interpretation from the ERP infrastructure. The congruence between the characteristics of an ERP system and its organisational context is critical for ERP implementation success. Therefore, identifying a set of dimensions of organisational environments internally and externally and ERP system characteristics provides insights into successful ERP implementation (Hwang, 2011).

Configurations that match the environment will perform better than those that don’t and help an organization achieve top performance. When applying structural contingency theory to SCM, individual parts of the supply chain should be aligned and organized to achieve the best performance (Holmes, 2013). The theory predicts that post-implementation design would be based on the organisation’s goals and objectives. For example, suppose organisations view the goals of ERP as simply an update to technology or as an opportunity for process improvements or business process reengineering. In that

case, those differing goals may yield different design choices for the support organisation (Gallagher, 2011). A web-based ERP platform such as KSHAL, flexible, dynamic, and open for customisation that utilises shipping operations, sales and marketing jobs, container sales activities, billing and accounting procedures, is expected to provide a productive environment for shipping companies to achieve planned performance criteria.

6.2 The Future of I.T. and S.C.M.

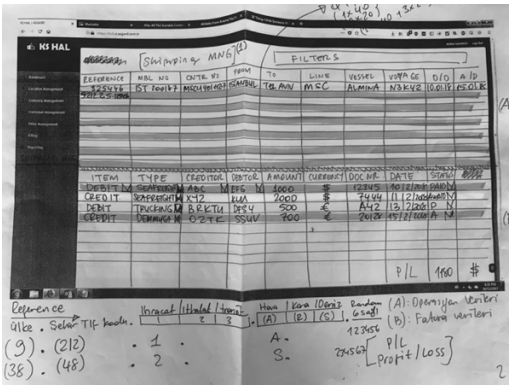
Alvin Toffler, says that "To understand what is happening to us as we move into the age of super-industrialism, we must analyze the process of acceleration and confront the concept of transience." in his tremendously fascinating book titled Future Shock. (Toffler, 1970). The companies of the future will develop new skills to adapt to the increasing speed of revolutionary changes. SCM organizations are going to be the ones leading these changes. The speed of the change in fields of SCM and I.T. will be increased hand in hand. The revolutionary changes will become a monolithic part of socio-economic life. According to Alvin Tofler's "The Shock", the speed of the change will have multiple effects in our lives. Our consumption behaviours will be evolved. Nowadays, consumers are able to reach whichever service or product they would like to purchase through multiple sources. Websites, mobile applications, retail stores, social media shops make it easier, faster and cheaper. From a social and business perspective, two of the main trends affecting freight transportation systems are the growing importance of e-commerce and increasing customer focus (Elbert, Friedrich, Boltze, & Pfohl, 2020).

A random buyer, purchasing sports shoes from a local store near his/her home, recently became an online customer of overseas web portals that sell similar goods at the lower or same price. While the local shop can not track the buyer's consumption statistics,

these digital platforms track our tendencies, commercial activities through the credit cards we use, web search keywords, social media interactions, and even our actual, intimate vocal conversations. Not only do the devices go hybrid, but also our habits of consumption do. This fact puts predictive analysis into top-hole. Intelligent systems, including ERP programs for companies or applications for end-users, will evolve into predictive tools which categorize, analyze and prescribe alternatives before the actual attempt occurs. The more efficient a company's pre-fulfilment processes are, the quicker the customer will receive their order (TradeGecko, 2020). We will be surrounded by digital organisms that actively collaborate with all parties, including producers, intermediary entities (wholesalers, freight forwarders) and S.C.M. companies to supply or propose to us whichever service or product we will need before it is practically needed. To get this manner widespread, all companies must become A.I. compatible. There is no way of handling big data without having proper algorithms examining our data.

Figure 176

Blueprint Sheet of KSHAL



This process of continuous change has multiple frontiers. Individual customers will change, so do software developers and buyers. On the one hand, we will observe that the

companies will continuously seek feasible methods for revising their efficiency frontiers. This necessity progressively converts the software developer company into a consultancy organization. It will be visible to see all vendors and buyers come closer in data sharing, process evaluating, model designing and even profit sharing. Intelligent systems and predictive, proscriptive models will empower forward buying. It is a process related to retail inventories, wherein they are purchased in quantity excess to demand. The retailer practises this when they find manufacturers selling the product at a discounted price and purchasing the items in bulk. Now when the product's price is set to the original price by the manufacturer, the retailer can make a profit by selling the item purchased at a low price earlier. This is used when manufacturers are overstocked and want to clear the inventory. They give discounts to the retailers, and retailers also get benefited by getting better profit margins (Trends in SCM, 2020). Performing such tasks are simple when there is a primary commercial relation, as one buyer of one product and one seller. However, when it becomes a multilayered, hyper-local and tangled body, it is no longer an issue that can be handled between humans but sophisticated I.T. platforms.

The future of I.T. for the S.C.M. industry will be an eye-opener tool to increase the utilization of resources. One of the fields which ERP platforms will boost will take place in single window processes. We will perceive that all parties will be integrated more than before to minimize duplicated and fruitless efforts, such as submitting the same data multiple times into different programs. The logic behind of single window idea is getting people to submit a cargo manifest into a customs database in China. Along the way of delivery, all these information bundles will be used by related I.T. systems such as airline cargo booking screens, freight forwarders' ERP at home and abroad, customer pre-alerts

and arrival notices. The single window feature will be permanently acknowledged, and more ERP programs will be single window compatible. Data transfers between shipping companies are going to use blockchain technology while encrypting the data being transferred. Cargo manifests, invoices, statements of account sheets, the bill of lading documents will be exchanged through blockchain encryption technology between single window compatible ERP programs. While the hype surrounding blockchain has certainly cooled off, the tech itself continues to evolve as time goes on. Given the importance of data throughout supply chain management, overall, there is no doubt that those who get acclimated with this maturing technology will be leaps ahead of their competition. Blockchain will step into the spotlight and provide much-needed visibility into transactions and processes. The market for cloud-based systems will continue to grow, alongside supply chain support in the form of Supply Chain as a Service (SCaaS) (Hopkins, 2020).

