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An Evaluation of Barriers to E-Procurement in Turkish Construction Industry

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Abstract: ***What:*** ***E-procurement provides chances for enhancing the traditional procurement approaches of the construction industry. Both suppliers and buyers in the supply chain utilize e-procurement methods as these help in the processes through providing opportunities for better communication and coordination. E-procurement expands the marketplace for all parties, which take part in the process. With e-procurement, the buyer gains the strategic advantage of i.) reaching more and more suppliers and ii.) the products of lower cost, while the supplier gets the advantage of reaching new customers in the online markets. In contrast to the globalization of procurement in many of the production sectors, research indicates that the advancement of e-procurement in the construction industry is slow and mostly occurs at the national level. This current situation is mainly caused by the barriers to e-procurement that appear from both supplier and buyer sides. How: This paper explores the barriers to e-procurement in relation to the Construction Industry based on the data gathered from Turkey. The study involves an extensive literature review and a web-based questionnaire survey and interviews to determine the key barriers to e-procurement in the construction industry. 64 stakeholders including engineers, architects from the public and private organizations (such as contractors, sub-contractors), and the providers of e-procurement services in Turkey participated in the study. Why: The findings indicated that the construction business organizations still seem to have not benefited from most values of e-procurement. The results of the study indicated the lack of trust between the parties and inadequacy of legal infrastructure as the most critical barriers. Another key barrier appears as the fear of unauthorized access to the critical project information. Efforts towards enhancing the security such as implementation of blockchain technologies and development of the legal infrastructure supporting these technologies can a key step towards overcoming key barriers to e-procurement.***

Index Terms: ***Construction, e-Procurement, e-Commerce, Turkey, Barriers***

I. INTRODUCTION

Recent developments in web technologies together with the introduction of new RESTful architectures and APIs, and the advancement of better security mechanisms facilitated the implementation of e-commerce and e-procurement in many production and service industries. The construction industry is one of the biggest contributors to wealth creation to Europe's business economy, accounting for 9.7% of gross domestic product (GDP) and almost 60% of gross fixed capital formation [1]. The industry is known as an extremely information-intensive and knowledge-based [2]. In fact, information technology is still regarded by organizations of the construction industry either as a tool that facilitates design and site management or as a tool for the management of site operations. Thus, the industry has still not benefited from most aspects of e-commerce and e-procurement. The implementation of e-procurement in construction has been very slow. For example, only less than 20% of construction organizations use e-procurement in the United Kingdom [3,4]. Despite the fact that many different industries benefit from the e-procurement, research shows that construction industry needs to overcome various barriers to utilizing e-commerce and adopt the electronic method of procurement.

II. METHODOLOGY

The research presented in this paper was focused on determining the barriers to e-procurement by focusing Turkish Construction Industry as the case. The key research question can be phrased as "What are the key barriers to e-procurement in Turkish Construction Industry?"

The Turkish Construction Industry is one of the fast growing construction industries of the world, as Turkish contractors operate in 3 continents including Asia, Europe and Africa. In contrast to the growth rate of the Turkish Construction Industry, the implementation of e-commerce and e-procurement is at an extremely low level. The research was carried out with the objective of finding the factors behind this phenomenon.

In order to find an answer, the research question researchers implemented a research approach that is based on 3 methodologies, a literature review, a questionnaire survey and semi-structured interviews (Fig.1).

Stage 1: The research commenced with a literature review of the studies in relation to e-procurement in the construction industry. The findings of the literature review were evaluated and helped in determining barriers to e-procurement in 4 distinct areas, including barriers related to i.) technology, ii.) organizational strategy, iii.) marketing, iv.) human factors and processes.

Stage 2: In the next phase of the study, a questionnaire survey was conducted to determine the critical barriers for the industry. The results of the survey gathered from 64 respondents were presented. Following this, the results and the possible reasons that would lead to these findings were evaluated by the researcher in light of the literature review findings.

