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RESEARCH ARTICLE

Kshal: A Web-Based Innovative Software Alternative for Maritime Logistics Companies

Kshal: Deniz Lojistiği Firmaları İçin Web Tabanlı Bir Yazılım Alternatifi

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ABSTRACT

The 20th Century was a milestone of evolutionary jumps in critical changes in the business world. Technological innovations have been sparked into our daily lives and triggered the rise of intelligent systems integrating production systems, supply chains, customs authorities, b2b, c2c commercial activities, etc. The boost of change occurred within companies by the push of intelligent 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 to become new winners, or by another name, "record breakers" in the world markets. This paper 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 organisational problems in the maritime industry. KSHAL is a web-based ERP program designed for small and medium-sized freight forwarders, shipping companies and maritime logistics organisations. KSHAL is capable of handling container shipments, container trading activities, freight quotations, and customer relations successfully. KSHAL Project as a web-based maritime software alternative will be the focal point of this article as an excellent example of planning, designing, coding, deploying and commercialising the whole software development process in one go. The paper also aims to illuminate the advantages of the SaaS (Software as a Service) based ERP systems for freight forwarding companies and merchants in the container trading industry.

Keywords: Software, Logistics, Innovation, Development, Maritime

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1. Introduction

This article aims to study the steps of building a web-based software alternative from drafts up to commercialising the final product by selling it to corporate level buyers in the maritime industry. The paper will try to obtain findings on the possibilities of bringing a creative, economical and straightforward software solution as a final product without compromising the building of an extensive data handling structure that provides a complete web-based IT system for maritime companies, particularly freight forwarders and container trading merchants. The article will also display a full-scale production process from blueprints to taking the completed and deployed software “live” and more. This study is a part of the first author’s PhD dissertation.

2. Research Problems and Theoretical Approach

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 creating a beneficial application. The first problem is allocated for the group of smaller issues related to the developer’s end. In this cluster, we will group questions or issues related to Start-Up Mentality, budgeting, human resources, design, development, creating differences while not burying the ideas under chunks of occupying “dead” decisions. Simply, “How to develop an industry-specific software without sacrificing the quality and operability.”

The second cluster is a base for several smaller problems related to innovation and market trends. Innovation, or General Product Innovation (GPI), shapes upmarket trends while market trends pull or push innovative technologies. Hence, a GPI provides a substantial improvement in 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 organisational 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. Identifying the distinction between GPI and minor changes typically depends on criteria relevant to a particular industry and technical settings. The empirical section of the paper uses a multi-dimensional approach to identifying GPIs that are appropriate in our analytic setting [1].

The final cluster of problems is classified as customers’/users’ end. No matter how much an investor ever believed in his/her product, the success is justified by the customers’ decision. All 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 IT solutions and complaints of customers? How may we reconceptualise enhancing end-user satisfaction through our technology? How advanced is our target audience when taking tech, IT, software, ERP topics into consideration? How simple should our screens and task flows 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 [2]?

Good research is grounded in theory. Theories consist thus of plausible relationships produced among concepts and set of concepts, providing both a framework for critically understanding a phenomenon and a basis for considering how what is unknown can be organized [3]. This paper cites Porter's Value Chain Strategy. This theory can be taken as a peerless management tool that is often used in the logistics industry to get into details of individual departments or activities of companies by splitting their functions into pieces. Value chain analysis describes the activities within and around an organisation and relates them to analysing its competitive strength. Therefore, it evaluates which value each particular activity adds to the organisations' products or services. 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 activities 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 manage the linkages between these activities is a source of competitive advantage [4].

As the second theoretical reference, this paper adjusts Time in Transit Theory to its narrative content. This theory was introduced by the Japanese academic Kiyoyasu Tanaka in 2010 by delivering a contemporary approach that analyses freight and distance alternatives. Distance as a variable derivative has a significant influence on freight. Tanaka concentrates his argument around the trade-off issue 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 puzzling because the effect of short distances on rates, as per-mile freight rates, tends to decline with distance as the ratio decreases [5].

The third theory that this paper is scholarly influenced by is The Theory of Constraints (TOC). TOC is a method 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 [6]. 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 for customers who have bought or will buy KSHAL. A lean, simple to use, easy to learn, and powerful software is one of the key players challenging constraints at companies, especially in shipping entities where data is a major player of the operational flow.

3. Methodology

Building up software from drafts has three project stages: before the project starts, the development phase, and the aftermaths of the deployment. Analytical Hierarchy Process (AHP) is a popular and effective method for deciding between numerous alternatives by weighting their importance levels. We will be seeking answers to our questions on which database platform, coding language, deployment environment and pricing technique

is best for our software named KSHAL. 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 visualise the budget aspect of software development. CPM requires us to compile all the activities needed to accomplish the KSHAL project and assign each station its unique time requirements. 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 buses are all important stations that run simultaneously or by sequence. While CPM has a deterministic approach, PERT runs in a probabilistic way. DEA will measure KSHAL's benefits at multiple hubs. This paper will evaluate how effective and efficient the software is at three different companies in two countries: Turkey and Ukraine. Medium-sized maritime logistics companies have used the program in their shipping, container storage, container sales, CRM, and documentation operations for over a year. DEA is an efficiency analysis that compares participating units' relative efficiency level, such as similar-sized companies that work in the same business field and different company branches. The participating teams must have the same or similar inputs and generate the same or similar outputs.

4. Statistical Comparison of Two ERP Programs

It is necessary to benchmark two software platforms, particularly an ERP that works on a local computer network and another one that works on the web to observe the benefits or inefficiencies of these systems. Company "A" is a participant freight-forwarding corporation with over 15 years of experience in container shipping, air cargo and truck transportation services, located in Istanbul, Turkey. Company A used these two different ERP platforms over the years. Our case study will reveal the substantial meaningful relations, if any, between these two ERP platforms as each has significant differences technologically and cost-wise.

This research used IBM's SPSS program to interpret the 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. Table 1 gives us an insight into ERP1, which the company used from 2010 to 2014, and the Table 2 shows us the details of ERP2, which was in use from 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. ERP1 is software that runs locally as an installed program. The primary DB is stored on a server, and CALs (Certified App License) connect to the mainframe as clients. It does not have access for third-party applicants unless otherwise 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 to access it. ERP2 is not an installed product; it does not require any applets or plug-ins to be installed to use 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 it with a daily backup process performed by the company's personnel.

ERP1 is an older software than ERP2, and cost-wise it is the one with a higher sales price. ERP1 uses Progress DB, and ERP2 uses MS SQL DB. As a result, the start-up cost of ERP1 is higher than ERP2. ERP1 requires two in-house servers, one dedicated for the program's core and one for hosting the DB. In addition to this, ERP1 only runs on Microsoft Server operating system. The client is asked to purchase Microsoft's Server Operating system twice, once 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 that does not ask clients to invest in hardware items such as servers or additional operating system licenses. In this respect, it is relatively simple to kick-start the ERP2 project for maritime companies willing to switch their old ERP or have a brand new one from zero ground.