While the world of SCM getting heavily involved with trending technological signs of progress such as Digital Twins, Dark Companies, Omni Channel SCM, Robotics, Transparent Chain Management and Green Logistics, this paper should focus on broader and further horizons. We will most likely meet Software as a Gateway (SaaG) based ERP platform providing detailed I.T. solutions to maritime companies sooner than expected. SaaG is an advanced form of SaaS system. We forecast a world where software companies are no longer selling their products in exchange for money, conventionally. The world of I.T. has discovered the potential of these programs can be used as their gateways between their customers. Software companies shift their shapes into data crunching and analyzing consultancy firms that create valuable reports with A.I. The customers become data suppliers. Imagine a world where a software company supplies its ERP program free of

charge. Instead of asking for money, they ask for authorization of processing the client's data that flows through the ERP platform. SaaG will be the next big thing in the I.T. business where customers will be pulled into ERP platforms by attractive conditions such as low or no payment terms, free of charge hosting services and unlimited bandwidth. The software company's goal will be to bring more information suppliers into the pool of big data. Active validated and categorized data of hundreds of freight forwarding companies are more valuable than the income generated through the sales of ERP programs. As much data gets compiled and analyzed, the better intelligent systems will create analytical reports solving certain hurdles. These reports will be created on-demand and become accessible at the most affordable conditions. The data suppliers will pay for only whichever report they need to acquire. These reports will either be client-specific or platform-specific. Above all, such enterprises will seize the opportunity of the new systems which, because of high flexibility requirements, are permanently under pressure to innovate and rationalize, and in the new systems see a chance to achieve robust productivity increases (Hirsch-Kreinsen, 2014).

SaaG and A.I. are inseparable twins. In order to create recommendations in the form of managerial prescriptions, the SaaG ERP must have a big pool of data continuously get filled by customers' ever-flowing data streams. This revolutionary change will convert innovative systems into active recommendation engines and upgrade software companies to consultancy entities. The commercial relationship between the software provider and the software user will be evolved into a continual and permanent partnership. While the industry talks about automation, robotics, digitalization, why do we neglect the managerial portion of making decisions? SaaG systems will deliver a dynamic range of intelligent tools

based on both the customer's data and the data analyzed through the shared pool of the ERP, where they handle the data of tens, if not hundreds, of maritime companies.

This research motivated us to look beyond the horizon and see what comes next. SaaS platforms have pervaded along with the industries since the last decade and attracted the masses, and the I.T. Industry responded to this by delivering the XaaS environment. XaaS is the abbreviation of Everything as a Service environment; if not, it is a fullscale management method that downsizes stable costs, inventory, staff and focuses on a dynamic range of services, digital habitats for all. We will see that the XaaS approach will surpass what SaaS platforms offer and become more acknowledged by supply chains. According to Ray Nagle, who is the director of managed services at Ireland basis Exclusive Networks company, "*A positive takeaway from a long-term perspective is that organisations are now in a position to take a more structured approach to cloud financial management, to assess cloud spend, identify areas of improvement, and make an action plan detailing where savings can be made – a practice known as FinOps. Though this has been a period of upheaval, it has accelerated digital transformation. It will help companies mature by enabling I.T. teams to become services organisations in their own right, who are focused on adding value to the business with cloud technology.*" as an active voice from the I.T. industry approving the direction of the trends in ERP business (Smith P. , 2021).

While XaaS getting pervasive among the shipping companies, it is possible to see data-centric proposals such as SaaG will emerge and become more visible through its alternatives. In the long run, the SaaG model will become ubiquitous, with many firms dropping their older operation and sales models favouring a full-subscription future as it lowers the stable costs while delivering complete control on their business by preventing

excess financial flow for unnecessary inventory such as hardware, staff and maintenance expenses.

6.3 Challenges and Limitations

In this section, we will criticize our dissertation and the KSHAL project. To create a reliable and confident paper, this is vital to have this outlook. Also, it will be a smooth flag for those interested in researching and enhancing a similar subject and taking it to a higher level in the future scientifically.

We have faced the difficulty of finding comprehensive company data sets during this research, which we intended to analyze statistically. It was critically important to have a list of datasets, especially when one of the study's goals was revealing correlative levels between before and after states of maritime companies that changed their ERP programs. This situation's managerial background was the tendency of shipping companies to keep their corporate information out of sight due to some concerns. Although we have analyzed one dataset thoroughly, it would be tremendously satisfying to have more datasets in our hands. While scripting the text, we have faced legal obstacles such as copyright infringements. As our lawyer consulted this text, we were suggested to express a portion of paragraphs implicitly; otherwise, it would violate copyrights. Screen flow, pricing policy and fees, service contract examples, data tree views of ERP alternatives shown in this thesis had been blurred without compromising from the context.

Having research about developing an industry-specific software platform put the whole study on slippery ground. It was a unique challenge to keep the text on its track without shifting its axis from international trade and logistics. We were compelled to interpret technical details for those who read this text from social sciences in certain

sections. These sections have been simplified and revised. On the one hand, the study might have been evolved into an M.I.S. research. On the other hand, it would be perfidious not to put the study in the right words to reveal all the aspects of creating software for the shipping industry. Nevertheless, we are confident that a well-balanced text accomplished this goal.

This thesis is a few examples of developing an innovative software alternative from scratch that experimented in the international trade and logistics sphere. Due to/ thanks to its innovative structure, it may be an introvert dissertation in places. To surpass this fact with enriching add-ons, we have revealed all the software's development, deployment, and commercialization steps. Some of the information might have been kept confidential such as the pricing policy and fees of KSHAL.

