# Cloud Computing Adoption in Logistics Firms in Turkey: An Exploratory Study
*Türkiye'deki Lojistik İşletmelerde Bulut Bilişim Uygulamalarının Benimsenmesi: Keşifsel Bir Araştırma*

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## Abstract
The purpose of this article is to contribute to a growing body of research on cloud computing, by studying logistics sector in a developing country. In this study the judgement sampling method is used in determining the sample so as to get information to find out the impact of Technological, Organizational and Environmental (TOE) context factors in the adoption of cloud computing. Research has been performed through a descriptive research method. The sample size in the study represents 10 logistics firms in various sizes and the interviews are performed in September-October, 2014 in Turkey. There are a number of important findings. First of all, most of the participants are aware of the cloud computing however there are also some who do not have knowledge about cloud computing yet. The main reasons of using computing are found parallel with literature such as: competing with the continuously changing technology requirements, outsourcing IT technology related issues to experts and reducing costs. The reasons for not using cloud computing are as stated as privacy, the importance given to "data ownership", insufficiency of service providers, privacy related risks and incompatibility with legal processes. One of the most important necessities for adopting cloud computing is realizing compatibility of technology infrastructure of firms with technological infrastructure of suppliers, stakeholders and government. Most important academic contribution is adding a new variable to Technology dimension of TOE framework. "Type of application" is a new variable in the "Technology" dimension of TOE model. Firms adopt cloud computing depending on the properties of application. Expectations are most heavily focused on service level of service providers and it is emphasized that logistics companies require special logistics applications in the clouds from service providers. The research is one of the few studies looking for the dimensions of cloud computing adoption in logistics sector in a developing country. The research both contributes to cloud computing literature and logistics literature.
**Keywords** – Cloud computing, Logistics, Technology Organization Environment Model, Turkey.

### *Özet*
*Bu makalenin amacı, gelişmekte olan bir ülkede lojistik sektörünü inceleyerek bulut bilişim ile ilgili araştırmalara katkı sağlamaktır. Bu araştırmada; örneklemin belirlenmesinde yargısal örnekleme yöntemi kullanılmıştır. Araştırma bulut bilişim uygulamalarının benimsenmesinde teknolojik, örgütsel ve çevresel faktörlerin etkisini belirlemeyi amaçlamaktadır. Çalışmada betimleyici araştırma yöntemi kullanılmıştır. Örneklemde farklı büyüklükteki 10 lojistik firması bulunmaktadır. Örneklemde blunan 10 lojistik firması ile Eylül-Ekim 2014 tarihleri arasında yüz yüze görüşme gerçekleştirilmştir. Araştırmada önemli sonuçlar elde edilmiştir. İlk olarak; katılımcıların çoğunun bulut bilişimle ilgili farkındalığı olmasına rağmen henüz bulut bilişim hakkında bilgisi olmayan katılımcılarda bulunmaktadır. Bulut bilişim kullanmanın nedenleri literatürle benzer şekilde bulunmuştur: sürekli değişen teknoloji gereksinimlerini karşılayabilmek, bilgi teknolojisi ile ilgili konuları dış kaynak kullanımı ile uzmanlara devretmek ve maliyetleri azaltmaktır. Bulut bilişim uygulamalarının kullanılmama nedeni ise gizlilik, "veri sahipliğine" verilen önem, gizlilik ile ilgili riskler ve yasal süreçlerle uyumsuzluk olarak belirtilmektedir. Bulut bilişim uygulamalarının kullanılmasında önemli koşullardan biri işletmelerin teknolojik altyapısının tedarikçiler, paydaşlar ve devletin teknolojik altyapısı ile uyumlu olmasıdır. Araştırmadaki en önemli akademik katkı (Teknoloji-Örgüt-Çevre) modelinde teknoloji boyutuna yeni bir değişken eklemektir. TÖÇ modelindeki "Teknoloji" boyutuna yeni eklenen değişken "Uygulama Türü" değişkenidir. Beklentiler hizmet sağlayıcıların hizmet düzeyine odaklanmaktadır bunun yanında lojistik işletmeler hizmet sağlayıcılardan lojistik ile ilgili bulut bilişim uygulamaları beklemektedir. Araştırma gelişmekte olan bir ülkede bulut bilişim uygulamalarının kullanımı ile ilgili boyutları inceleyen az sayıdaki çalışmadan biridir. Araştırma bulut bilişim ve lojistik literatürünün her ikisine de katkı sağlamaktadır.*
*Anahtar Kelimeler - Bulut Bilişim, Lojistik, Teknoloji Örgüt Çevre Modeli, Türkiye*

## Introduction
In the current competitive environment, technological innovation has become a key aspect of business competition. Therefore, studies focused on defining the criteria for adopting technological innovations in different sectors are of great importance.

The main idea of logistics is movement of a product from the place of origin into customer's hands. A multitude of suppliers, manufacturers, carriers, 3PLs and 4PLs take part in order to realize this goal. Management of information flow should be realized in logistics information systems for a smooth execution of logistics. However, new information technologies should be evaluated in terms of whether to use them in their processes.