ERP1 has fewer modules, and broader skills to cover the major needs of shipping companies. Most importantly, ERP1 has an 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 that is needed and supply their customers with their licensed products. ERP1 needs two to three weeks to get the program customised and running correctly for each new client, while ERP2 needs a week to set it all up and get ready, including custom-designed documents.

As seen below, 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 company A, as it is their preference in business, has only air cargo parcel exports; that is why there is an equal number of air cargo exports and MAWBs (Master Airway Bill). Table 1 shows that company A's 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.

Table 1. ERP1 Dataset (A Locally Installed Program)

ERP 1 (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

Table 2. ERP2 Dataset (A Web-Based Program)

ERP 2 (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

It is possible to observe that due to several upgrades and changes in ERP1, the time of submitting a BL (Bill of Loading) 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. Moreover, 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.

At this step, to take our study up to a more concrete scale and have it materialise, 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.

Table 3. Results of Different Statistical Analyses

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						
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						

A normality test applied for all the variables is reported in Table 3. The test was conducted to determine whether to use parametric or non-parametric inferential tests to examine the variables and interpret the results. As the first step, it was 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 ($p > .05$). Those variables that were normally distributed had an independent t-Test (a parametric test) applied to examine them, while those variables that were not normally distributed had a Mann-Whitney u-test (non-parametric test) conducted.

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 that is not bound by the frequency count rule; therefore, Mann-Whitney U 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, since the differences are pretty minimal. Some categories are significantly higher for ERP 2 and others that are considerably lower for ERP 2.

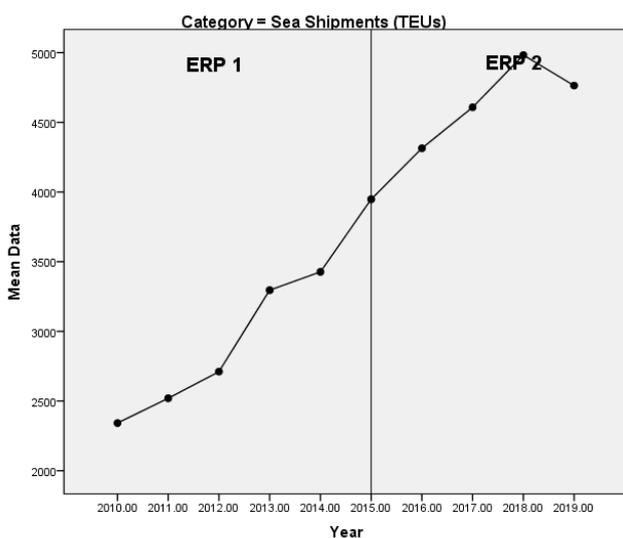


Figure 1. Container Shipments (TEUs)

Overall, the results show us that ERP2 as a web-based platform is a more effective and efficient tool than ERP1, is locally installed and comes with hardware investment requirements. Therefore, H1 appears to be a significant proposal.

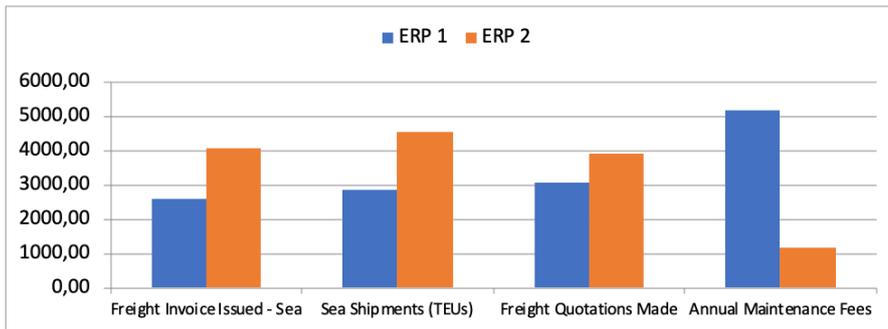


Figure 2. Bar Chart of Mean Values of Different Categories Compared by ERP

From this point of view, our benchmark showed that ERP platforms that run on the cloud environment run on less expensive, less limiting but more flexible database structures and will have a brighter future than those that run on local computers and use relatively weak DB tools.

5. KSHAL Project

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. Why did 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 is such a system for companies to use? How effective is KSHAL as a web-based ERP alternative for the maritime industry? Answers and solutions to these questions, some of which have come from our hypotheses, will be sought in this section.

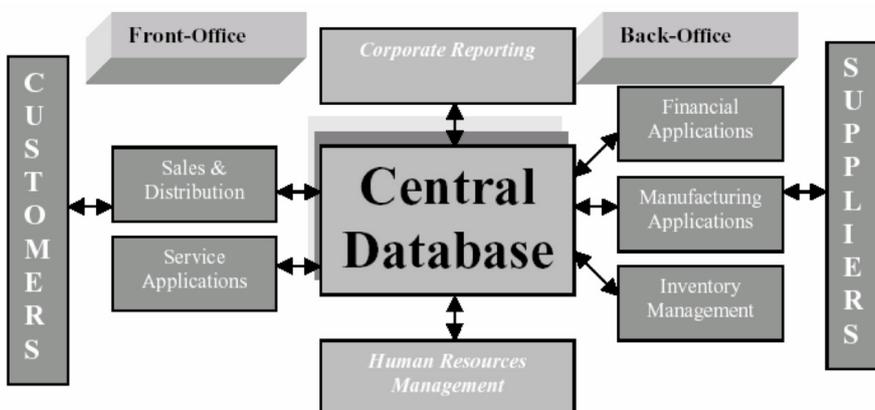


Figure 3. Web-Based ERP Model (eiilmuniversity.ac.in)

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. KSHAL was developed using 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. KSHAL, briefly, is coded using C# on Visual Studio, it uses MS SQL Server as DB and gets hosted by Microsoft’s Azure VPS service. 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. KSHAL is a practical simulation of what we do during routine shipping operations in our daily life. It deliberately aims to simplify logistic operations by its database model, screens and menu structure.

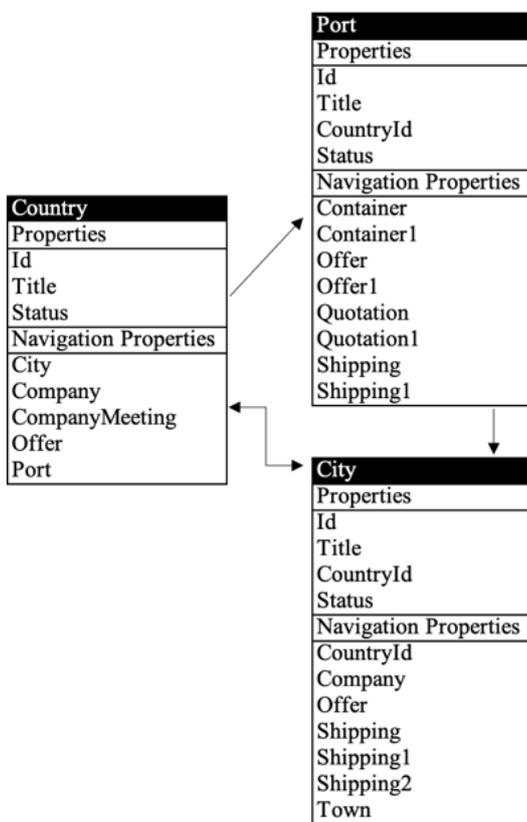


Figure 4. Data Tables Relation Model Detail

User experience (UX) encompasses all aspects of the end-user interaction with its services and products [7]. 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 menus of the program while simultaneously considering branding, usability, functionality, and simplicity. While building up an ERP for the shipping industry, a lean user experience powered by a simple design can assist customers in achieving their goals more effectively than the opposite ones with a complex screen flow and difficult navigation. The word simplicity does not equate to primitiveness

for ERP programmes, 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 but has a lean design. KSHAL’s UX was designed by focusing on simplicity, which led the project into a clean and sleek design with a robust back-end interaction with a purposeful front-end build.