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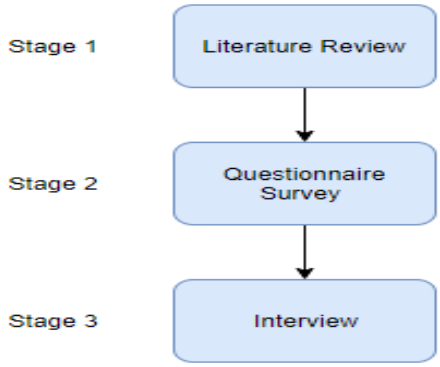

Fig 1. Stages of the research

Stage 3: The final phase of the research included a series of telephone interviews with 1/4 of the respondents, where a total of 16 phone interviews were carried out. The phone interviews were conducted in form of semi-structured interview where the participants were asked about their views on the reasons behind the barriers.

The following sections of the paper present the findings of the literature review, the results of the survey and phone interviews, as well as presenting the critical barriers to the utilization of e-procurement in construction industry based on a Turkish Industry perspective.

III. E-PROCUREMENT IN THE CONSTRUCTION INDUSTRY

Studies concerned with the implementation of e-procurement in construction appeared around the early 2000s. For instance, in 2001, McIntosh and Sloan [5] explained the role of Electronic Procurement and Global Sourcing in the UK industry. The paper indicated that in order to increase efficiency, competitiveness and the profits the industry needs to shift from the traditional methods of sourcing and utilize the global marketplace. Another study in the same year [6] was an analysis to determine the barriers to implementing e-commerce that small-medium sized contractors experienced. The substantial barriers were identified as technical, financial, organizational and behavioral. In addition, the underlying factors that acted as constraints to the introduction of information and communication technologies to support an e-commerce infrastructure were identified as a risk, uncertainty, change, and knowledge. Another example of early research [7] presented the application of E-commerce in construction material procurement and problems in non-interoperable E-commerce systems. Tserng and Lin [8] implemented an e-procurement model through the development of a web-based system. In another effort, researchers [9] focused on process modeling of e-procurement in construction. The use of GIS also facilitates the e-procurement process. For instance, a study [10] demonstrated how a Web-GIS would enhance the functionality of an e-commerce system for procurement of construction material. Another research [11], defends practical applications for construction industry focused on e-ordering can be an area where construction companies may benefit from technology. Achieving success in this requires organizational change, change in the way of working, and change in the relations, internal and external. In 2004 an agent-based system, named C-Negotiators was developed [12], to help contractors and suppliers to negotiate via the Internet. C-Negotiators improved negotiation efficiency through reducing negotiation time and cost, while effectiveness has been improved by suggesting a better agreement with a higher joint payoff. In another study in the same year, an interoperable construction products catalog model was proposed [13]. Agent based approaches was also popular in 2005, where researchers [14] worked on a system equipped with electronic agents for material procurement. The benefits of the system were (i) reducing communication between buyers and suppliers, (ii) reducing supplier selection and evaluation problem, (iii) reducing the excessive time and labor consumption for material procurement purposes, (iv) reducing information loss, (v) reducing unnecessary costs. The use of fuzzy logic was in the focus of the researchers in 2006 for instance a study [15], suggested a method for evaluating a fuzzy case-based construction procurement selection system. In 2006, (i) e-procurement solutions and applications were still in their infancy and construction organizations were currently experiencing development issues. In fact, e-procurement brings benefits such as reduction of the purchase price, process efficiencies, and reduction of process costs [16]. At the same year, another study [17] indicated that 'Improving communication' and 'reduced administration costs' as the two most important drivers while 'security of transactions' and 'being unsure as to the legal position of e-procurement' were pointed as the two most important barriers to construction e-procurement. In 2007 researchers [18] examined the drivers and barriers for e-procurement in construction within Northern Ireland. Findings showed that the two highest ranked drivers by the contractors were improving communication and reduced administration costs, while the two most important barriers were the security of transactions and the uncertainty surrounding the legal issues of e-procurement. Next year a study [19] demonstrated that the speed and efficiency of initial Selection of Suppliers would increase with the successful implementation of a web service. In 2009 researchers [20] showed that despite the characteristics of the construction industry that hinder the implementation of e-marketplaces, there were, in fact, many companies that have adopted this new technology and have experienced important benefits through e-commerce. In 2010, a major study [21] aimed to investigate the reasons for the poor uptake of e-procurement in construction through the identification of drivers and barriers to construction e-procurement. A collated set of drivers and barriers to e-procurement containing 20 drivers and 30 barriers were revealed through the literature search. The drivers and barriers were grouped into different bands by the authors as barriers relating to General, Cost, Time, Quality, Cultural, Infrastructure, Security, Legal, and Compatibility.