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Cloud computing is an ideal system, which integrates the entire functions and operations for logistics information system into a single system. Ilin et al. (2013:30) suggested that cloud computing should provide a portion of data to the partners which drives the logistics process so that each partner has a role in the successful delivery of goods to the final location. Since its emergence around 2007 (Baker, 2007; Lohr, 2007) the topic has exploded in interest within academic and technical literatures (Carr, 2008; Zhang, Cheng and Boutaba, 2010). Yang and Tate (2012:42) classified researches on cloud computing in 4 categories as: 1) Technological issues, 2) Business issues, 3) Conceptualising cloud computing, and 4) Domains and applications. However; the small number of papers regarding business issues indicates a lack of business perspective in cloud computing research. Furthermore, cloud computing is not suitable for all companies and industries. When comparing industries by average number of cloud applications usage, computer/ electronics/ telecommunications equipment manufacturing is uppermost by far and transport/ logistics industry is ranked number eight (Tata Consultancy Services, 2012). Hence, evaluating and assessing the cloud computing applications with respect to different sectors is a major concern. Besides, Tata Consultancy Services (2012) has also found that there are regional differences in adoption of cloud computing. In the context of cloud adoption, main driver of U.S. and Asia-Pacific companies is to standardize applications and business processes and of Europe and Latin America companies is to increase applications flexibility. All over the world, 'overcoming IT security concerns' regards as the key factor in generating benefits from cloud computing and as the second 'demonstrating strong ROI early'. While Asia-Pacific and Latin America companies spend most for the customer service fuction, U.S. companies spend for the sales function and Europe companies spend for the marketing function for cloud computing applications. The other regional difference reveals in vendor selection; while U.S. and Latin America companies seek 'reliability/ uptime' criteria as the most important capability of cloud vendors, Europe and Asia-Pacific companies seek 'data security/ privacy' criteria.

Application of cloud computing technology to build a logistics information platform to realize intelligent logistics is one of the main projects in the future development of the logistics informationization (Li, Zhang and Li, 2014; Ilin *et al.*, 2013). Therefore, researches on identifying the adoption variables of cloud computing in logistics firms are valuable. The cloud has opened a wide range of opportunities for potential users in developing countries. In this context; it is necessary to clarify the factors which inhibit the adoption of cloud computing in developing countries.

Our study aims to improve the understanding of organizational context factors inhibiting or fostering the adoption of cloud computing in logistics sector in Turkey. It sets out the structure, link it to findings from existing research, and summarized in the research question: What is the impact of technological, organizational and enviromental context factors on the adoption of cloud computing in logistics sector in Turkey?

The remainder of the paper is organized as follows. In section 2, we review existing literature and define conceptual background. Next, we outline our data collection and analysis methodology in section 3, followed by the findings of this research and conceptual model in section 4. Finally, the section 5 draws conclusions, academic contributions and practical implications and limitations and potential future research directions.

## Literature Review

Small and medium enterprises are badly in need of professional logistics services and IT systems to improve work efficiency and quality of management, reduce operating costs and enhance core competitiveness. Therefore, improving the IT level of small and medium-sized logistics enterprises has now become the bottleneck of informationization in logistics. In fact, logistics industry in Turkey is constituted by a large number of small/ medium enterprises. Huge investments in IT limit the adoption of new technologies and business innovation in those enterprises. Therefore, raising the IT level of those enterprises remains a difficult problem.

Li *et al.* (2013:1696) classified logistics resources and web services as two major aspects of cloud oriented logistics. Logistics resources are characterized by variability, geographical distribution, heterogeneity, morphological diversity and self-governing zone. Web services are characterized by distribution and heterogeneity in a cloud logistics platform. Integrated into complexity of cloud network, logistics resources present a platform for the virtualization of information and material flows. Ilin *et al.* (2013:36) defined the goal of cloud computing related with logistics as to facilitate smooth realization of individual and complex logistics services.

Logistics service mode under cloud computing has completely different characteristics from the existing logistics service modes. 1) The openness of the logistics environment makes users get the service according to their needs; 2) Logistics resource virtualization makes logistics resources in the form of cloud services.; 3) Logistics tasks are complex and different, and the logistics task may be performed by multiple enterprises. Different logistics task subjects complete the task through cooperation. Cloud service composition is the process to meet user needs and complete the logistics task by dynamically discovering from various cloud services and assembling into a more value-added, large-granularity of the service or system. (Wang *et al.*, 2015:36). Cloud computing provides these advantages by supporting collaboration, modernization and improving implementation speed (Ilin *et al.*, 2013). Hence; "Cloud Computing" have been attractive to logistics industry due to its advantages of efficient use of computing resources, low client device requirements and information sharing.

Technology adoption has been an important research in information system field. There are various theories which are used to evaluate technological innovations: Technology Acceptance Model (TAM), Technology Organization Environment (TOE), Theory of Planned Behaviour (TPB), Unified Theory of Acceptance and Use of Technology (UTAUT) and Diffusion of Innovation (DOI) theory. DOI theory (Rogers, 1995) emphasized both the internal and external characteristics of the organization as drivers for innovations (Chang *et al.*, 2013:408) and TAM (Davis, 1987), TPB (Ajzen, 1991) and UTAUT (Venkatesh et al., 2003) need individual factors. But in the TOE framework (Tornatzky and Fleischer, 1990), innovation is evaluated at organization level in broader content and it extends DOI theory by adding environmental context which presents both constraints and opportunities for technological innovation (Bradford *et al.*, 2014:151). The current study seeks to contribute to the emerging body of research on adoption of cloud computing on logistics firms, through cases and the situations that logistics firms perceived in terms of cloud computing then the results are evaluated within the framework of TOE. Studies employing TOE framework, also recognize that the decision to adopt a technological innovation is based

on factors in organizational and external environment, as well as the technology itself. TOE specifies three types of factors that influence adoption: The technological context (including both internal and external technologies of the firm), organizational context (defined in terms of size and scope, characteristics of a firm's managerial structure, and quality and degree of its human and slack resources), and environmental context, which refers to firm's industry and dealings with business partners, competitors and government.