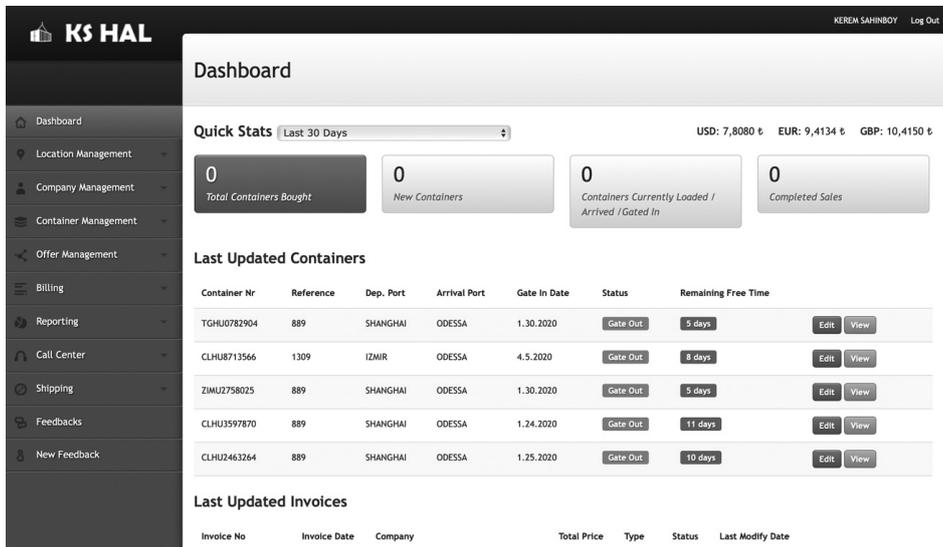


Figure 5. KSHAL’s Dashboard

Since we have analysed the alternatives and decided which DB management system and coding language to use for KSHAL, it was necessary to merge these technical aspects with practical applications and needs, which have become the foundation of our UX designing process. The UX of KSHAL is the purified expression of converting particular know-how into code, as no software engineer will know container shipping better than an expert experienced in this field. So, we acknowledge that KSHAL is the first and only ERP platform designed by shipping and maritime experts in Turkey. The container management module (CMM) is the flagship of KSHAL. It is used to buy and sell all types of used or brand-new containers, set them for lease, calculate profits/losses, warehousing expenses, agency fees, demurrage incomes and costs, and track all sorts of demographic and operational information correlated to containers in the inventory list. 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 utilises several complex processes, such as container tracking, storage and demurrage calculations in the container trading business. When the number of containers in stock reaches up to hundreds of units and is circulated between tens of different depots, these tasks may become troubling responsibilities. In our UX, KSHAL positions the container merchant at the centre of the operations.

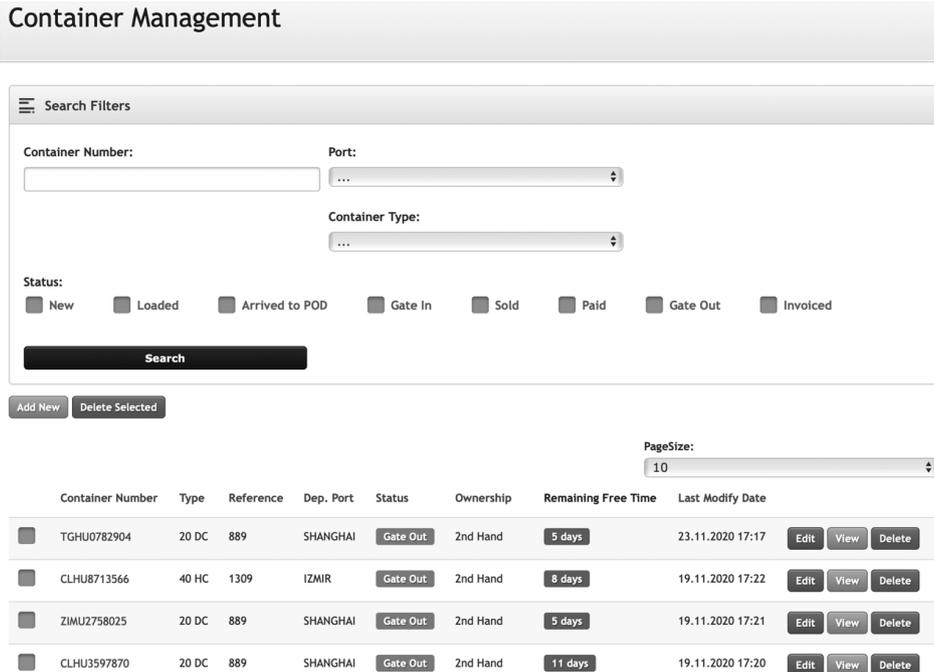


Figure 6. Container Management Module Dashboard

The container module of KSHAL fulfils all buying, selling, cost-profit recording, status checking, and shipping automation requirements. It is a 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 as shown on KSHAL. KSHAL operators can issue income invoices and also register cost invoices. The bulk update feature assists us in modifying records of containers in large quantities at once with ease. It is a simple, robust, consistent, shipshape software alternative for maritime logistics companies. Freight quotations are the face of marketing departments and most likely the face of companies in the SCM industry. A freight quotation should be as simple, as understandable, and as intact as possible. It must be lean and informative. Along the way, when shipping lines, trucking companies and air cargo carriers grow, freight quotations also become complex documents to understand by end customers. Surcharges, cited laws, seasonal fees, warnings, restrictions, and liability reminders have 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. KSHAL’s pricing module is concentrated on container shipping services. It manages costs and generates sales prices based on a number of selections. 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. The costs link takes users to 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. On the cost dashboard, users have a list

of fees that have been retrieved from various container shipping lines in default order that shows most recent records as first in line.

Page Size: 10

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

Figure 7. KSHAL Cost Module Dashboard

Each column's title is a clickable link that, once clicked, sorts the whole column either alphabetically or numerically in ascending order. We can search active (valid) and deactivated (invalid) tariffs here on this page. Invalid rates are also shown on the software to give users a glimpse of the historical evolution and change of the freight levels. We can see the name of the container line, port of departure, port of destination, BAS based on various types of containers and surcharges such as OTHC, Vgm, Seal Fee, Ens, and Telex Release Fee. We can see the validity of the cost and the date it was created. KSHAL can assign two major currency types, such as USD and EUR, to all expense items. KSHAL produces freight quotations in PDF file format by using NRECO technology of .NET. NRECO (.Net REusable Components) is a productive tool when some 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.