This thesis is a literal snapshot of software development in a nutshell from start to end. We aimed to create a resourceful paper for whoever intends to build similar programs or team up for similar projects. It has a rigidly finite budget that we had to stick to while developing the program. We have revealed the budget segmentation and planning in section 4.3 in depth. The budget was one of the major limiting factors that became a coercive force on our decisions about building up the software and carrying it on to deployment. Due to this necessity, KSHAL has been deployed with the utmost important and vitally necessary modules in the first version by leaving a few modules to the subsequent phases. Finally, the KSHAL project was carried out in a country with a smaller economy and a lower rate of technological acceptance than more significant economies. Despite this fact, we take this reality as an advantage of delivering functional, practical, comprehensive, affordable, dynamic tools that adjust the competitive skills of small and medium-sized maritime logistics companies.

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Appendix A : Data Usage Permit

[redacted]

14 November 2020 / Istanbul

To Whom May It Concern

Dear Sir, Madam,

We would like to inform you that the attached data files regarding two logistics software systems used at our company during 2010 to 2019 have been supplied to Mr. Kerem SAHINBOY for his academic research, by our company in mutual agreement with the researcher that these files will be used solely in his research by keeping the customer information anonymity.

Attachments:
1. ERP1 Data Sheet
2. ERP2 Data Sheet

Sincerely Yours

[redacted]

ERP 1	UNIT	2010	2011	2012	2013	2014
Turnover (Mil)	Usd	3,5	3,8	4,2	5,1	5,3
Net Profits (Mil)	Usd	0,32	0,34	0,39	0,46	0,49
Sea Shipments (TEUs)	Qty	2342,0	2520,0	2711,0	3296,0	3427,0
Air Shipments (Parcel)	Qty	132,0	244,0	296,0	371,0	404,0
Road Shipments (Truck)	Qty	721,0	826,0	899,0	927,0	1012,0
Sea B/L Issued	Qty	834,0	681,0	777,0	1089,0	911,0
Air B/L Issued	Qty	132,0	244,0	296,0	371,0	404,0
Road Cmr Issued	Qty	721,0	826,0	899,0	927,0	1012,0
Freight Invoice Issued - Sea	Qty	2006,0	2114,0	2645,0	3010,0	3127,0
Freight Invoice Issued - Air	Qty	132,0	244,0	296,0	371,0	404,0
Freight Invoice Issued - Road	Qty	701,0	808,0	890,0	894,0	997,0
Error(s) Reported	Qty	44,0	52,0	31,0	27,0	24,0
Integration Demanded	Qty	0,0	0,0	1,0	0,0	1,0
Annual Maintenance Fees	Usd	2382,0	4248,0	5310,0	6018,0	7788,0
Av. Profit Per Shipment	Usd	100,2	94,7	99.84	100,1	101,2
Av. Profit Per Shipment Sea	Usd	92,2	90,8	104,0	105,0	93,2
Av. Profit Per Shipment Air	Usd	110,1	97,7	98,8	97,1	91,3
Av. Profit Per Shipment Road	Usd	98,2	95,6	96,7	98,2	119,1
Time for Submitting a B/L	Min	5	5	5	6	6
Average Amount of Reports	Qty	4	4	5	5	6
Active CALs	Qty	10	13	13	15	16
Program Crash Reports / Annual	Qty	3	2	0	0	1
Training Time	Min	40	52	55	68	78
Training Time per CAL	Min	4	4	4,23	4,53	4,87
Training Costs	Usd	1200	1560	1650	2040	2340
Training Costs per CAL	Usd	120	120	126,92	136	146,25
Freight Quotations Made	Qty	2576	2747	2741	3179	3893
Freight Quotes. Made Sea	Qty	1104	1310	1098	1561	2080
Freight Quotes. Made Air	Qty	410	328	366	307	384
Freight Quotes. Made Road	Qty	1062	1109	1277	1311	1154
Average Time to Make Offers	Qty	7	7	8	8	7
Visit Reports Submitted	Qty	378	432	842	1040	1092
Acquired Orders After Quotes	Qty	695	906	1014	1208	1479
Lost Customers	Qty	27	24	18	32	19
Acquired Customers	Qty	32	22	27	28	33
Reclaimed Customers	Qty	4	0	2	1	1
Quantity of International Partners	Qty	9	11	12	15	14
Quantity of Domestic Partners	Qty	17	22	26	35	33
Amount of Integrations	Qty	0	0	0	1	1
Integrated 3rd Party Apps	Qty	0	0	0	1	1
Average Screen Time per CAL per Day	Min	178	181	202	216	209
Amount of Complaint Tickets (CALs)	Qty	32	27	38	41	45