There are various TOE researches that contain innovations that have come up with the Internet and development of informations systems such as EDI (Yuan and Chau, 2001), ERP (Raymond and Uwizeyemungu, 2007), e-commerce (Zhu, Kraemer and Xu, 2002; Zhu *et al.*, 2004; Lin and Lin, 2008), Web services (Lippert and Govindarajulu, 2006), RFID (Wang, Wang and Yang, 2010); technological innovation (Tornatkzy and Fleischer, 1990), engineering projects (Rekveldt *et al.*, 2011); business analytics (Ramanathan *et al.*, 2012) and e-supply chain management (Lin ,2014). Evaluating various technological innovations within the TOE framework reveals common points involved in every context. In the technological context, organizations' technological infrastructure readiness and perceived benefits and risks constitute the common point. In the organizational context firm size is seen as the most affecting factor and business segment, business strategy and top management support factors are also seen important. In the environmental context, industry requirements, business partners and the industry pressure are the most affecting factors.

There are also another studies using DOI when evaluating cloud computing adoption (Low, Chen and Wu, 2011; Lin and Chen, 2012; Wu *et al.*, 2013), RFID adoption (Tsai, Lee and Wu, 2010) and e-business use (Zhu *et al.*, 2006). TAM studies evaluating video conferencing (Townsend *et al.*, 2001), banking technology (Chau and Lai, 2003) and e-mail (Huang, Lu and Wong, 2003); UTAUT studies evaluating 3G services (Wu, Tao and Yang, 2007), Internet banking (Cheng *et al.*, 2008) and e-learning (Maldonado *et al.*, 2009).

Many cloud computing studies are evaluated within the context of TOE (Chen Li and Chen, 2011; Tan and Lin, 2012; Borgman *et al.*, 2013; Chang *et al.*, 2013; Morgan and Conboy 2013; Saedi and Iahad, 2013; Akande and Belle, 2014; Cilliers, 2014; Hsu, Ray and Li-Hsieh, 2014; Lian, Yen and Wang, 2014; Oliveira, Thomas and Espandal, 2014; Stieninger and Nedbal, 2014). The most affecting factors in the technological context are compatibility, perceived benefits and complexity in making decision on adoption of cloud computing. In the organizational context, firm size, top management support and technological readiness are the main factors. Competitive sector pressure and legal processes are the factors affecting organizations in making decisions within the environmental context. When comparing other technological innovations and cloud computing studies, it is seen that the factors affecting both sides within the context of TOE are mostly similar. But some factors like data security, data privacy and employees' IT knowledge differ from the other group.

## Method

Main aim of the research is to find out the impact of technological, organizational and enviromental context factors on the adoption of cloud computing in logistics sector in Turkey.

In this study, which evaluates of use and non-use cases, the judgement sampling method is used in determining the sample so as to get more reliable information. Since there is no certain data to determine sample from the universe, firstly the thoughts are revealed in order to determine the sample in the expert panel that consists of an academician, a logistics sector expert and an owner of a software company which offers logistics information systems solutions. Thus, data from the logistics companies the constraint is specified as 'logistics companies that carry on business with their self-owned vehicle and use vehicle tracking systems on them'. Besides, it is not necessary to use cloud computing services for all samples taking part in the study and sample equally divided as users and non-users. In the process of determining the sample, expediency and predicted data intensity are taken in consideration. As a result of the interviews with the experts, the logistics companies that are suitable for the research are determined.

Research has been performed through a descriptive research method. According to this, logistics companies' opinions about cloud computing, use and non-use cases and the results of the usage of logistics information systems are investigated in an extensive way. Furthermore; the findings are evaluated within the scope of the TOE (technological-organizational-environmental). The research process started with literature review about logistics information systems, outsourcing in logistics, vehicle tracking systems and cloud computing. Then the questionnary form was created and submitted to expert panel in order to evaluate of its suitability. After all these assessment phases, the sample was determined and the interviews were carried out. The data obtained were evaluated within the scope of TOE and the TOE framework was created according to the results.

### a.    Participants

Proper participants are determined as a result of the expert panel negotiations by taking into consideration the following constraints:

- It is necessary that the person to be interviewed have knowledge of the land operational processes.
- It is necessary that the participating firms use vehicle tracking systems either on premise or as a cloud computing service.
- It is necessary to have interviews in period of time in which the participants are available and the place they determine.

As a result, 14 logistics firms are interviewed within the above mentioned constraints and 4 firms are removed from the scope of research due to lack of enough information.

Sample size in the study represents 10 logistics firms. Various studies in the literature have revealed that the sample size can contain 20 to 30 (Creswell, 2007) or 30 to 50 (Denzin and Lincoln, 2005) interviews. In respect of the other various studies, depending on the content and depth of qualitative research the study can reach data saturation with 4 to 5 (Creswell, 2007) or at least 6 (Yin, 2009) interviews.