- Dashboard
- Location Management
- Company Management
- Container Management
- Offer Management
- Costs**
- Offer Cost Types
- New Cost
- Quotations
- New Quotation
- Billing
- Reporting
- Call Center
- Shipping
- Feedbacks
- New Feedback

GLOBAL OCEAN LINK
 Contact: EKATERIBA GORINA
 E-Mail: [REDACTED]
 Departure: AMBARLI
 Destination: ODESSA

Ref Id: 39719
 Type: Sea Freight
 Created On: 2/2/2021 9:05 AM
 Created By: IZZET DOGRUBANAK

Export
Export Quotation

Offers

Company	Type	Validity	20 DC	20 OT	40 DC	40 HC	40 OT	45 HC	OTHc	VGM	Seal Fee	20" P.S.F	40" P.S.F	I
ADMIRAL	Sea Freight	28.02.2021	138.00 \$	864.00 \$	295.00 \$	295.00 \$	750.00 \$	-	310.00 \$	35.00 \$	5.00 \$	100.00 \$	170.00 \$	-
COSCO	Sea Freight	28.02.2021	160.00 \$	-	285.00 \$	285.00 \$	-	-	325.00 \$	25.00 \$	-	80.00 \$	100.00 \$	-
OOCL	Sea Freight	28.02.2021	85.00 \$	-	185.00 \$	185.00 \$	-	-	300.00 \$	25.00 \$	-	35.00 \$	55.00 \$	-
ARKAS	Sea Freight	28.02.2021	263.00 \$	975.00 \$	371.00 \$	371.00 \$	-	-	325.00 \$	25.00 \$	5.00 \$	60.00 \$	100.00 \$	-

Notes: lmo 3, 40tk lumpsum 880 USD maliyetimiz var. All in 20" OT IG-USD1260 / G.T.31.01.2020

Export Container Types

20 DC
 20 OT
 40 DC
 40 HC
 40 OT
 45 HC

Figure 8. Quotation Detail Screen

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 prevents unnecessarily repeated jobs such as asking for the same quotations from container lines on different working days. Two or more sales operators with no tool such as KSHAL may accidentally request the same route from the same shipping line. 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, in which period and how many of these price offers have been realised as concrete shipping orders. Hence, transport companies are commercial bodies for sustainable profits, and these activities must be actively observed via ERP platforms such as KSHAL. Hereby, we may acknowledge that KSHAL's price quotation module models the container shipping industry's needs accurately and responds to those who want to simplify these tasks on a budget.

The shipping module menu has only two buttons on the left navigation panel. The records link takes users to the dashboard and the new record link takes users into a new shipping record screen. This is purposely designed as lean as possible to keep the philosophy of KSHAL's simplicity approach. However, there is no concession of sleek design while applying the rules of simplicity. On the shipping module dashboard, we display columns such as Booking No, Ref No, M B/L No, From, To, Line, Vessel, Voyage, D/D, A/D, and Created on (date).

Booking No	Ref No	MBL No	From	To	Line	Vessel	Voyage	D/D	A/D	Created On
B211101253	49718607	AD1958632	IZMIT	NOVOROSSYSK	ADMIRAL	PAWA	21/145	1.02.2021	27.02.2021	3.02.2021 14:24
52563975456	7666471	CSG25685296	AMBARLI	ROTTERDAM	COSCO	COSCO SHIPPING ZHANE	266	3.02.2021	19.02.2021	3.02.2021 16:01
BKAN2 856956	25799426	OC659843258	AMBARLI	KLAIPEDA	OOCL	CMA CGM RHINE	BSLM12524	1.02.2021	25.02.2021	3.02.2021 13:59
BGAH98657	19807804	CAA791346852	MERSIN	NOVOROSSYSK	CMA CGM	MEHMET KAHVECI A	256	22.01.2021	6.02.2021	3.02.2021 13:55

Figure 9. Shipping Management Module

The shipping module of KSHAL is a consistent and hardwearing part that delivers technological facilities and is an easy to adapt and learn container shipping operations model. As well as the other modules of the program, it is fully customisable, responsive, lean, and simple to utilise. KSHAL's parametric system structure is used to define the flexibility, which the program can offer. This flexibility represents dynamism. Any ERP program with fixed navigation panels, static components and complicated screen design

is outdated. Contemporary ERP alternatives are semi-designed platforms that get their final shapes and running forms after being customised to fit 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 discussions between staying loyal to our UX while providing the utmost flexibility to our users since this approach is an inseparable part of our user experience design from day one. Supplying a flexible, dynamic and parametric software as a strategic approach was embedded into KSHAL's unique UX from the beginning. Therefore, it is a coherent strategy.

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 their services, they use an almost endless number of options that are available, such as email campaigns, advertising on a wide array of media sources, hot calls or customer visits at their premises.

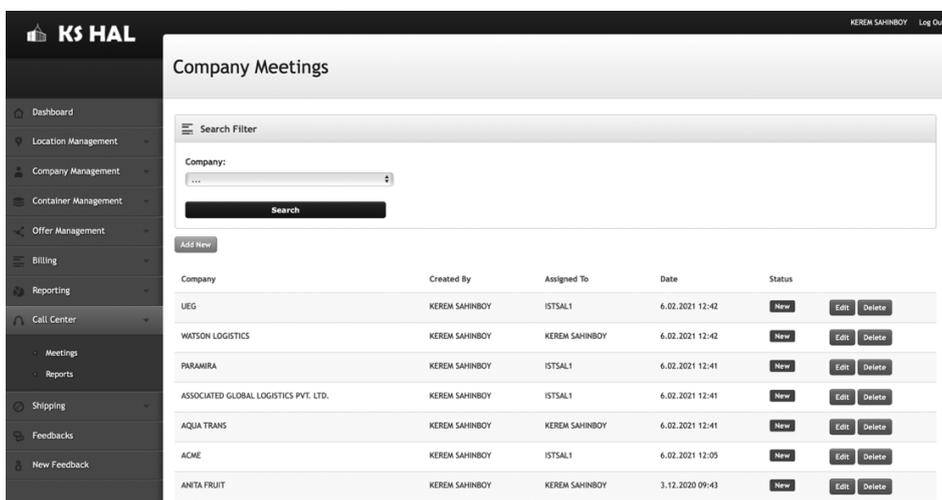


Figure 10. Call Centre Module

On the Reports page, Super Admin may obtain activity reports of each user's outcalls and customer meetings in defined terms. 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 panel because those methods' negative impact is easily visible in the market. Nevertheless, it has complete call centre activities, meeting reporting features, a comments section, and an activity reporting section. Moreover, it works with the offer management module in harmony under the same roof of KSHAL. This approach is a simple, practical and valuable tool that helps maritime companies coordinate their sales and marketing activities through the same platform.

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. One of the reasons why KSHAL has a built-in, separate billing module is the probability of issuing invoices unassociated with shipping or container trading activities.

Invoice No	Invoice Date	Company	Total Price	Type	Status
ASA201900000380	24.05.2019	CONTAINER TRADE	4.600,00 \$	Income	Paid
EAR201900001204	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
ASA201900000489	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 ...