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The lists of drivers and barriers to construction e-procurement were then ranked through using a web-based questionnaire survey.

In another key effort [3] resulted at the same year, a total of 775 construction organizations were surveyed regarding the barriers and drivers determined in [21] to provide a cross-discipline comparison of drivers and barriers to construction.

The literature in the field demonstrated that there are severe barriers to implementing e-procurement in the construction industry. In fact, the findings of the literature also demonstrated that there is a willingness to adopt and implement e-procurement in their processes. In 2013, researchers investigated the e-procurement value for construction companies in Malaysia through a survey of 120 construction firms in Malaysia, all of which have moved beyond the basic stages of e-Procurement [22] The findings indicated that the value of e-Procurement's is generally limited to improvements in operational and tactical areas. Improvements in market access and customer/supplier relationships were not noted by a majority of the respondents. In 2015, another study [23] investigated the use of e-Procurement in the South African construction industry. The data were derived from an online questionnaire survey involving 603 respondents and interviews conducted in South Africa with seven experts. The study implies that construction firms in South Africa predominantly use e-mails and websites to support the execution of pre-award phase of construction procurement. In addition to the technological issues, culturally related challenges are hindering the adoption of e-Procurement in the South African industry. The study suggests that to accelerate the rate of uptake of e-Procurement there is a need to improve the quality and quantity of ICT infrastructure across the country; and to embark on aggressive enlightenment campaigns, training and skill development programs. A more recent study [24] in 2016 investigated the barriers to the uptake of e-Procurement using data derived from a questionnaire survey of 213 consulting firms, contractors, client organizations and government establishments in the Nigerian building industry (NBI). The result shows that the two factors with the most significant adverse effect on the uptake of e-Procurement were the high investment cost, and lack of technical expertise required in setting up e-procurement technologies and processes. The lack of evidence of the benefits of e-Procurement in the building industry; and lack of top management support were the three strongest predictors of low uptake of e-Procurement by the organizations surveyed.

IV. A SURVEY ON BARRIERS TO E PROCUREMENT

Following the literature review, the study continued with a web-based questionnaire survey to determine the key barriers to e-procurement in the construction industry. The survey is designed in form of a web survey and sent to 200 participants including engineers, architects from the public and private organizations (such as contractors, sub-contractors), and the providers of e-procurement services in Turkey. In the questionnaire, a set of possible barriers to e-procurement, which were determined based on the literature review, were presented to the participants. The barriers were presented to the participants in 4 groups as barriers related to technology, organizational strategy, market, human factors and processes. Table-1 provides the list of possible barriers presented to the survey participants.