ERP 2	UNIT	2015	2016	2017	2018	2019
Turnover (Mil)	Usd	5,9	6,4	6,8	7,2	8,1
Net Profits (Mil)	Usd	0,58	0,63	0,65	0,64	0,77
Sea Shipments (TEUs)	Qty	3948,0	4314,0	4608,0	4983,0	4764,0
Air Shipments (Parcel)	Qty	425,0	471,0	518,0	615,0	552,0
Road Shipments (Truck)	Qty	1107,0	1184,0	1213,0	1340,0	1205,0
Sea B/L Issued	Qty	842,0	922,0	1221,0	1422,0	1385,0
Air B/L Issued	Qty	425,0	471,0	518,0	615,0	552,0
Road Cmr Issued	Qty	1107,0	1184,0	1213,0	1340,0	1205,0
Freight Invoice Issued - Sea	Qty	3801,0	3926,0	4107,0	4048,0	4513,0
Freight Invoice Issued - Air	Qty	425,0	471,0	518,0	615,0	552,0
Freight Invoice Issued - Road	Qty	1096,0	1091,0	1175,0	1213,0	1106,0
Error(s) Reported	Qty	29,0	16,0	10,0	14,0	9,0
Integration Demanded	Qty	2,0	0,0	0,0	1,0	1,0
Annual Maintenance Fees	Usd	1416,0	1289,0	1154,0	1080,0	928,0
Av. Profit Per Shipment	Usd	105,8	105,5	102,5	92,2	118,1
Av. Profit Per Shipment Sea	Usd	111,3	106,1	101,5	94,6	124,8
Av. Profit Per Shipment Air	Usd	102,0	107,2	98,4	87,9	108,8
Av. Profit Per Shipment Road	Usd	104,2	103,3	107,7	94,0	120,7
Time for Submitting a B/L	Min	5	5	4	4	3
Average Amount of Reports	Qty	6	6	7	8	9
Active CALs	Qty	15	16	16	19	22
Program Crash Reports / Annual	Qty	3	0	1	0	2
Training Time	Min	120	72	64	86	96
Training Time per CAL	Min	8	4,5	4	4,52	4,36
Training Costs	Usd	1200	720	640	860	960
Training Costs per CAL	Usd	80	45	40	45,26	43,63
Freight Quotations Made	Qty	3925	3841	4190	3433	4211
Freight Quotes. Made Sea	Qty	2810	2706	2971	2522	2885
Freight Quotes. Made Air	Qty	505	248	303	201	286
Freight Quotes. Made Road	Qty	610	887	916	710	1040
Average Time to Make Offers	Qty	5	5	5	5	4
Visit Reports Submitted	Qty	921	1183	1320	1408	1560
Acquired Orders After Quotes	Qty	1570	1728	1718	1510	1588
Lost Customers	Qty	23	14	25	16	12
Acquired Customers	Qty	21	7	32	29	31
Reclaimed Customers	Qty	2	0	3	4	5
Quantity of International Partners	Qty	18	18	19	19	19
Quantity of Domestic Partners	Qty	29	42	44	45	44
Amount of Integrations	Qty	2	0	0	3	4
Integrated 3rd Party Apps	Qty	2	0	0	3	5
Average Screen Time per CAL per Day	Min	217	234	242	252	268
Amount of Complaint Tickets (CALs)	Qty	8	11	5	7	7

Appendix B: 1Ci Presentation

1Ci

Skyrocket Your Business

1C:ERP

Orchestrate your business with ultimate flexibility

Powerful and flexible solution to help companies meet the challenges of today's business, achieve transparency of processes, and grow faster.

Vision. Insight. Control.

- ✓ Flexible solution for any specific business process
- ✓ Transparency of business and focus on the big picture
- ✓ One intuitive dashboard to control all business units
- ✓ Easy customization in-house as the business grows
- ✓ Fast implementation and launch within 3 – 4 months
- ✓ Low TCO and high acceptance rate

Impact on business

- Profit growth by 14%
- Reduction in operating costs by 20%
- Reduction of accounts receivable by 19%
- Reduction in cost of production by 8%

THE REAL DATA FROM REAL PROJECTS*

- Reduction of inventory by 20%
- Increase in output by 29%
- Warehouse turnover increased by 25%
- Acceleration of order processing by 85%

Appendix C: ERP KPI Selection & Evaluation Models

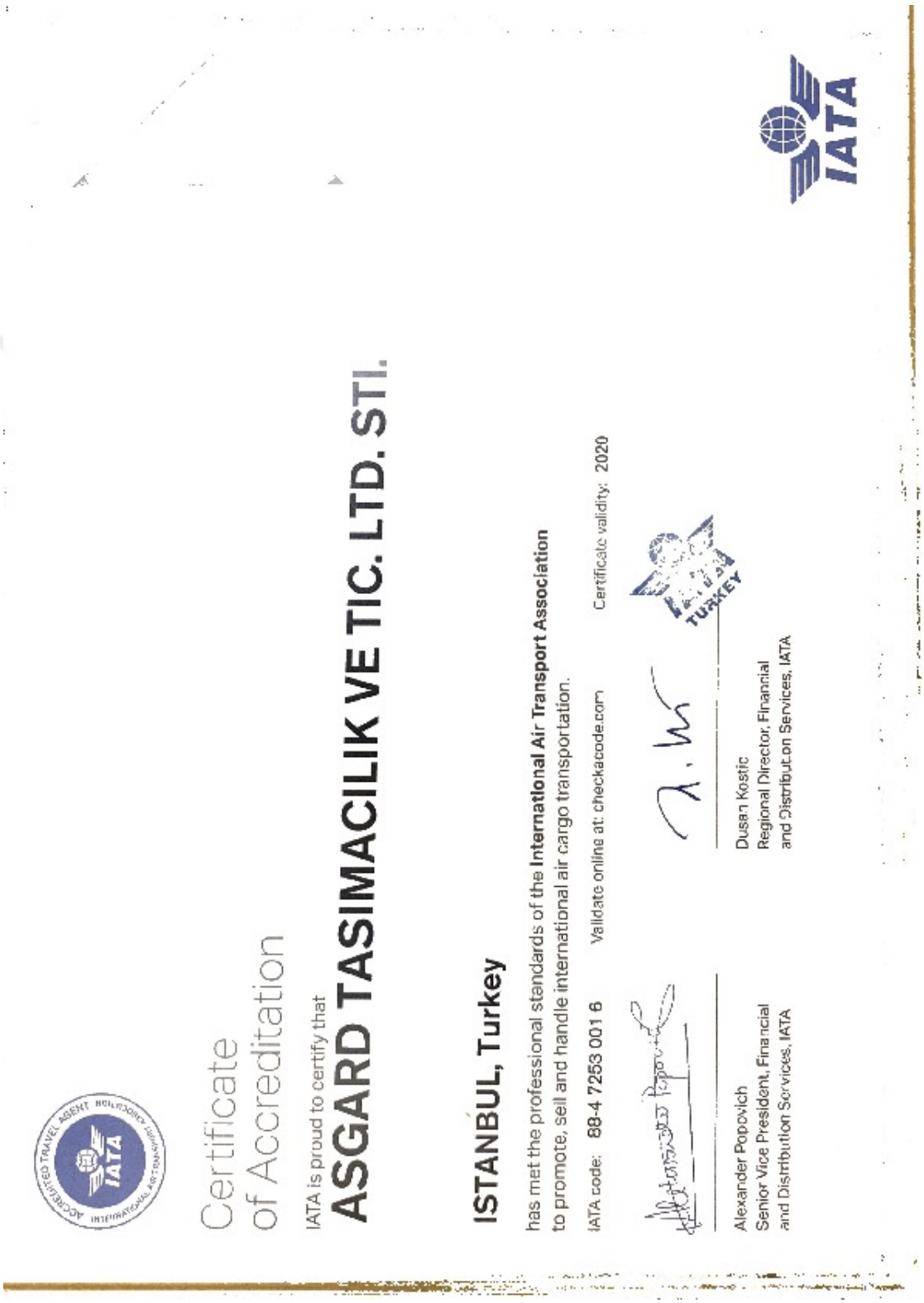
Financial KPIs (Group 1)	**DeLone & McLean Model**	**The Gable et al. Model**
Turnover Mil	Net Benefits -	Organizational Impact - Overall Productivity
Net Profits Mil	Net Benefits -	Organizational Impact - Overall Productivity
Freight Invoice Issued Sea	Systems Quality - Usability	Information Quality - Usability
Freight Invoice Issued Air	Systems Quality - Usability	Information Quality - Usability
Freight Invoice Issued Road	Systems Quality - Usability	Information Quality - Usability
Annual Maintenance Fees	Net Benefits - Cost Savings	Organizational Impact - Cost Reduction
Av Profit Per Shipment	Net Benefits - Cost Savings	Organizational Impact - Cost Reduction
Av Profit Per Shipment Sea	Systems Quality - Reliability	Systems Quality - Reliability
Av Profit Per Shipment Air	Systems Quality - Reliability	Systems Quality - Reliability
Av Profit Per Shipment Road	Systems Quality - Reliability	Systems Quality - Reliability
Training Costs	Net Benefits - Cost Savings	Organizational Impact - Organizational Costs
Training Costs per CAL	Net Benefits - Cost Savings	Organizational Impact - Cost Reduction