Figure 11. Billing Module Dashboard

The billing module is not an “all-inclusive” accounting portal. Still, it works as a simple and effective component of KSHAL for issuing invoices, registering cost invoices and controlling cancelled invoices. It is directly linked to all other modules. It allows users to perform pre-accounting tasks such as generating income invoices and recording payments or cost invoices without leaving the software.

Feedback

Search Filter

Name / Surname:

Status: Unread Read In Process Completed

Search

Ticket Nr.	Member	Create Date	Subject	Status	
1007	KEREM SAHINBOY	13.02.2021 10:52	SMS MODULE FOR CONTAINER MANAGEMENT	Unread	View
1006	KEREM SAHINBOY	13.02.2021 10:40	PDF SCREEN ERROR MESSAGE	Unread	View
1005	KEREM SAHINBOY	13.02.2021 10:38	DASHBOARD SUGGESTION	Completed	View
1004	KEREM SAHINBOY	7.02.2021 17:40	test	Unread	View
1003	KEREM SAHINBOY	3.12.2020 09:56	TEST	In Process	View
1002	KEREM SAHINBOY	3.12.2020 09:53	NEW IDEA	Completed	View
1001	KEREM SAHINBOY	3.12.2020 09:52	PLEASE ADD OUR NEW BL TEMPLATE	Unread	View
1000	KEREM SAHINBOY	26.10.2020 10:04	Test Feedback	Completed	View

Figure 12. Error & Feedback Module

KSHAL’s error and feedback handling module establish a direct connection between the developers and the program users. It is an instant messaging and ticketing feature that 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. 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 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 in Figure 12.

KSHAL is a comprehensive, web-based, industry-specific, innovative ERP program that delivers customised, effective IT solutions to small and mid-sized freight forwarders, container trading merchants, and maritime logistics companies. The program has a container management module that container traders use. KSHAL has a shipping module used by freight forwarders. KSHAL has the Parametric System Management Module, Billing Module, CRM Module, Error and Feedback Module, Offer Management Module, and Reporting Module. It is sold for affordable prices. Freight forwarders can subscribe to KSHAL to have their fully functional, turnkey ERP solution in seconds. Overall, KSHAL is an excellent example of how SaaS (Software as a Service) platforms should be built. 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. In conclusion, we have a fully functional, self-proven, commercialised, innovative, industry-specific, new model proposing, dynamic, affordable ERP alternative program named KSHAL that serves small and medium-sized maritime logistics, freight forwarding, and shipping companies in complete competence, at the end of this research.

6. Determining Software Components with Analytical Hierarchy Process

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.

Decision Hierarchy			
Goal	Criteria	Alternatives	Glb Prio.
Tool Selection [AHP]	DB [0.250] [AHP]	IBMDB2 [0.200]	5.0%
		MSSQL [0.200]	5.0%
		PROGRESS [0.200]	5.0%
		MYSQL [0.200]	5.0%
		PROSTGREDB [0.200]	5.0%
	Code [0.250] [AHP]	JAVA [0.250]	6.2%
		C# [0.250]	6.2%
		C [0.250]	6.2%
		C++ [0.250]	6.2%
	Platform [0.250] [AHP]	LOCALWIN [0.250]	6.2%
		CLOUD VPS [0.250]	6.2%
		COHOST [0.250]	6.2%
		DEDICATED [0.250]	6.2%
	Pricing [0.250] [AHP]	ONETIME [0.250]	6.2%
		SAAS [0.250]	6.2%
		ANNUAL [0.250]	6.2%
PAY PER USAGE [0.250]		6.2%	
			1.0

Figure 13. The Decision Tree

AHP analysis questions were sent to twenty different members of the Universal Carriers' Alliance Network [8]. 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, which employ between 25 to 40 staff members in one hub. In addition to this, the participants were selected from different continents of the world. The following companies have contributed to this study:

	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 Outab 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

Figure 14. AHP Participants

As a conclusion and as a result of this section, Microsoft SQL Server was selected as the database of the software build. 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.

Postgre SQL	.114
Ms SQL	.447
Progress DB	.056
My SQL	.383

Figure 15. DB Choice Result (Expert Choice Output)

It was critically important to decide on which coding language will be used for our software. Each of these languages is strong, reliable, sophisticated and able to respond to our needs. However, they come with their strong and weak points. C# is far more effective for KSHAL as a coding language as it is backed up by a strong company, Microsoft.

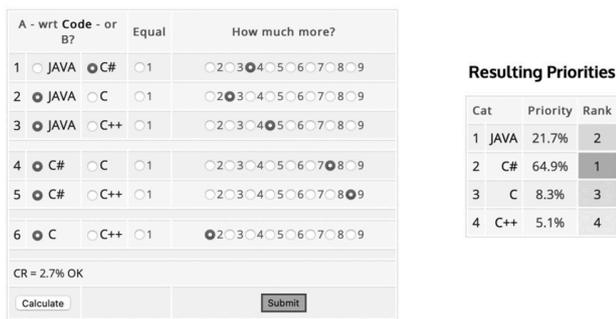


Figure 16. AHP Result Screen For Coding Language

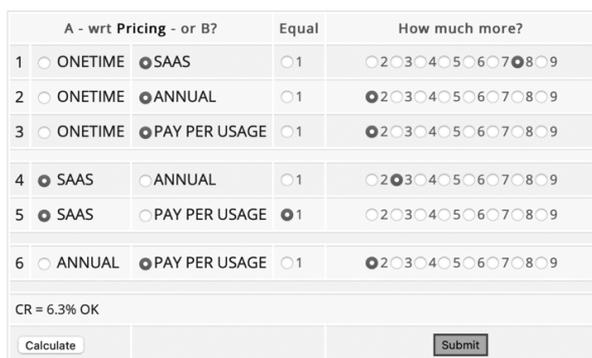
As the result of our AHP analysis, we picked up Cloud VPS alternative as a place where we deployed KSHAL and put it in use for our potential customers. The cloud environment was both our development periphery and the digital habitat where KSHAL would be available for customers to log in and use as a web-based ERP solution. These correlated decisions automatically identified KSHAL as a turnkey solution for maritime logistics companies.

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

Figure 17. KSHAL’s Deployment Platform

In conclusion, we decided to use MS SQL as our database infrastructure, C# as our coding language, CLOUD VPS as our deployment environment, SaaS as our service, and pricing commitment while developing KSHAL. Among these four criteria, the choice of coding



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

Figure 18. Pricing Method Decision

language had a heavier weighting than a database, platform and pricing methodology, as shown below. Suppose we observed secondary alternatives, particularly for a software language choice. In that case, Java came 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 was 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 was designed and deployed on the cloud VPS, using Microsoft's Azure environment.