**Table 1.** Participants Demographics

| Number / Topic | Interviewees' Position | Interviewees' Educational Background | Interviewees' Age Range | Interviewees' Work Experience | Companies' Self-Owned Vehicles | Number Of Employees |
|---|---|---|---|---|---|---|
| | Vehicle Planning Specialist | | | | 0-100 400-500 | 200-300 |
| | General Manager, Technology Development Department Manager, IT Manager | | 50-55 | 5-10 10-15 15-20 20-25 25-30 (years) | 100-200 300-400 500-1000 1000+ | 500-1000 |
| | Operation Manager | High-School Graduate | 35-40 | | | 300-400 |
| | | | | | | 1000+ |
| | | | 40-45 | | | |
| | | Bachelor's Degree | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

transcript. The model and research findings reflect the themes from the ten interviews alone. As seen in Table 1, participants represent 10 logistics firms in total, 5 of whom benefit from cloud computing services and 5 do not. 2 of the participants are general managers, 2 of them are technology development department managers, 3 of them are operation managers, 2 of them are information technologies managers and 1 is vehicle planning specialist in their firms. Interviewees are between 35 and 55 and they have 9 to 28 years work experience in their industry. Participants' firms represent different sized enterprises. In this respect, four of the firms have over 1000 employees, 2 firms have 500-1000 and 4 firms have 200-500. According to firm size, 2 firms have over 1000 self-owned vehicles, 2 firms 500-1000, 3 firms 300-500 and the other 3 firms 0-300 self-owned vehicles. Thus, the interviews done with different sized firms provide variety in acquired data.

### b. Procedure

It is benefitted from structured interview technique in the face to face in-depth interviews. The questionnarie form comprises two steps: in the first step demographical questions are asked to understand participants' and firms' background, in the second step open ended questions are asked to both cloud service users and non-users in different forms. In preparing the questions, various studies and international surveys have been made use of (Shimba, 2010; WEF, 2010; Ferreira and Moreira, 2012; Lin and Chen, 2012; Techsoup, 2012; ENISA, 2013). Besides the written resources, academicians and sector specialists contribute to preparing the questionnaire form. In preparing questions, it is aimed to be simple and comprehensive because the cloud computing is a new concept and there is no heightened awareness for it in Turkey yet. The interviews are performed in participants' offices whenever they are convenient in September-October, 2014. Each interview has taken 1 hour in average (between 30 minutes and 90 minutes), all of them have been recorded with tape recorder. There was an interview protocol guide that provided the topic to address. The researchers only interrupted for clarification and to probe for deeper understanding. The interviews were transcribed verbatim resulting in 33 pages of raw text and then analyzed by each researcher for common themes. Themes were reconciled and then analyzed independently by each researcher for common themes. Themes were then reconciled and a model was developed. Concepts and issues raised by the interviewees were interpreted within each

**Finding And Analysis: Model Development**

The data obtained by analysing the results are evaluated within the TOE (technology-organization-environment) framework.
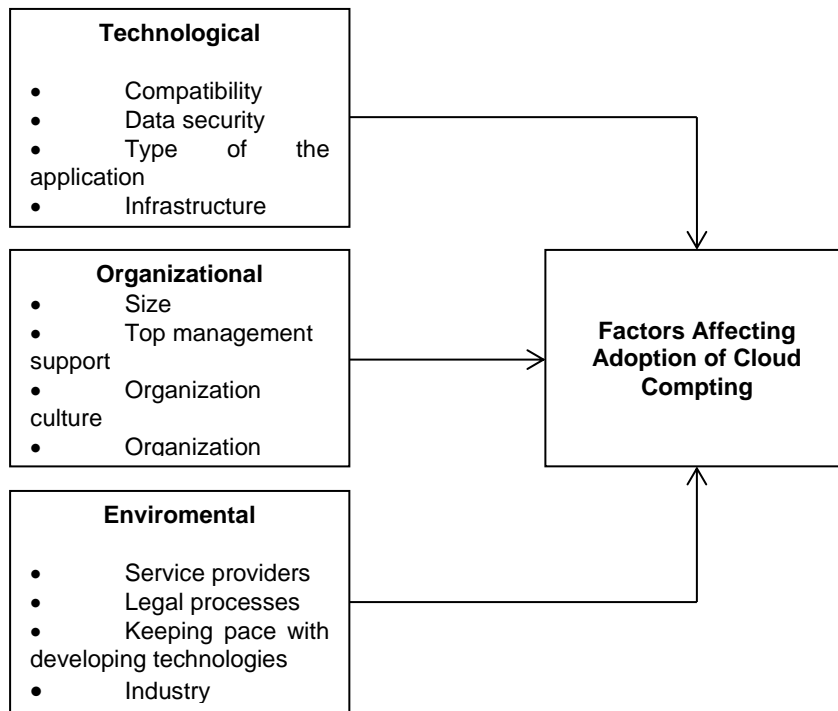
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┌─────────────────────────────┐
│        Technological        │
│                             │
│  •      Compatibility       │
│  •      Data security       │
│  •      Type     of    the  │
│  application                │
│  •      Infrastructure      │
└─────────────────────────────┘

┌─────────────────────────────┐
│        Organizational       │
│  •      Size                │
│  •      Top management      │
│  support                    │
│  •      Organization        │
│  culture                    │
│  •      Organization        │
└─────────────────────────────┘

┌─────────────────────────────┐
│         Enviromental        │
│                             │
│  •      Service providers   │
│  •      Legal processes     │
│  •      Keeping  pace  with │
│  developing technologies    │
│  •      Industry            │
└─────────────────────────────┘
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**Factors Affecting Adoption of Cloud Compting**

**Figure 1.** Factors Affecting Adoption of Cloud Computing

*a.       Technological Factors*

The TOE framework's technology context refers to internal and external technologies which are relevant for the firm.

*Compatibility*

Compatibility refers to consistency between an innovation and the foundation's current values, past experiences and needs (Borgman *et al.*, 2013). The technology development department manager of a medium sized logistics firm that operates in global market has stated about technological compatibility that:

*'For example, using vehicle tracking systems stands alone on the clouds is not useful for us. Because we prefer to use it integrated with other systems, such as ERP. In this way, information obtained from both sides provide us the data, we need them in different areas, with the aid of the softwares we developed by ourselves. We have spent lots of money and time to put the system right and we totally got used to usage of it, so we do not have any intention to leave this system.'*

*Proposition1a:* Technological compatibility in logistics firms positively affects cloud computing adoption decision.