Operational KPIs (Group 2)	**DeLone & McLean Model**	**The Gable et al. Model**
Sea Shipments TEUs	Service Quality	Organizational Impact - Improved Outputs
Air Shipments Parcel	Service Quality	Organizational Impact - Improved Outputs
Road Shipments Truck	Service Quality	Organizational Impact - Improved Outputs
Sea BL Issued	Use - Number of Transactions Executed	System Quality - Ease of Use
Air BL Issued	Use - Number of Transactions Executed	System Quality - Ease of Use
Road Cmr Issued	Use - Number of Transactions Executed	System Quality - Ease of Use
Freight Quotations Made	Systems Quality - Usability	System Quality - System Features
Freight Quotes Made Sea	Systems Quality - Usability	System Quality - System Features
Freight Quotes Made Air	Systems Quality - Usability	System Quality - System Features
Freight Quotes Made Road	Systems Quality - Usability	System Quality - System Features
Quantity of International Partners	Service Quality - Empathy & Responsiveness	Satisfaction - Overall
Quantity of Domestic Partners	Service Quality - Empathy & Responsiveness	Satisfaction - Overall

Technological KPIs (Group 3)	**DeLone & McLean Model**	**The Gable et al. Model**
Errors Reported	Information Quality - Completeness	System Quality - System Accuracy
Integration Demanded	Systems Quality - Adaptability	System Quality - Integration
Time for Submitting a BL	Net Benefits - Time Savings	Information Quality - Timeliness
Program Crash Reports Annual	Information Quality - Security	System Quality - Reliability
Amount of Integrations	Systems Quality - Adaptability	System Quality - Integration
Integrated 3rd Party Apps	Systems Quality - Adaptability	System Quality - Integration
Amt. of Complaint Tickets CALs	Systems Quality - Reliability	Individual Impact - Problem Identification

Human Performance KPIs (Group 4)	**DeLone & McLean Model**	**The Gable et al. Model**
Average Amount of Reports	Information Quality - Personalization	Satisfaction - Information
Active CALs	Information Quality - Usability	Information Quality - Usability
Training Time	Information Quality - Ease of Understanding	Individual Impact - Learning
Training Time per CAL	Information Quality - Ease of Understanding	Individual Impact - Learning
Average Time to Make Offers	Net Benefits - Expanded Markets	Individual Impact - Individual Productivity
Visit Reports Submitted	Net Benefits - Expanded Markets	Individual Impact - Task Performance
Acquired Orders After Quotes	Net Benefits - Incrementional Additional Sales	Organizational Impact - Improved Outputs
Lost Customers	Service Quality - Responsiveness	Individual Impact - Problem Identification
Acquired Customers	Net Benefits - Expanded Markets	Organizational Impact - Increased Capacity
Reclaimed Customers	Net Benefits - Incrementional Additional Sales	Organizational Impact - Improved Outputs
Av. Screen Time per CAL/Day	Use - Nature of Use	Satisfaction - Enjoyment

Appendix D: IATA Certificate of Company A



Certificate
of Accreditation

IATA is proud to certify that

ASGARD TASIMACILIK VE TIC. LTD. STI.

ISTANBUL, Turkey

has met the professional standards of the **International Air Transport Association** to promote, sell and handle international air cargo transportation.