Table 1. Barriers to E-Procurement

Technology Related Barriers • Slow shift towards digital signatures • Technology related security concerns in transfer of valuable information • Difficulties in establishing the e-commerce environment (website/portal etc.) • Problems related to Internet infrastructure and bandwidth in implementing and running an e-commerce site • Problems in management of servers (database/auction/ad/mail/transaction processing) • Difficulties in hosting or outsourcing decision • Problems in establishing security mechanisms • Lack of trust in the validity of electronic documents in dissemination or approval of physical products • Problems in Integration of e-Commerce environments with ERP Systems
Strategic Barriers • Lack of nationwide information exchange standards • Inadequacy of legal infrastructure supporting e-commerce • Lack of organizational focus • Lack of top management support to move towards e-commerce • Lack of knowledge regarding national/global taxation regime related to e-commerce • Organizational reluctance to move from "bricks" to "brick-and-clicks" • Lack of bodies supporting the shift towards e-commerce • Lack of best practice studies and pilot projects
Market-Related Barriers • The traditional media being still much stronger than new media in marketing and public communication • The inefficiencies in making use of user-generated content for online marketing • The concerns related to the number of customers that can be targeted in the online environment • The resistance of intermediaries against online commerce • The fear of price transparency in e-procurement • The lack of pioneering agents/firms
Human and Process Related Barriers • The lack of IT skills of staff • The fear of unauthorized access to critical project information • The inadequacy of interaction in online environment during personal communication • The lack of trust between parties in the electronic commerce • The lack of training regarding the implementation and use of e-commerce systems • The resistance against the new way of working brought about by moving towards e-procurement and commerce • The difficulties in re-engineering of business processes for supporting the information flow e-procurement

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Following this, the participants were asked to rank the severity of the barriers with 5 levels of a Likert Scale, in the form of most severe one being 'vital' and the least severe one being 'not important' (i.e. 1. Vital; 2. Key; 3. Important; 4. Less Important and 5. Not Important). The return rate of the survey was around 30%, with 64 responses being received from the survey participants.

V.RESULTS AND DISCUSSION

The following section presents the results of the survey, the vitality percentages of each barrier, and the views of participants on the key/vital barriers that are acquired as a result of the phone interviews. 60% of the respondents were from the group of engineers, architects from both the public sector and private organizations (such as contractors, sub-contractors), and 40% of the respondents were from the providers of e-procurement services (service providers and material suppliers. The demographics of respondents was as follows. 35 of them were technical staff of contractors and 3 of them were technical staff of sub-contractors, 12 of them were from technical (e-)service providers, 3 of them were material suppliers, 11 of them classified themselves in the "other" category 3 being the buyer and 8 being on the provider/supplier side (Fig. 2). The respondents were main procurement or sales representatives of the organizations.