7. Project Scheduling and Budgeting with CPM/PERT

KSHAL Project had a budget of 60,000 USD, and it was planned to be completed within 36 weeks or less. While forecasting project duration, working days were defined as Monday to Friday and working hours were set between 08:30 to 17:00, including a 1-hour lunch break between 12:00 AM to 1:00 PM. Gross salaries were scaled monthly and included team members' social security, insurance expenses, daily meal tickets, and mobile communication fees. The project budgeted for three developers as follows:

- 1. Architect:** The principal designer and the team leader 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 complied to project schedules or not, applying system and ERP analyses, and deciding when the ERP would be completed and ready to run. The monthly gross salary was 2,500 USD.
- 2. Senior Developer:** The person responsible for developing the database structure, relays relational links between the tables, and coding the back-end section of the software that is the core of the KSHAL platform. The senior developer, who had a decade-long experience developing web-based ERP projects, is an engineer experienced in MSSQL Server and C# language. The monthly gross salary was 2,200 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) worked with the back end without flaws. The person had a five-year long active coding experience and who had completed several similar projects. The monthly gross salary was 1,600 USD.

The project activity nodes are shown in Figure 19, starting from the project's draft until the finished product deployment. The test sequence is from Alfa to Beta.

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

Figure 19. CPM/PERT Activity Nodes -Project Steps

A network arrow or a node indicates activities. The arrow's tail displays the start of an activity while the head suggests/points to the end of an activity. A single arrow reflects 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, which 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 as a whole or a node can be finished at the latest time. Total Float (TF) is the difference between the maximum time allowed for an 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 the start of 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 means the activities that are performed after the predecessors. Critical Activities are events that have no floats. The essential 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 was planned as nine months. A logical network diagram revealed that D and F’s activities 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 was reduced to 33 weeks in these conditions. In addition to the aspect of the whole project in-depth, we applied a scenario as if our project would be completed after the 40th week. Therefore, to meet the project requirements, we had 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:

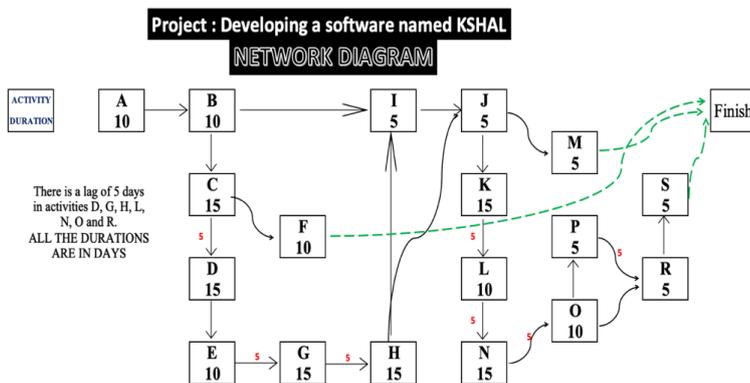


Figure 20. CPM Network Diagram of KSHAL

According to our CPM calculations, by defining the critical path, the first leg of the study showed that it was possible to start the project at the beginning of January and complete it by the beginning of October. However, best practices in the software development business predict that there is always a gap between the plan and realised timelines. Moreover, financial shortages, technical difficulties, human resources related changes, and even the weather conditions influence such projects. Thus, we should use a probabilistic method such as PERT to statistically determine whether the project will have a chance to be embodied within planned deadlines. PERT is a convenient tool for relatively smaller projects such as ours, but it is hard to apply to more significant projects with thousands of node inflows. PERT defines 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 usually 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 usual.
- expected time: the best estimate of the time required to accomplish an activity (te) or a path (TE), accounting for the fact that things do not always proceed as standard (the implication being that the expected time is the average time the task would require if the tasks were repeated on several occasions over an extended period).

$$te = \frac{o + 4m + p}{6}$$

$$TE = \sum_{i=1}^n te_i$$

- standard deviation of time: the variability of the time for accomplishing an activity

$$\sigma_{te} = \frac{p - o}{6}$$

$$\sigma_{TE} = \sqrt{\sum_{i=1}^n \sigma_{te_i}^2}$$

Standard Deviation (SD) measures the discrepancy between the mean and the average. The weighted average determined by the PERT formula was 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 applied the following formulas as follows:

1. Expected Time (T_e) = $\frac{O + 4M + P}{6}$
2. Standard Deviation (SD) = $\left(\frac{P-O}{6}\right)^2$
3. Variance = $\left(\frac{P-O}{6}\right)^2$ where O = Optimistic Time, M = Most Likely Time, and 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, and SD = Standard Deviation of Critical Path

For this part, we used the same data we had for the CPM leg of the study and refigured the whole project timeline based on optimistic, most likely and pessimistic deadline expectations. Naturally, the optimistic approach indicated the shortest possible time expectation that our software developers needed to accomplish the completion, while the pessimistic estimation approach forecasted a more extended calendar for project completion. Concerning the above definitions, our activity estimation table was reconstructed for PERT analysis. There were eight paths out to finish, and number eight was detected as the critical path shown in Figure 20. By considering the critical path, we calculated total project duration, variance and standard deviation as follows:

$$\Sigma T_e = 190 \text{ Days}$$

$$\Sigma \text{Variance} = 44.444444$$

$$S.D = \sqrt{\Sigma \text{Variance}} = \sqrt{44.444444}$$

$$S.D = 6.6666667 \cong 6.7$$

General Normal Distribution Graph under conditions $T_e = 190$ Days and $S.D = 6.7$ Days.

The findings of our calculations were referenced on Z-Table. The probability calculation of completion days was 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

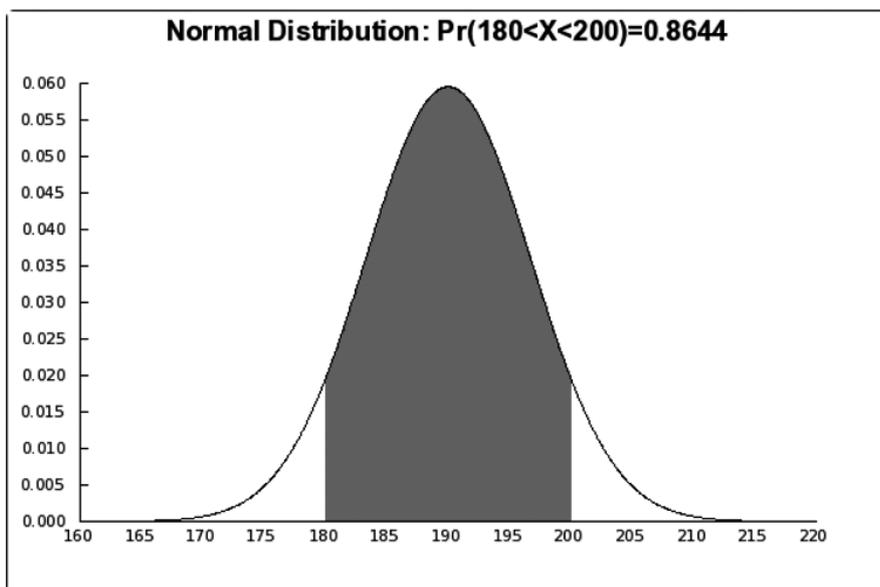
Probability between 180 & 200 Days = $1 - 0.0681 - 0.0681$

Probability between 180 & 200 Days = 0.8638 or 86.38%

Table 4. CPM/PERT 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 a conclusion of this section, KSHAL Project was completed as planned within the budget and timeline at the end of September 2020. However, the project took an evident 38 weeks, and the cost of the software was realised as 59,100 USD.