IATA code: **88-4 7253 001 6** Validate online at: checkacode.com Certificate validity: **2020**

Alexander Popovich
Senior Vice President, Financial
and Distribution Services, IATA

Dusan Kostic
Regional Director, Financial
and Distribution Services, IATA

IATA TURKEY

IATA

Appendix E: TIO (Tasima Isleri Organizatoru) Certificate of Company A

T.C.
ULAŞTIRMA VE ALTYAPI BAKANLIĞI
ULAŞTIRMA HİZMETLERİ DÜZENLEME GENEL MÜDÜRLÜĞÜ
YETKİ BELGESİ

UDH0320120801448005

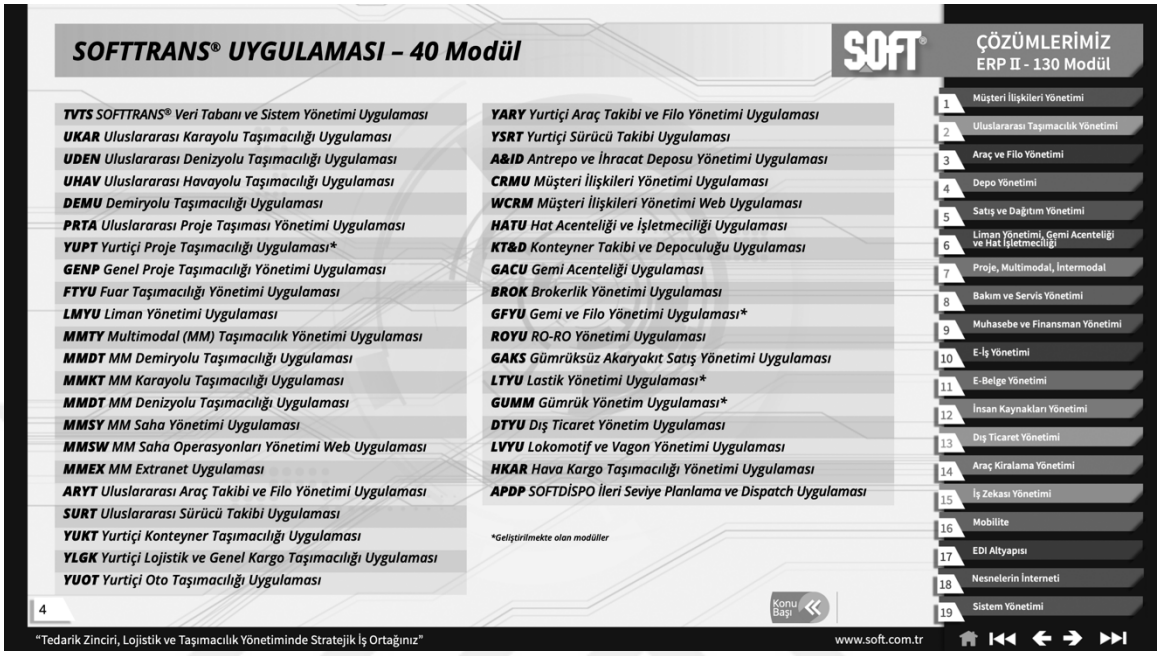
BELGE TÜRÜ
TİO

YETKİ BELGESİNİN		
VERİLİŞ TARİHİ	GEÇERLİLİK TARİHİ	BELGE NUMARASI
08/12/2020	08/12/2025	İST.U-NET.TİO.34.1278
YETKİ BELGESİ SAHİBİ (U-NET NO = 277947)		
TİCARİ ÜNVANI	ASGARD TAŞIMACILIK VE TİC.LTD.ŞTİ.	
KISA ÜNVANI	-	
ADRES	BEYLİKDÜZÜOSB MAH. BİRLİK SAN. SİT. 3. CAD. KELESOĞLU PLAZAAPT. NO:3/23 BEYLİKDÜZÜ / İSTANBUL	
TİCARET SİCİL NO	492365	
VERGİ DAİRESİ / NO	BEYLİKDÜZÜ / 0860300750	

Bu Taşıma İşleri Organizatörlüğü Belgesi, Taşıma İşleri Organizatörlüğü Yönetmeliği'nin 5. Maddesi uyarınca, taşıma işleri organizatörlüğü faaliyeti gerçekleştiren gerçek ve tüzel Kişilere verilir.

Bu belgenin doğruluğu https://www.turkiye.gov.tr/belge-dogrulama adresinde veya mobil cihazlarınıza yükleyebileceğiniz e-Devlet Kapısı'na ait Barkodlu Belge Doğrulama uygulaması vasıtası ile yandaki karekod okutularak kontrol edilebilir.

Appendix F: SOFT Information Systems Company Brochures



SOFTTRANS® UYGULAMASI – 40 Modül

SOFT ÇÖZÜMLERİMİZ ERP II - 130 Modül

TVTS SOFTTRANS® Veri Tabanı ve Sistem Yönetimi Uygulaması	**YARY** Yurtiçi Araç Takibi ve Filo Yönetimi Uygulaması
UKAR Uluslararası Karayolu Taşımacılığı Uygulaması	**YSRT** Yurtiçi Sürücü Takibi Uygulaması
UDEN Uluslararası Denizyolu Taşımacılığı Uygulaması	**A&ID** Antrepo ve İhracat Deposu Yönetimi Uygulaması
UHAV Uluslararası Havayolu Taşımacılığı Uygulaması	**CRMU** Müşteri İlişkileri Yönetimi Uygulaması
DEMU Demiryolu Taşımacılığı Uygulaması	**WCRM** Müşteri İlişkileri Yönetimi Web Uygulaması
PRTA Uluslararası Proje Taşıması Yönetimi Uygulaması	**HATU** Hat Acenteliği ve İşletmeciliği Uygulaması
YUPT Yurtiçi Proje Taşımacılığı Uygulaması*	**KT&D** Konteyner Takibi ve Depoculuğu Uygulaması
GENP Genel Proje Taşımacılığı Yönetimi Uygulaması	**GACU** Gemi Acenteliği Uygulaması
FTYU Fuar Taşımacılığı Yönetimi Uygulaması	**BROK** Brokerlik Yönetimi Uygulaması
LMYU Liman Yönetimi Uygulaması	**GFYU** Gemi ve Filo Yönetimi Uygulaması*
MMTY Multimodal (MM) Taşımacılık Yönetimi Uygulaması	**ROYU** RO-RO Yönetimi Uygulaması
MMDT MM Demiryolu Taşımacılığı Uygulaması	**GAKS** Gümrüksüz Akaryakıt Satış Yönetimi Uygulaması
MMKT MM Karayolu Taşımacılığı Uygulaması	**LTYU** Lastik Yönetimi Uygulaması*
MMDT MM Denizyolu Taşımacılığı Uygulaması	**GUMM** Gümrük Yönetim Uygulaması*
MMSY MM Saha Yönetimi Uygulaması	**DTYU** Dış Ticaret Yönetim Uygulaması
MMSW MM Saha Operasyonları Yönetimi Web Uygulaması	**LVYU** Lokomotif ve Vagon Yönetimi Uygulaması
MMEX MM Extranet Uygulaması	**HKAR** Hava Kargo Taşımacılığı Yönetimi Uygulaması
ARYT Uluslararası Araç Takibi ve Filo Yönetimi Uygulaması	**APDP** SOFTDİSPO İleri Seviye Planlama ve Dispatch Uygulaması
SURT Uluslararası Sürücü Takibi Uygulaması	
YUKT Yurtiçi Konteyner Taşımacılığı Uygulaması	*Geliştirilmekte olan modüller
YLGK Yurtiçi Lojistik ve Genel Kargo Taşımacılığı Uygulaması	
YUOT Yurtiçi Oto Taşımacılığı Uygulaması	