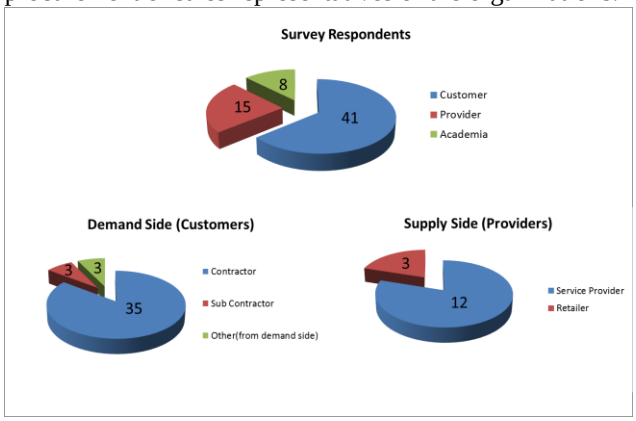

Fig. 2. Demographic Profile of the Respondents

The first set of barriers in the survey was related to the technology. Table 2 summarizes the results of the first set in form of percentages of answers for each item on the Likert scale. For each of answers, a sum of percentages of answers which either view the barrier as a vital or a key barrier is calculated, and this score is named as the Vitality Percentage Score (VPS). For instance, the Vitality Percentage Score (VPS) for the first item in Table 2. is 59,10. In the first set "Technology Related Barriers" the barriers with the highest VPS were "Technology related security concerns in the transfer of valuable information", and "Problems in establishing security mechanisms". These two are followed by "Lack of trust in the validity of electronic documents in dissemination or approval of physical products".72% of the respondents indicated that the security concerns appear as a result of technological vulnerabilities and problems in establishing security mechanisms are a vital or key barrier preventing their intention of transfer of critical information such as bank account details, confidential documents. The participants expressed that security is a key issue as the transactions regarding procurement of construction materials involve the transfer of financial details. In addition, when a service (i.e. design) is procured in the design phase the key details about a project needs to be exchanged between the stakeholders which might threaten the competitiveness of the company when this information is acquired by its rivals/competitors. The hacking, phishing and similar attempts which are increasing in recent years, was indicated as the main reason behind this thinking. 68% respondents point out the lack of trust in the validity of electronic documents in dissemination or approval of physical products as a vital or key barrier, this view would change in the near future as new secure validation mechanisms emerge every day. The use of digital signatures in the construction industry is very limited. The slow shift towards digital signature was found either vital or key barrier by 59 % of the respondents. In e-commerce and procurement, digital signature plays a key role in validating the identity of the parties and is an indispensable component of e-commerce transactions. The participants mentioned that low penetration of digital signatures is a factor that is preventing e-transactions in the construction industry. In summary, the barriers related to security appeared as the biggest technological barriers against the development of the e-procurement practices in the industry.

The second set of barriers that were investigated were related to the "Strategic Level Barriers". Table 3 summarizes the results of this set in form of percentages of answers for each item in the Likert scale. In this second set, the barrier with the highest VPS was "Inadequacy of legal infrastructure supporting e-commerce", followed by "Lack of top management support to move towards e-commerce" and "Lack of best practice studies and pilot projects". Nearly 91% of the respondents indicated that a strategic barrier preventing e-procurement in the Turkish construction industry is the inadequacy of legal infrastructure supporting e-trading and e-commerce and thus this has negative impacts on e-procurement. and this creates a huge barrier against the move to e-procurement in the industry. In addition, the majority of the respondents from the telephone interviews stated that the shift towards e-procurement is not encouraged through regimes such as tax deduction and concession.

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Table 2. Technology related barriers

Technologic Barriers	Vital Barrier	Key Barrier	Important Barrier	Less Important Barrier	Not Important Barrier	No Idea	Vital or Key Barrier
Slow shift towards digital signature	22.70%	36.40%	9.10%	18.20%	0.00%	13.60%	59.10%
Technology related security concerns in transfer of valuable information	63.60%	9.10%	22.70%	0.00%	4.50%	0.00%	72.70%
Difficulties in establishing the e-commerce environment(web site/portal etc)	18.20%	18.20%	31.80%	18.20%	0.00%	13.60%	36.40%
Problems related to internet infrastructure and bandwidth in implementing and running an e-commerce site	13.60%	36.40%	13.60%	9.10%	9.10%	18.20%	50.00%
Problems in management of servers (i.e. database/ auction / ad/mail/transaction processing servers)	22.70%	31.80%	31.80%	9.10%	0.00%	4.50%	54.50%
Difficulties in hosting or outsourcing decision	9.10%	22.70%	18.20%	27.30%	4.50%	18.20%	31.80%
Problems in establishing security mechanisms	40.90%	31.80%	0.00%	9.10%	4.50%	13.60%	72.70%
Lack of trust in the validity of electronic documents in dissemination or approval of physical products	31.80%	36.40%	13.60%	9.10%	0.00%	9.10%	68.20%
Problems in Integration of E-Commerce environments with ERP Systems	13.60%	18.20%	27.30%	4.50%	0.00%	36.40%	31.80%