*Data Security*

The issue of data security has been one of the primary drawbacks of cloud computing (Saedi and Iahad, 2013; Akande and Belle, 2014; Lian, Yen and Wang, 2014; Rosado *et al.*, 2012). The IT department manager of a medium sized logistics firm that operates in global market with more than 1000 self-owned vehicles and employees has stated about cloud computing and data security as follows:

*'I consider the cloud computing as a service which is still immature but has a fast-growing awareness in our country. The main reason of this immaturity is possessiveness and the underlying cause is security concerns. When you hold your IT processes in your own, you bring some concerns about data security into the forefront such as; to reach the data on request, not to worry about your data's security, to reassure your customers of that their information is secure with you.'*

*Proposition1b:* The issue of data security with regards to logistics firms negatively affects cloud computing adoption decisions.

*Type of the Application*

Participants of the study who prefer to use cloud computing indicate that they do not transfer all IT applications to the clouds in the first step of their adoption period and the type of the application, which they firstly transfer, is important factor in this process. The IT department manager of a medium sized logistics firm that operates in global market has stated about the type of the application as follows:

*'For now, we are using a hybrid system. The systems we use on the clouds are simple, in package and have less hire charge. For example, we use e-mail services, which have simple technological infrastructure, in the clouds because its hire charge is not high and we are exempt from the cost of their (may be thousands in a day) storage. On the other hand, we use more complicated, costlyand critical systems through in house structure such as ERP, EDI, vehicle tracking systems.'*

*Proposition1c:* Cloud computing adoption decision in logistics firms differs in terms of the type of the application.
*Infrastructure*
The firms, in which current technological infrastructures are better, are more successful at adopting new technological changes (Zhu and Kraemer, 2005; Lin and Lin, 2008). The findings which are consistent with literature, the opportunity to reach high-tech without infrastructure cost that cloud computing provides to small sized enterprises abolishes the necessity for businesses to have current IT infrastructure. Besides the internal infrastructure, the technological infrastructure of the country is also an important factor that influences cloud computing adoption decision. The general manager of a small sized logistics firm that have all their IT infrastructure on the clouds and that operates in global market with between 300-500 self-owned vehicles has stated about especially technological infrastructure of the country as follows:

*'Region we are settled is a very important industrial zone for our country but to my opinion it is not attached adequate importance to technological infrastructure. Whereas cloud computing services are used more qualified and more extensive in abroad, we can not use the potential that we have since the required investments are not done and we have compliance problem with our oversea connections.'*

*Proposition1d:* Technological infrastructure of logistics firms and of the country negatively affects cloud computing adoption decision.

### b.     Organizational Factors
Organizational factors are related to the internal factors of an organization that are controllable and manageable by the organization. Organizational factors include generic factors (e.g. size), and management factors, as well as innovation adoption related factors (Saedi and Iahad, 2013).
*Size*
Firm sizes are found to influence a firm's technology adoption process in most of similar studies (Ho, Liu and Lee, 2011; Aragon-Correa and Cordon-Pozo, 2005; Chang *et al.*, 2013; Oliveira, Thomas and Espadanal, 2014; Li, Wang and Chen, 2011; Ngai, Lai and Cheng, 2008). In the adoption process of cloud computing, large-scale enterprises are more advantageous than those which are small-scale, because it is revealed that larger scale means more resources that can be used to comply with and more risk can be taken. Also, researches found out that smaller enterprises have bigger difficulties in adopting new technologies (Oliveira, Thomas and Espadanal, 2014; Zhu, Kraemer and Xu, 2006). But, although the findings that are emerged from this study support those in literature mostly, it also found out that in several conditions small-medium sized enterprises are more open and flexible to innovations than are large-scale ones (Borgman *et al.*, 2013). The general manager of a medium sized logistics firm that operates in global market has stated about the firms and opportunities of cloud computing as follows:

*'We are an organization that have more than one thousand employees and more than 1500 vehicles. I do not think that there is a service provider which is able to provide service to such a structure in our country. International technology companies, however, have offered very great amount of money that we can not handle stemming from our country's high pricing policies.'*

*Proposition2a:* Cloud computing adoption decision in logistics firms differs according to firm size.
*Top Management Support*
Another important organizational factor affecting cloud computing adoption decision is the top management support because critical managerial decisions like resource allocation, integration of services and configuration of processes belong to top management (Low, Chen and Wu, 2011). Moreover, top management support for the departments have a promotive role in adoption of innovative technologies (Wang, Wang and Yang, 2010). The technolgy development department manager of a medium sized logistics firm has stated about the top management support in the process of the transition to cloud computing as follows:

*'Adoption of cloud computing is a decision that affects all organization structure, so we have to put shared decision making mechanism in place. Since each department's needs and the factors they are affected are different, we decided in adoption of cloud computing in the end of an evaluation phase, during which we conduct meetings with unit managers and top management. In this period, the most important step was to take top management's support because in any bad situation whole process would be stopped in an irremediable way.'*

*Proposition2b:* Top management support in logistics firms positively affects cloud computing adoption decision.
*Organization Culture*
Inherent beliefs about how to manage a firm and outer beliefs about how to compete in marketplaces compose organization culture. Effective IT plannings have a great impact in having a flexible entrepreneurial culture progressing on its own instead of a formal organization culture having an IT process with static and intensive bureaucracy (Bradley, Pridmore and Byrd, 2006).  The operation department manager of a small sized logistics firm has stated about the relationship between organization culture and the cloud computing as an innovative technology as follows:

*'I can say that with the adoption of cloud computing our employee's jargon has changed. Since we have gathered under a new technology roof, their business manner has changed, their attitudes and points of views have developed.'*

*Proposition2c:* Cloud computing adoption decision in logistics firms differs based on organization culture.
*Organization Strategy*
As long as IT structure is integrated with organization strategies, higher added-value can be created (Kearns, 2005). The IT department manager of a medium sized logistics firm has stated about the relationship between organization culture and cloud computing services as follows:

*'We have assessed to use applications among recent developed technologies, which is thought that they can make our business processes more simple. In this assessment, showing regard to our company's long-term strategies we have brought the favourable services on the clouds into play.'*

*Proposition2d:* Organization strategy of logistics firms reveals differences on cloud computing adoption decision.
*Perceived Benefits*

The core idea of modern logistics is to create value at the lowest cost. Logistics can choose the version according to their actual demand, investing in a relatively low 'monthly/annual charge'. Previous technologies can not help logistics industry achieve this goal without appropriate business model and cloud computing can give a hand. Flexibility is also an important benefit that cloud users gained (Marston *et al.*, 2010; Lin and Chen, 2012). Participants have revealed that the perceived benefits like cost advantage, focus on core competence, flexiblity and velocity have a facilitator role in decisions on adoption. The general manager of a small sized logistics firm has stated about the benefits they take advantage as follows:

*'Velocity, accessibility, easy reporting and to be able to see whole process are the benefits that we obtain from cloud computing. In addition to these, it provides us information security and focus on our core competence. Having said that it also provides us to adapt to recent technologies faster and cost affective way and enable us to join on 'new world'.'*

The operation department manager of medium sized logistics firms that operates in global market with more than 1000 self-owned vehicles has stated about the relationship between the contributions of cloud computing to operations and the customer relations as follows:

*'With the adoption of cloud computing our customer relations have developed rapidly when we compared to past. The possibility of following the processes reciprocally has risen without losing time. Without confrontation, except the compulsory cases, we can transmit the processes they want to see owing to the mobility cloud computing provides. Thus, transparency and mutual trust have increased.'*

*Proposition2e:* Logistics firms' perceived benefits positively affect the cloud computing adoption decisions.

*Perceived Risks*

The firms' perceived risks of cloud computing might be categorized into various topics: privacy and security, service providers, performance, efficiency, transparency (Armbrust *et al.*, 2009; Leavitt, 2009; Bizarro and Garcia, 2012; Iyer, 2014). The general manager of a medium sized logistics firm has stated about disconnection of the Internet, seen as a big risk with regard to cloud computing, and their potential negative effects as follows:

*'The first risk that I see with regard to cloud computing is disconnection of Internet connectivity with foreign countries, like was in 2003 Algeria earthquake. It is a really big risk that I am not able to reach my data held in data centers, which are located in different locations. It may cause to halt all of my business. '*

*Proposition2f:* Logistics firms' perceived risks negatively affect the cloud computing adoption decision.

### c. Environmental Factors

The TOE framework's environmental context relates to the area "in which a firm conducts its business - its industry, competitors, access to resources supplied by others, and dealing with the government" (Tornatzky and Fletcher, 1990).

*Service Providers*

In research extent, the determinant which affects most the firms' decision on cloud computing adoption has been service providers among other environmental determinants. The IT department manager of a medium sized logistics firm has stated about the problems about service providers on which the participants have a consensus as follows:

*'Actually adaptation process of cloud computing was so difficult for us. The most serious problems we have encountered have been stemming from our service provider although we tought that we make tiny distinctions for choosing. Even though it is a well-known technology firm and we had been using their services before, they had had difficulty in putting into practice the cloud computing, which is a new service model for them, as well. We had had serious problems about connection speed and the time they promised to put the applications into practise and we reached to level of performance in a long period of time.'*

*Proposition3a:* Service providers according to logistics firms negatively affect cloud computing adoption decision.

*Legal Processes*

The government supports technologic innovations by providing tax advantages etc and encourages firms in reaching technologic standards. However, in circumstances that data security has to be kept at high-level, the government may regulate policies restricting cloud computing use (Borgman *et al.*, 2013; Oliveira, Thomas and Espadanal, 2014). The operation department manager of a medium sized logistics firm has stated about the possible problems in terms of the legal processes with the cloud computing adoption as follows:

*'In our day government technology infrastructure is also well-developed and we do the operations/ paperworks electronically. For instance, the government assigns you as an 'authorized customs' for the customs works and annihilate the customs so that you can do all of your customs work electronically. However, it has very strict rules about the data security. Your security conditions have to be in accord with the standars which are specified through regulations and you must have archives and back-up systems. You have to give any information from any time to the government whenever they want. So I can not trust any service provider to give my information to put into clouds I do not know where they are because of these strict regulations. It is really a big risk for us.'*

*Proposition3b:* Legal processes involving logistics firms negatively affect cloud computing adoption decision.

*The Obligation of Keeping Pace with Developing Technologies*

Firms' survival in global marketplaces with permanently increasing trading volume and remaining as a global player depends on how much they adapt to developing technologies. The IT department manager of a small sized logistics firm has stated about the advantages of cloud computing keeping pace with the continiously developing technology world as follows:

*'The main factor why we prefer to use cloud computing is that it enables to reach a more flexible system via computers and mobile devices at any moment and from anywhere. Thus, we take the opportunity about solving customer demands in a faster way. At the same time, I can say that we see cloud computing as a business partner, which supports us in the developing technology world.'*

*Proposition3c:* The obligation of keeping pace with developing technologies for logistics firms positively affects cloud computing adoption decision.