8. Measuring Effectiveness and Efficiency with Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a mathematical programming-based method used to evaluate the relative performance of organisations [9]. DEA is a benchmarking method between several variables compared based on several types of inputs and outputs. DEA is a mathematical tool that helps us measure the efficiency of limited resources and guides us to improve their efficiency. DEA is actively used in organisations with multiple branches. 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.

KSHAL is in use in three companies, which are controlling five branches in two countries. All these companies have work 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, and air cargo deliveries. They all have their sales teams that call and visit customers constantly. Each of these hubs were 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 began with one input and one output sample and carried it to multiple inputs and multiple outputs experiments. The research focused on their half-a-year-long activity.

Table 5. 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 Table 5, we can observe how productive each branch was when issuing the marine bill of ladings using KSHAL. It is supportive information to visualise how keenly these branches carry their activities onto the KSHAL platform. Table 6 divides the quantity of issued bill of ladings by each DMU's employee quantity:

Table 6. The Most Efficient 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 in Table 6 DMU1 is the most efficient DMU based on the comparison between the BL's (Output) produced by employees (Input) of the different DMUs. It is necessary to calculate the RE (Relative Efficiency) of the other inefficient DMUs at this stage. RE is the ratio of inefficient DMUs compared to the efficient DMU.

Table 7. 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

$$RE = \frac{DMU_i}{DMU_e}$$

DMU_i identifies inefficient DMUs while DMU_e is the efficient DMU (i.e., Company A in our example). Relevant efficiencies are sequenced between 1 and 0, as indicated on the first page. Figure 22 shows the Efficient Frontier (EF) that shows the best solution while including all DMUs. We can see which branch of our experiments is the most efficient one by using KSHAL software at this first stage. 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)

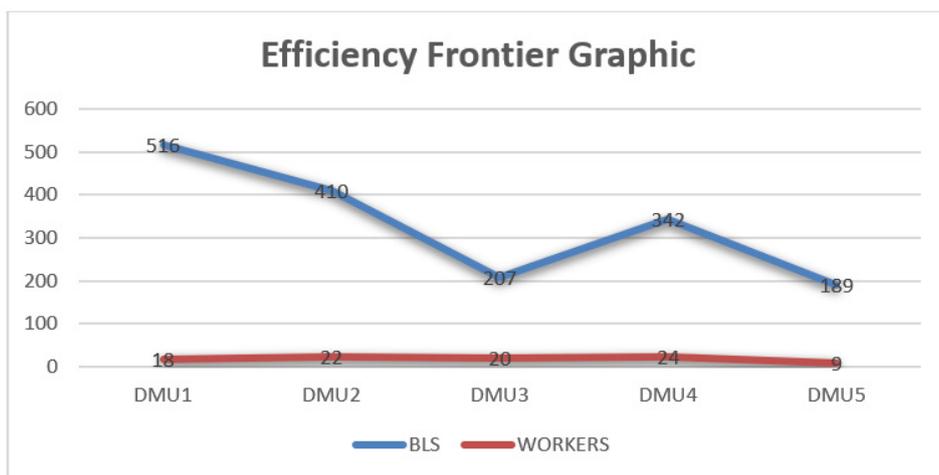


Figure 22. Efficiency Frontier

It is proved that DMU1 is the most efficient branch when comparing the results of the other DMUs. We can classify the rest of the DMUs as inefficient. The gap (or the distance) between their positions to EF shows their 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 questionnaire 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 took multiple inputs and one output into consideration to visualise the efficiency level of KSHAL at DMUs.

Table 8. 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 measured how our DMUs reach up to a 1 million USD turnover based on two inputs: the number of employees and running costs. It was shown that DMU5 makes a one million USD turnover with nine employees while DMU4 does the same with 24 personnel. While Cost/Turnover and Employee/Turnover comparisons seek lower values, Figure 23 shows a convex graphic as shown below. Cost minimisation aiming models should

push variables (DMUs) down to zero, and this is why our graphic pictures the efficiency frontier downwards. We can indicate the opposite in maximisation models as the push-up of data expands the efficiency frontier far from zero (origin of the graphic). Here, in Figure 23 we can see some DMUs are located far from our efficiency border (the efficiency frontier). Finding out the amount of improvement, called Technical Inefficiency (TI), became more straightforward 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.

REACHING UPTO 1 MILLION USD TURNOVER

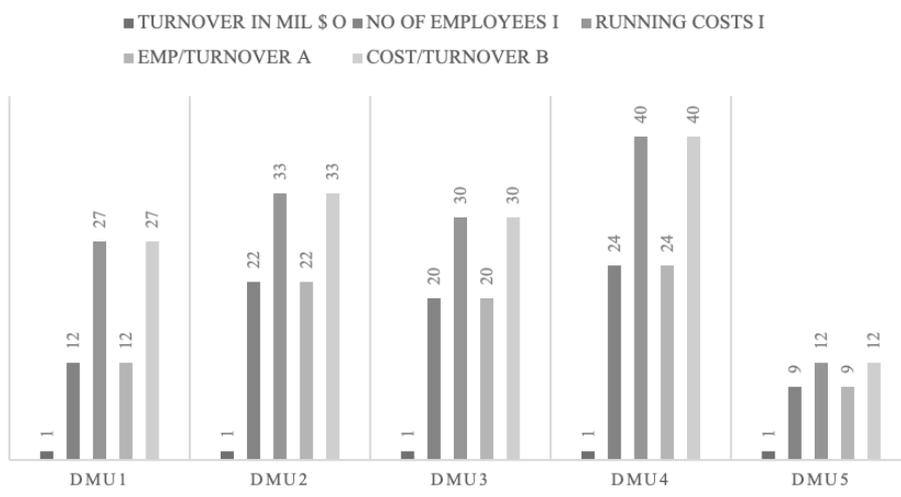


Figure 23. Efficiency Frontier

To set all DMUs efficient, we must propose the participants, which are also KSHAL users, solutions that may bring their activity results closer to the efficiency curve clustered around DMU5. DMU5 represents our EF line on the above graphic. DMU2 and DMU4 are inefficient participants who need to revise their strategies, while DMU5, 1, and 3 are efficient ones. Here, on Table 9 we may tag the distance from the origin to EF on the line to DMU1 as ψ_{DMU_i} and compare that value over ψ_{DMU} , which gives us the Relative Efficiency. The visual distance between DMU1 and EF shows the amount of improvement, by another name, the technical inefficiency ratio. If we calculate a new scale for inefficient branches, we will have virtual decision-making units as our referencing points. They are suggestive ‘stations’ for inefficient branches. Simply, it indicates that all participants must catch the EF level of the most efficient DMU. We examined one input and multiple output variants of the DEA data in the final step, a valuable example for maximisation (profit, shipment quantity, new customers acquired, sales statistics, etc.) purposes.