Table 3. Strategic level barriers

Strategic Barriers	Vital Barrier	Key Barrier	Important Barrier	Less Important Barrier	Not Important Barrier	No Idea	Vital or Key Barrier
Lack of nation-wide information exchange standards	18.20%	45.50%	18.20%	9.10%	0.00%	9.10%	63.70%
Inadequacy of legal infrastructure supporting e-commerce	77.30%	13.60%	9.10%	0.00%	0.00%	0.00%	90.90%
Lack of organizational focus	40.90%	22.70%	18.20%	18.20%	0.00%	0.00%	63.60%
Lack of top management support to move towards e-commerce	45.50%	31.80%	18.20%	4.50%	0.00%	0.00%	77.30%
Lack of knowlege regarding national/global taxation regime related to e-commerce	40.90%	31.80%	18.20%	9.10%	0.00%	0.00%	72.70%
Organizational reluctance to move from "bricks" to "birck-and-clicks"	36.40%	36.40%	18.20%	9.10%	0.00%	0.00%	72.80%
Lack of bodies supporting the shift towards e-commerce	36.40%	36.40%	9.10%	18.20%	0.00%	0.00%	72.80%
Lack of best practice studies and pilot projects	31.80%	45.50%	22.70%	0.00%	0.00%	0.00%	77.30%

77% respondents mentioned the lack of support from the top-level management is another vital and key barrier preventing e-procurement in the industry and agree about the lack of top-management support in the move from traditional to electronic procurement. The respondents mentioned that top management is mainly over-focused on everyday tasks and thus, mostly stays short-sighted with a vision of saving-the-day. This short-sighted mentality and short-term focused reasoning of the top-level management was mentioned as one of the highest intra-organizational barriers against the move towards e-procurement. The participants indicated that this vision would remain similar to the status-quo, and might continue to remain so, unless best practice cases and pilot projects would be introduced within the construction industry. A high majority of the participants (77%) mentioned that the lack of best practice studies and pilot projects is the main reason behind the lack-of-awareness related to the benefits of e-procurement. The respondents stated that this in turn causes the industry to remain to adopt the status-quo (i.e. the traditional procurement). It is apparent that national agencies need to put significant effort into establishing the legal infrastructure for seamless transformation from traditional procurement practices to e-procurement practices. 72% of the respondents indicated other vital and key barriers as lack of knowledge regarding e-commerce taxation regimes, organizational reluctance to move from traditional -bricks- method to brick-and-clicks method of e-commerce, and lack of bodies in support of this paradigm shift. The survey participants mostly (i.e. 73%) indicated that the level of knowledge related to taxation regimes for e-procurement within their organizations is very low, and this generates a fear towards implementing e-procurement methods within the organization. In the phone interviews, they mentioned that the authorities are sometimes reluctant in providing such information to organizations, and this negatively affects the organizational motivation towards process change. The participants indicated that there is not much enthusiasm in organizations towards implementing e-procurement as their new procurement strategy.

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In addition, the participants from the telephone interviews expressed that even big nation-wide sellers only use the internet for promoting their products but not for selling them online. Another key barrier that has risen against the implementation of e-procurement within the industry was mentioned as the lack of bodies promoting and supporting the shift towards e-commerce and procurement (again by 73% of the participants). The telephone interviews revealed that most of the organizations are feeling isolated when they decide to implement e-procurement in real-life projects, as there are nearly no (non-profit) organizations supporting the move towards e-commerce and e-procurement in the construction industry. Furthermore, the participants indicated that two main (industrial non-profit) associations in the field of e-commerce have nearly no members from organizations of construction supply-chain. This situation also proves that the construction industry material and service suppliers are falling behind in terms of moving to e-procurement. 63% indicated that the organizational focus is not towards e-procurement and viewed this as a vital or key barrier to the implementation of e-procurement practices.