*Industry Requirements*

The emerging industrial requirements and competitive conditions have been driving forces behind adapting innovations (Ifinedo, 2011; Low, Chen and Wu, 2011; Stieninger and Nedbal, 2014; Closs and Xu, 2000; Pokharel, 2005). The general manager of a medium sized logistics firm has stated about the possible benefits of cloud computing that can meet the need of the industry requirements that:

*'Nowadays, following the technology in an affective manner comes to the boil. In my opinion, it is really difficult to reach that point for a company whose working area is not about technology and IT is a very critical department in which information is managed. Thus, we prefer to outsource our IT resources to a professional technology firm to keep up with this developing technology world and to meet industry requirements.'*

*Proposition3d:* Industry requirements perceived by logistics firms positively affect cloud computing adoption decisions.

**Discussion and Conclusion**

Usage of technology has gained importance in logistics as well as in other industries. The firms which don't use technological developments are in danger of being withdrawn from the market. Cloud computing is a technological innovation which can change market structure. Hence, it is important to evaluate the adoption process of cloud computing in logistics companies by means of a qualitative research. Sample is formed from 10 logistcis companies 5 of which are using cloud computing and 5 of which are not using cloud computing. Structured and in-depth interview method is used. With the interviews, knowledge and awareness of companies about cloud computing is revealed. Most of participants have knowledge about cloud computing due to their interest and usage whereas few of them don't have knowledge about cloud computing though they are using cloud computing applications. These findings are thought to be result of the fact that cloud computing is a new technology in Turkey. The most stated issues related with computing are outsourcing, mobile technologies and usage of Internet as an infrastructure.

Competing with the continuously changing technology requirements, outsourcing IT technology related issues to experts and reducing costs are the main reasons for using cloud computing. These reasons are parallel with advantages of cloud computing in literature.

The reasons for not using cloud computing are stated as privacy and the importance given to "data ownership". The other reasons are insufficiency of service providers, privacy related risks and incompatibility with legal processes.

The users state that they encountered a lot of problems during the transition process of cloud computing applications. The most important problem was service providers. They couldn't realize their obligations. The users who don't prefer to use cloud computing state service providers as the main reason. All users of computing state that they had a considerable amount of advantage, whereas non-users point out that they will also use cloud computing when suitable conditions are provided. Thoughts of both users and non-users confirm that cloud computing is a demanded service model for logistics sector. The other point to be emphasized is that technological infrastructure of firms should be compatible with technological infrastructure of suppliers, stakeholders and government.

*a.* **Academical Contribution**

Emergence of cloud computing as a new research area improved the number of academic researches on cloud computing. However, most of the studies focus on properties and advantages of cloud computing. There are a limited number of sectorwide researches. The first contribution is that the research is one of the few studies looking for the dimensions of cloud computing adoption in logistics sector in a developing country. The research both contributes to cloud computing literature and logistics literature.

The variables that affects cloud computing adoption positively are technological compatibility; top management support; perceived benefits; obligation of keeping pace with developing technologies and industry properties.

The variables that affect cloud computing adoption decisions negatively are data security; technological infrastructure of logistics firm and country; perceived risks; service providers and legal processes.

The other variables that need to be mentioned are:
- Cloud computing decision in logistics firms differs acoording to firm size.
- Organization strategy of logistics firms reveals differences on cloud computing adoption decision.

Today, there are just a few logistics companies which have adopted cloud computing in all of their applications. Furthermore, variable related with the adoption of cloud computing is found in the research. "Type of application" is a new variable in the "Technology" dimension of TOE model. Firms adopt cloud computing depending on the properties of application.

*b.* **Practical Contribution**

Expectations are most heavily focused on service level of service providers. Users also emphasize that they also require logistics applications from service providers. Research provides insights for country wide applications. Other implications for countrywide applications are removing risks, improving countrywide technology infrastructure.

Findings have also revealed that cloud computing can provide small and medium companies a lot of advantages such as: cost, speed, flexibility and focusing on core business.

*c. Limitations and Further Studies*

Considering the fact that cloud computing has just been used recently, it was impossible to select logistics companies that transferred all of the applications to cloud computing. Only 1 of the firms in the research is using all of its applications on cloud computing. Besides, the research couldn't be conducted with respect to the different types of cloud computing applications. Suggested further studies are as follows:

- Propositions established in this research should be tested with larger samples both in Turkey and other countries.
- Profiles of companies related with cloud computing usage should be identified.
- "Type of application" variable should be tested and properties of applications related with cloud computing usage should be identified in further studies.

- Cloud computing usage should be analysed in different companies in detail.

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## *Özet*

*Lojistiğin temel amacı ürünlerin herhangi bir noktadan müşterilere ulaşmasını sağlamaktır. Lojistik bilgi sistemleri ise lojistiğin temel amacına ulaşmada kullanılabilecek en önemli ve gerekli araçtır. Bununla birlikte; süreçlerin etkinliğinin arttırılmasını sağlamak için sürekli olarak yeni teknolojilerin araştırılması ve uygulanması gereklidir. Lojistk bilgi sistemlerinin etkinliğini artıracak teknolojilerden biri ise bulut bilişimdir. Bulut bilişim, lojistik bilgi sisteminin tüm bileşenlerini tek bir sistemde toplamaktadır. Bunun yanında; bulut bilişim akıllı lojistik uygulamalarının geliştirilmesinde etkili olacak en önemli uygulamalardandır. Bulut bilişim uygulamalarının kullanımında ülkelere gore farklılıklar bulunmaktadır. Amerika ve Asya-Pasifik ülkelerinde temel amaç uygulamaların ve süreçlerin standardizasyonu iken; Avrupa ve Latin Amerika ülkelerinde ana amaç esnekliğin arttırılmasıdır. Tüm ülkeler açısından önemli factor ise güvenlik ile ilgili problemlerin çözümü ve yatırımın geri dönüşünün daha kısa sürede sağlanmasıdır.*