1 Müşteri İlişkileri Yönetimi
2 Uluslararası Taşımacılık Yönetimi
3 Araç ve Filo Yönetimi
4 Depo Yönetimi
5 Satış ve Dağıtım Yönetimi
6 Liman Yönetimi, Gemi Acenteliği ve Hat İşletmeciliği
7 Proje, Multimodal, İntermodal
8 Bakım ve Servis Yönetimi
9 Muhasebe ve Finansman Yönetimi
10 E-İş Yönetimi
11 E-Belge Yönetimi
12 İnsan Kaynakları Yönetimi
13 Dış Ticaret Yönetimi
14 Araç Kiralama Yönetimi
15 İş Zekası Yönetimi
16 Mobilite
17 EDI Altyapısı
18 Nesnelerin İnterneti
19 Sistem Yönetimi

Konu Başı

4

"Tedarik Zinciri, Lojistik ve Taşımacılık Yönetiminde Stratejik İş Ortağınız" www.soft.com.tr

SİSTEM YÖNETİMİ UYGULAMASI

SOFT Lojistik ve Taşımacılık Yönetimi Uygulamasının Sistem Yönetimi Modülü, SOFTTRANS® Veri Tabanı'nı, tüm modüllerin çalışması için gerekli tanım ve parametreleri içermektedir. Bu uygulama PROGRESS Veri Tabanı Yönetim Sistemi ile kullanıcılar ve tüm uygulama modülleri arasındaki bağlantıyı ve arayüzü oluşturmaktadır.

- Menü tanımları
- Şirket tanımları
- Döviz tanımları
- Şube tanımları
- Operasyon grupları tanımları
- Kodlu bilgi tanımları
- Kullanıcı tanımları
- Kullanıcı yetkileri
- Kullanıcı şifre tanımları
- Sistem işlem günlüğü (*log*)
- Doküman yönetimi alt sistemi
- Otomatik işlem robotu

Sayfa 14 / 16

Source : SOFT Informations Systems Company Brochure, 2017

Appendix G: STEPS (SELECT) Company Brochures

select
ADVANCED SOLUTIONS

Büyükdere Cd. Fulya Mh. Garaj Sok.
Andsoy Apt. No:4/6 34387 Şişli/İstanbul
+90 (212) 211 32 11
+90 (212) 211 32 12
select@selectbilisim.com

StepsPro Lojistik ERP, veritabanı konusunda en güçlü olan MS SQL desteği ve son yazılım teknolojileri ile sizlere hizmet vermek amacı ile geliştirilmiştir.

Select Bilişim Hizmetleri uzun yıllardır lojistik sektörüne özel çözümler sunmaktadır. Bunların yanında özel internet web tasarımı, donanım, outsourcing, sistem yazılımları, iletişim sistemleri, network çözümleri, doküman arşivleme, barkod çözümleri, araç takip sistemleri ile tüm bu konular hakkındaki eğitim ve danışmanlık hizmetlerini de sunmaya başlamış olmanın gururunu yaşıyoruz.

Saygın firmalara sunduğumuz "**StepsPro Lojistik ERP**" adlı son versiyonumuz kuruluşlara birçok yenilik ve avantaj getirmektedir. Veritabanı olarak MS SQL gibi dalında en büyük firmanın ürünlerinin kullanımı size verilerinizin korunmasında, yüklü miktarda verinin saklanmasında ve bunların yönetiminde hız ve kontrol sağlarken dışarıdan gelecek veritabanlarına karşı saldırılarda bilginizi koruyacaktır.

Yeni yazılımın oluşturduğu ortak veri tabanı sistemi ile tüm modüller arası anında entegrasyon sağlanmaktadır. Bu bilginin doğru zamanda bir kerede girilmesinde önemli olup işlemlerinizde hız kazandıracaktır.

- WE ARE CHANGING THE WAY OF DOING LOGSITICS -

- LOJİSTİK YAPMANIN YOLUNU DEĞİŞTİRİYORUZ -

Neden BULUT Tabanlı ve SaaS* bir sisteme sahip olmalısınız?