The 3rd set of barriers that were investigated were related to marketing. Table 4 summarizes the results of this set. The barriers with highest VPS in this set were "The concerns related to the number of customers that can be targeted in the online environment" and "The traditional media being still much stronger than new media in marketing and public communication". The size of online market related to the construction industry appeared as the key concern for 77% the respondents. The concern was related to a number of potential customers that can be targeted by marketing through online media. The participants mentioned at the phone interviews that these concerns are mainly caused by the lack-of-awareness in the industry regarding the potential of the online media and the opportunities provided by the use of social network sites. In fact, the participants indicated that the construction industry is not currently benefiting from the opportunities provided through the new media. 64% of the respondents viewed the traditional media as being stronger than new media in marketing and public communication. The respondents stated that the organizations in various parts of the supply chain still continue to use traditional media for promoting their products. A key example of this is in the sales of the final products i.e. the apartment sales and in the real-estate business. Most SMEs use TV and newspaper ads and prefer these to, ads in the social media or to search engine ads. Big construction-related retail stores in the mainly prefer to distribute flyers with a printed version of a newspaper. Nearly 60% of the respondents mentioned the lack of pioneering enterprises and the resistance of intermediaries against e-commerce as the other barriers related to marketing. The final set of barriers that were investigated were related to human resources and processes. Table 5 summarizes the results of this set. In this section, the barriers with high VPS were "The lack of trust between the parties in e-commerce", "The lack of IT skills in the staff", and "The fear of unauthorized access to the critical project information"

The survey results showed that there are also a considerable number of barriers related to human and process related factors. The most severe barrier in this group is human resource related, as 91% of the participants mentioned the lack of trust between the parties is a key barrier preventing e-procurement in the construction industry. The participants indicated that the traditional nature of the procurement in the construction industry is social network focused. The people in the industry usually prefer to procure from the people that they know in-person. In contrast, e-procurement offers a different way of procurement where the meeting or knowing the other party in-person is not required. As this contradicts with the traditional procurement practices of the industry, trust issues arise in relation to processes involving e-procurement. The participants indicate that these concerns would decrease in time, as e-procurement would become a part of the organizational culture. As indicated by 86%, the lack of IT skills of staff still seems to be a problem towards the implementation of e-procurement in processes. The interviewees of the phone interviews mentioned that the IT knowledge level of staff who will work at the e-procurement and e-commerce operations is very limited, and in an attempt to implement e-procurement in the supply chain processes, questions regarding security are mostly raised. This forms a barrier towards timely implementation of an e-procurement system. There are also psychological barriers such as the fear of unauthorized access to critical information (such as the financial details of the project). 86% of the participants viewed this fear as a barrier against the move towards e-procurement. 82% of the participants view the lack of training as another barrier. The respondents mentioned that training aimed to support the use of e-procurement systems would be much beneficial for the industry and for the recognition and implementation of e-procurement. The final important barrier that is indicated as a result of the survey was related to the difficulties in process re-engineering (or re-alignment of processes) for supporting this new way of procurement. Although the processes would become agiler in the end, as the process change would require lots of training and re-engineering effort, the participants of the phone interviews mentioned that the contractors mostly prefer to stay behind in implementing e-procurement unless it is required as a contract requirement. On the supply side, the situation is not much different. They are also reluctant to process change and to undertake re-engineering to become e-suppliers. Suppliers highlight the reason behind it as the lack of consumer demand for e-procurement.

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Table 4. Marketing related barriers

Market Related Barriers	Vital Barrier	Key Barrier	Important Barrier	Less Important Barrier	Not Important Barrier	No Idea	Vital or Key Barrier
The traditional media being still much stronger than new media in marketing and public communcation	22.70%	40.90%	18.20%	13.60%	4.50%	0.00%	63.60%
The inneficiencies in making use of user-generated content for online marketing	18.20%	13.60%	40.90%	27.30%	0.00%	0.00%	31.80%
The concerns related to the number of customers that can be targetted in the online environment	27.30%	50.00%	18.20%	4.50%	0.00%	0.00%	77.30%
The resistance of intermediaries against online commerce	31.80%	27.30%	36.40%	4.50%	0.00%	0.00%	59.10%
The fear of price transparency in e-procurement	27.30%	27.30%	31.80%	13.60%	0.00%	0.00%	54.60%
The lack of pioneering agents/firms	18.20%	40.90%	13.60%	13.60%	13.60%	0.00%	59.10%