Table 9. One Input and Multiple Outputs

		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 for customer visits, which is 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 Table 9, two output variables are compiled: How many customers were visited by KSHAL users 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. A simple benchmark was applied by comparing customer visits per CAL and quotations sent per CAL. The KSHAL system allows all users to provide freight quotations to customers, disregarding whether they are sales personnel or not. 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 maximisation task. In our example, DMU2 scored the most efficient result compared to the figures of the other DMUs in this study. DMU4 was the least efficient participant of this analysis that must improve their activity results upwards to match and even surpass the EF.

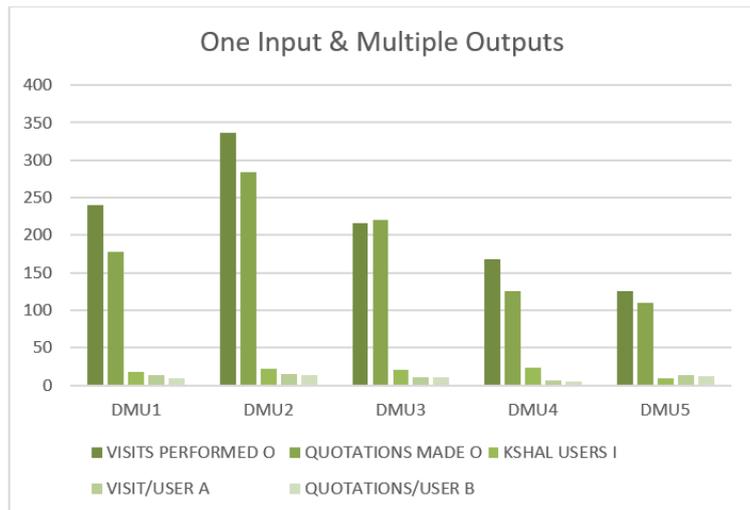


Figure 24. One Input and Multiple Outputs

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. Table 9 shows how actively each worker of the branches uses the quotation module. Here we can observe that the least active customer-visiting branch per CAL was DMU4. As shown in Figure 24, the aim of participants must boost up sales and quotations by numbers. The boost, is in the form of an explosion that scatters from origin to outside, so the visualisation of the graphic will be a concave curve. This section concludes that we could identify the most efficient spots and weakest links of the network to support

data envelopment analysis. DEA assisted our research to visualise the possible directions that companies must head to increase or decrease their activity results for reaching their efficiency frontiers.

9. Conclusion

According to Porter's Value Chain Theory, we must focus on 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. Each department from inbound logistics, operations, outbound logistics, marketing & sales, and other services drives the company's productivity. Therefore, each department must contribute to the goal of achieving sustainable efficiency and profitability. Most organisations 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 [10].

Therefore, the role of a robust ERP infrastructure that communicates with each of those departments and helps them achieve their goals are vital parts of this strategy. Nowadays, value chains cannot be considered without IT 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 is evident that KSHAL approaches maritime companies and their activities by how Porter's Value Chain Theory approaches companies strategically. KSHAL segments the activities into 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 to focus on the sources of competitive advantage, that is, the specific activities that result in higher prices or lower costs [11]. One of the hypotheses of this paper was indicating that, a web-based maritime software provides a noticeable decrease on operational software-related expenditures of small and midsized freight forwarders and supply chain companies. Thus, this research mainly walks hand in hand with Porter's Value Chain Theory along the path of decreasing the costs while increasing companies' efficiency and profitability.

The evolution of big data technologies has introduced us to the concept of data visualisation. The data owners must have these figures, which they think will be easier to work through as big heaps of data clusters, visually expressed. Data visualisation 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 visualise effectively, it is argued by some authors that it is both art and science [12]. According to theories cited in this article, Kiyoyasu Tanaka's "Time in Transit Theory" needs data visualisation to solve complex transportation problems. According to Tanaka's theory, shippers pay higher freight for short routes compared to longer routes, proportionally. Tanaka adds that "Individual freight transactions are characterized by timely, frequent, and small-batch shipping." and with this explanation, we realise the challenge of making the right

decisions for which shipping option, service provider or tariff will be used becomes a perplexing subject for the shippers [13]. One of the obstacles in front of this issue is how to display meaningful results visually to the screens of decision-makers. Tanaka's theory aims to analyse freight and distance (route) alternatives while finding affordable solutions without compromising delivery times, safety and reliability of selected service options. This perspective is also held by KSHAL's UX while compiling costs, shipping line alternatives, surcharge derivatives and visualising 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. Moreover, 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, that states "A web-based maritime software triggers a remarkable progress for good on data handling of small and mid-sized freight forwarders and shipping companies." is definitely in use on KSHAL while cost storing and freight quoting.

We should cite the Theory of Constraints (TOC) that will ask us several questions; "Where will you focus your attention on 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. These are successfully implemented in industries like Heavy Capital Equipment, Retail, Banking, FMCG, Logistics, Job Shops, Mining, Healthcare, etc. [14]. 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. As per our paper, economic constraints hold freight companies back from recruiting more professionals when considering CAL fees applied by the cited software companies. In addition, technical difficulties such as the impossibility of using the Cyrillic alphabet, not providing access to users via the web, delaying feedback times, and expensive pricing strategies become 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. The paper proposes that a web-based maritime software delivers an essential refining effect on the operational documentation process of small and mid-sized freight forwarders and supply chain companies. KSHAL achieves this goal by simplifying data submitting steps severely. It also solves many other constraints 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 monitoring company credibility online.

According to the research, among the maritime ERP alternatives already being used in Turkey, we observed their innovative tendency to evolve from conventional software products towards web or cloud-based SaaS platforms. We have determined four major

software suppliers in Turkey during our research: SOFT, SELECT, XINERJI, and DOA. Three of these companies offer their products as SaaS solutions except for 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 is moving its production environment to the cloud. This fact expresses that the contemporary structure of shipping ERP alternatives will be inhabited on the web or the cloud environments, just like KSHAL has persistently offered these options for its customers since day one.

This study 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. Furthermore, these results showed us SaaS systems’ preponderance with the lean design over conventional and orthodox, bulky and stodgy ERP programs. The repercussion of the results takes us to one of our hypotheses, indicating that web-based maritime software creates a meaningful usage or a good 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 which are unaffordable for small and medium-sized freight forwarders or maritime companies. In the case of a simple comparison, KSHAL has certain advantages over two major ERP product suppliers even when we consider their basic product packages.

Table 10. Price Comparison Between KSHAL and Two Other Alternative Software Platforms

Service	Company A	Company B	KSHAL
Sales Price	\$\$\$\$	\$\$\$\$	\$
DBMS License	\$\$\$	\$	-
Maintenance Fee	\$\$\$	\$\$\$	-
CAL License	\$\$\$	\$	\$

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 supports the indicated approval; a web-based maritime software engenders a noteworthy improvement in sales and marketing activities of small and midsized freight forwarders and supply chain companies.

In conclusion, there is a fully functional, self-proven, commercialised, innovative, industry-specific, new models proposing, dynamic, affordable ERP alternative program named KSHAL that serves small and medium-sized maritime logistics, freight forwarding, and shipping companies in complete competence. Furthermore, the program’s building and deployment process is an excellent example of a feasibility exercise for other researchers, developers, entrepreneurs or shipping companies who would like to design their ERP programmes.

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