*Bu makalenin amacı, gelişmekte olan bir ülkede lojistik sektörünü inceleyerek bulut bilişim ile ilgili araştırmalara katkı sağlamaktır. Bu araştırmada; örneklemin belirlenmesinde yargısal örnekleme yöntemi kullanılmıştır. Örneklemin belirlenmesinde bir akademisyen, lojistik sektöründen bir uzman ve lojistik bilgi sistemi çözümleri sunan bir yazılım firmasının sahibinin görüşleri alınmıştır. Örneklemin oluşturulmasında "kendi araçlarıyla lojistik gerçekleştirme ve araç takip sistemi kullanma" kriteri kullanılmıştır. Araştırma bulut bilişim uygulamalarının benimsenmesinde teknolojik, örgütsel ve çevresel faktörlerin etkisini belirlemeyi amaçlamaktadır. Çalışmada betimleyici araştırma yöntemi kullanılmıştır. Örneklemde farklı büyüklükteki 10 lojistik firması bulunmaktadır. Örneklemde blunan 10 lojistik firması ile Eylül-Ekim 2014 tarihleri arasında yüz yüze görüşme gerçekleştirilmştir. Bulut bilişim uygulamalarının lojistik firmaları arasında henüz yaygınlaşmadığı gözönüne alındığında 5 bulut bilişim uygulaması kullanan, 5 bulut bilişim uygulaması kullanmayan firma ile görüşme yapılmıştır. Araştırmada önemli sonuçlar elde edilmiştir. İlk olarak; katılımcıların çoğunun bulut bilişimle ilgili farkındalığı olmasına rağmen henüz bulut bilişim hakkında bilgisi olmayan katılımcılarda bulunmaktadır. Bulut bilişim kullanmanın nedenleri literatürle benzer şekilde bulunmuştur: sürekli değişen teknoloji gereksinimlerini karşılayabilmek, bilgi teknolojisi ile ilgili konuları dış kaynak kullanımı ile uzmanlara devretmek ve maliyetleri azaltmaktır. Bulut bilişim uygulamalarının kullanılmama nedeni ise gizlilik, "veri sahipliğine" verilen önem, gizlilik ile ilgili riskler ve yasal süreçlerle uyumsuzluk olarak belirtilmektedir. Bulut bilişim uygulamalarının kullanılmasında önemli koşullardan biri işletmelerin teknolojik altyapısının tedarikçiler, paydaşlar ve devletin teknolojik altyapısı ile uyumlu olmasıdır. Araştırmadaki en önemli akademik katkı (Teknoloji-Örgüt-Çevre) modelinde teknoloji boyutuna yeni bir değişken eklemektir. TÖÇ modelindeki "Teknoloji" boyutuna yeni eklenen değişken "Uygulama Türü" değişkenidir. Beklentiler hizmet sağlayıcıların hizmet düzeyine odaklanmaktadır bunun yanında lojistik işletmeler hizmet sağlayıcılardan lojistik ile ilgili bulut bilişim uygulamaları beklemektedir. Araştırma sonucunda daha sonra test edilmesi önerilen 13 önerme oluşturulmuştur. Test edilmesi önerilen önermeler: 1) Lojistik işletmelerindeki teknolojik uyumluluk bulut bilişim uygulamalarının benimsenmesini olumlu etkilemektedir. 2) Veri güvenliği ile ilgili konular bulut bilişim benimseme sürecini olumsuz etkilemektedir. 3) Lojistik işletmelerin ve ülkenin teknolojik altyapısı bulut bilişim benimseme kararını olumsuz etkilemektedir. 4) Lojistik işletmelerinde bulut bilişim benimseme kararı firma büyüklüğüne gore değişiklik göstermektedir. 5) Lojistik işletmelerinde üst düzey yönetim desteği bulut bilişim benimseme kararını olumlu etkilemektedir. 6) Lojistik işletmelerde bulut bilişim benimseme kararı örgüt kültürüne gore farklılık göstermektedir. 7) Lojistik işletmelerinin stratejileri bulut bilişim uygulamalarını benimseme kararı açısından farklılık göstermektedir. 8) Algılanan faydalar lojistik işletmelerinin bulut bilişim benimseme kararını olumlu etkilemektedir. 9) Algılanan riskler lojistik işletmelerinin bulut bilişim benimseme kararını olumsuz etkilemektedir. 10) Hizmet sağlayıcılar lojistik işletmerin bulut bilişim uygulama kararını olumsuz etkilemektedir. 11) Lojistik işletmeler ile ilgili yasal süreçler bulut bilişim uygulama kararını etkilemektedir. 12) Gelişmekte olan teknolojilerle uyumlu olma zorunluluğu lojistik işletmelerin bulut bilişim uygulama kararını olumlu etkilemektedir. 13) Lojistik işletmeler tarafından algılanan sektör algılamalrı bulut bilişim benimseme kararını olumlu etkilemektedir.*

*Araştırma gelişmekte olan bir ülkede bulut bilişim uygulamalarının kullanımı ile ilgili boyutları inceleyen az sayıdaki çalışmadan biridir. Araştırma bulut bilişim ve lojistik literatürünün her ikisine de katkı sağlamaktadır.*