Şu anki sistemler	OPTIMUS Bulut Platformu
Yüksek Server maliyeti	Server gerektirmiyor
Uzak erişim için lisans maliyeti	Ücretsiz uzak erişim
Yüksek satın alma maliyeti	Düşük başlangıç maliyeti ile kiralama modeli
Uzun vadede yüksek toplam maliyet	Uzun vadede düşük toplam maliyet
Lokal veya az şubeli firmalar için uygun	Lokal yanında Globalleşen ve çok şubeli firmalar uygun
Ofis içi hızlı kullanım, dışarıdan yavaş kullanım	Her yerden erişim ve hızlı kullanım.
Başka bir donanım destek firması ihtiyacı	Bakım ve destek hizmet sağlayıcıdadır
Yenilenmesi gereken lisanslar	Tüm lisanslar ücrete dahildir ve günceldir
Dışarıya karşı güvenlik sistem kurulumları	En üst düzeyde güvenlik sistemleri kullanılır
Yede yedekleme için ayrı sistem	Yedekleme sistem dahilindedir.
Yedekleme kontrolü zorluğu	Yedekler kontrollüdür ve Select ilgilenir.
Uzun süreli yedeklerin yönetimi zordur	Uzun süreli yedekleme hizmeti dahildir.
Pc ve Notebooklarda çalışır	Tüm mobil ve masaüstü cihazlarda çalışır

*SaaS: Software as a service - Aylık abonelik ücreti ödenerek kullanılan sistemler.

Appendix H: Siber Software Correspondence

KÇ

Kenan Çelik (Siber Yazılım)
RE: Soru
Kime: KEREM ŞAHİNBOY

Merhaba Kerem Bey,

Yazılım dili Delphi, database MS SQL kullanıyoruz.

İyi Çalışmalar

Kenan ÇELİK
CEO

-----Original Message-----
From: KEREM ŞAHİNBOY
Sent: Friday, November 13, 2020 3:09 PM
To:
Subject: Soru

Merhaba,

Taşımacılık, doktora öğrencisiyim.
Okulda nakliye sektöründe kullanılan yazılımlar hakkında bir sunum yapacağım.
Nakliye programınızı yazdığınız programlama dili nedir ve hangi database'i kullanıyor?

Teşekkürler

Saygılar

Kerem Şahinboy

Appendix I: List Of Abbrevations

SCM	: Supply Chain Management
IOT	: Internet of Things
B2b	: Busines to Business
C2c	: Customer to Customer
IT	: Information Technologies
EDI	: Electronical Data Interchange
AI	: Artificial Intelligence
ERP	: Enterprise Resource Planning
AHP	: Analytical Hierarchy Process
CPM	: Critical Path Method
PERT	: Program Evaluation and Review Technique
DEA	: Data Envelopment Analysis
CAL	: Client Access License
AKA	: As Known As
GSA	: General Sales Agent
POL	: Port of Loading
POD	: Port of Destination
TOC	: Theory of Constraints
CMT	: Contingency Management Theory
SCP	: Structure Conduct Performance Paradigm
CRM	: Customer Relationship Management
PhD	: Doctorate Degree

HPP	: Harzing's Publish or Perish Software
Ed.	: Edition
METU	: Middle East Technical University
ISP	: Internet Service Provider
GPS	: Global Positioning System
AIS	: Automatical Identification System
TBMM	: The Grand National Assembly of Turkey
SPDG	: The State Ports General Directorate of Turkey
PC	: Personal Computer
DB	: Database
SQL	: Structured Query Language
RAM	: Short Term Memory
CPU	: Central Processing Unit
RDBMS	: Relational Database Management Systems
NGO	: Non-Governmental Organization
3PL	: Third Party Logistics
LE	: Light Edition
LAN	: Local Area Network
TDA	: Technology Development Area
RD	: Research and Development
SBS	: Soft Business Solutions
XLM	: Extensible Markup Language
SWOT	: Strenghts-Weaknesses-Opportunities-Threats

HDD : Hard Disk Drive

SAAS : Software As A Service

RFID : Radio-Frequency Identification

BI : Business Intellgience

M B/L : Master Bill of Loading

SI : Shipper's Instructions

SAAG : Software as a Gateway

TMS : Transport Management Software

FCP : First Contentful Paint

LCP : Largest Contentful Paint

PAAS : Platform as a Service

CAGR : Compound Annual Growth Rate

TEU : Twenty Feet Equavalent Unity

MAWB : Master Airway Bill

AHP : Analytical Hierarchy Process

CI : Consistency Index

GUI : Graphical User Interface

NVOCC : Non Vessel Owning Common Carrier

VPS : Virtual Private Server

SKU : Stock Keeping Unit

PPU : Pay Per Usage

IDE : Integrated Development Environment

JSON : Java Script Object Notation

HTML : Hypertext Markup Language

CSS : Cascading Style Sheets

SD : Standard Deviation

DMU : Decision Making Unit

EF : Efficiency Frontier

RE : Relative Efficiency

SSIS : SQL Server Integration Services

SSRS : SQL Server Reporting Services

SSAS : SQL Server Analysis Services

UX : User Experience

TEU : Twenty Feet Equavalent Unit

M/V : Marine Vessel

ISO : International Standardization Organization

CMM : Container Management Module

CML : Company Management Module

CS : Container Seller

OTHC : Origin Port Terminal Handling Charges

DTHC : Destination Port Terminal Handling Charges

MERSİS : Merkezi Sicil Kayıt Sistemi (Central Registry System)

YOM : Year of Made

LOI : Letter of Intent

BAF : Bunker Adjustment Factor

CAF : Currency Adjustment Factor

PSS	: Peak Season Surcharge
BAS	: Basic Sea Freight
ISPS	: International Ship and Port Facility Security Code
CCF	: Container Cleaning Fee
ENS	: Entyr Summary Declaration
TOS	: Terms of Shipment
FOB	: Free On Board
FAS	: Free Alongside Ship
COC	: Carrier Owned Container
SI	: Shipper's Instructions
FCL	: Full Container Load
LCL	: Less Than a Container Load
H B/L	: House Bill of Lading
KPI	: Key Performance Indicators
SCAAS	: Supply Chain As A Service
MIS	: Management Information System
GPI	: General Product Innovation
XaaS	: Everything as a Service