Table 5. Human and Process Related Barriers

Human and Process Related Barriers	Vital Barrier	Key Barrier	Important Barrier	Less Important Barrier	Not Important Barrier	No Idea	Vital or Key Barrier
The lack of IT skills in the staff	50.00%	36.40%	13.60%	0.00%	0.00%	0.00%	86.40%
The fear of unauthorized access to the critical project information	54.50%	31.80%	13.60%	0.00%	0.00%	0.00%	86.30%
The inadequacy of interaction in online environment during personnal communication	18.20%	31.80%	40.90%	4.50%	0.00%	4.50%	50.00%
The lack of trust between parties in the electronic commerce	68.20%	22.70%	9.10%	0.00%	0.00%	0.00%	90.90%
The lack of training regarding the implementation and use of e-commerce systems	40.90%	40.90%	13.60%	4.50%	0.00%	0.00%	81.80%
The resistance against the new way of working brought up by moving towards e-procurement and commerce	18.20%	45.50%	27.30%	4.50%	4.50%	0.00%	63.70%
The difficulties in re-engineering of business processes for supporting the information flows e-procurement	18.20%	59.10%	13.60%	0.00%	0.00%	9.10%	77.30%

VI. CONCLUSIONS

The research presented in this paper was focused on determining the barriers to e-procurement by focusing Turkish Construction Industry as the case. The research commenced with a literature review. The findings of the literature review were evaluated and helped in determining barriers to e-procurement in 4 distinct areas to i.) technology, ii.) organizational strategy, iii.) marketing, iv.) human factors and processes. Later a questionnaire survey was conducted to determine the critical key barriers for the industry. The final phase of the research included a series of telephone interviews where the participants were asked about their views on the reasons behind the barriers. In the overall evaluation the barriers emerge with high Vitality Percentage Score (VPS) are illustrated in Fig. 3. Four of the identified critical key barriers were among the "Human and Process Related Barriers" group and one of them belongs to "Strategic Barriers" group. This indicates that the barriers are more rising as result of trust and skill related issues instead of technology related ones. On the other hand, the results indicated that legal infrastructure needs to be more established.

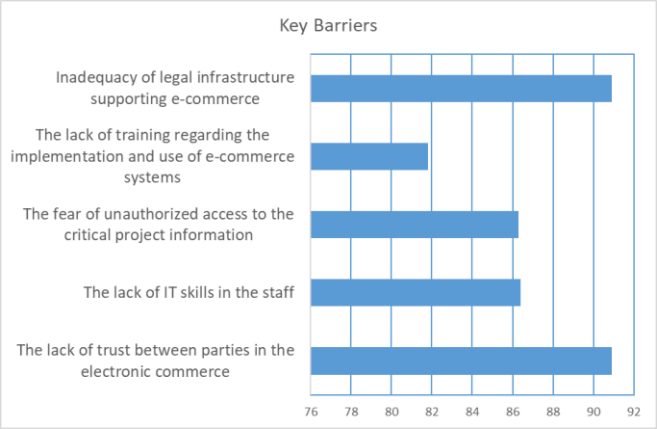

Fig. 3. 5 Key Barriers to E-Procurement in Construction

"The lack of trust between the parties" and "Inadequacy of legal infrastructure" appeared as the most critical barriers as result of the study. As a strategic move towards removing these barriers, the legal infrastructure for the e-commerce in construction needs to be supported by the new local laws and regulations. In addition, new technological advancements such as blockchain technology and best practice examples can help to overcome the lack of trust between parties.

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Training on implementation and use of e-commerce tools and systems will help to overcome "The lack of IT skills in the staff". "The fear of unauthorized access to the critical project information" can be overcome by building up better IT (software) infrastructures within and between the organizations. Efforts towards enhancing the security such as implementation of blockchain and cryptocurrency technologies and development of the legal infrastructure supporting these technologies can a key step towards overcoming barriers to e-procurement.

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