

UNDERSTANDING DETERMINANTS OF CLOUD COMPUTING ADOPTION USING AN INTEGRATED DIFFUSION OF INNOVATION (DOI)-TECHNOLOGICAL, ORGANIZATIONAL AND ENVIRONMENTAL (TOE) MODEL

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Abstract

Purpose of the study: This study aims to investigate the internal and external factors for CC adoption decisions of companies in Izmir, Turkey using a combination of DOI and TOE models.

Methodology: This is a confirmatory survey of businesses, forming a questionnaire for 176 IT decision-makers of non-cloud or cloud user businesses in the city of Izmir in Turkey. SmartPLS 3.0 software is used to assess the determinants affecting cloud computing adoption.

Main Findings: The study identified relative advantage, compatibility, complexity, and top management support, using security and privacy concerns and cost savings as mediating variables of relative advantage for CC adoption. The survey results indicated that complexity and top management supports are significantly important for efficient CC adoption. The model explained 41.2 percent of CC adoption.

Applications of this study: The study is believed to be useful in fields including business development for most sectors, computing, cloud providers as well as researchers on business administration, sales, marketing, and IT infrastructure. Particularly this study and the suggested framework will help companies and businesses adopt CC appropriately. Moreover, as suggested in the study, governments can use such frameworks when encouraging cloud providers to support companies in their decision making and transition periods for CC adoption.

Novelty/Originality of this study: This study will undoubtedly contribute to the decision making processes of the companies for CC adoption. Through the integrated in-depth analysis of the factors that affect the adoption decisions in an industrial region of Turkey, the study will also provide valuable data for the researchers and businesses within similar company personas.

Keywords: *Cloud Computing, IT Adoption, Cloud Computing Adoption, Diffusion of Innovation, Technological, Organizational and Environmental, Confirmatory Factor Analysis.*

INTRODUCTION

In-house or traditional computing is generally known as the infrastructure of information technology (IT) departments embedded in manufactures, firms or offices with centralized control of companies. It includes licensed computing products such as servers, storage devices, central processing unit (CPU) and bandwidth use, tools such as operating systems, software and applications that belong to the company's property. This brought up issues of time management, budget management difficulty due to covering IT team needs and switching costs of newer technology in case of updating it (Chulkov, 2017). As a result, traditional computing tends to increase IT expenses and overall costs with more experienced user's needs in businesses unless the company has an experienced IT department.

Cloud computing is mainly described as the infrastructure of IT departments settled in manufactures, firms or offices or outside the manufacturers, firms or offices with centralized control of cloud providers. It has internet-based computing services rented from cloud providers based on the needs of servers, storage devices, CPU and bandwidth use, tools such as operating systems, software and applications. This caused the dependency of cloud providers and data migration issues in case of changing the service provider. However, cloud computing provides an opportunity for companies to just focus on the market and cost-effectiveness without setting up an experienced IT department.

The decision of IT infrastructure (In-house Computing or Cloud Computing) is significant for the top manager and IT decision-makers to set up the most appropriate IT departments. With internet advancements and increasing business needs, cloud computing is an inevitable technology for businesses.

Turkey is ranked as 10th in Europe and 20th globally in terms of overall information and communication technologies (ICT) sector (Deloitte, 2016). The CC market in Turkey has a sharp growth of 37.03% between 2014 and 2019 (Technavio, 2018). CC adoption in Turkey is still in the early phase and the emerging market of CC in Turkey is evolving. Thus, it is important to understand the factors that encourage companies to adopt CC.

LITERATURE REVIEW

CLOUD COMPUTING (CC)

There has been no specific definition of CC until 2007 ([Bento & Bento, 2011](#); [Wang et al. 2010](#)). [Wang et al., \(2010\)](#) defined CC as a mixture of grid computing, software engineering, and database. [Bento & Bento\(2011\)](#) also described as a virtualized technology of the internet. Since 2008, there have been narrower definitions of CC. The first popular broad definition known by National Institute of Standard Technology (NIST) is that “*CC is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction*” ([Mell & Grance, 2011, p.6](#)). [Lian, Yen, & Wang\(2014\)](#) described CC as the fifth utility after water, power, phone, and gas.

There are four classification of CC studies: by research types, by conceptualization and definition of CC, by business benefits and barriers, by market research and the factors affecting CC adoption ([Alkhalil, Sahandi, & John, 2017](#)).

The first classification is the research types. One of the research types is the exploratory study ([Carcary et al.2014](#); [Irshad et al., 2015](#)). The second type is the descriptive study ([Vasiljeva, Shaikhulina, & Kreslins, 2017](#); [Yuvaraj, 2016](#)). The third type is confirmatory studies ([Pathan et al., 2017](#); [Senyo, Effah, & Addae, 2016](#)). The fourth type is case-based research([Jones, 2015](#); [Tripathi & Nasina, 2017](#)).

The second classification is the conceptualization of CC([Rosati et al. , 2017](#); [Stieninger & Nedbal, 2014](#)). Potential and challenges of CC were mentioned by [Creeger\(2009\)](#) and [Jones\(2015\)](#). Requirements of CC were explained by [Creeger\(2009\)](#) and [Iyer\(2014\)](#). Consequences of CC were observed by [Akar & Mardikyan\(2016\)](#), [Creeger\(2009\)](#), [Cusumano\(2010\)](#), [Hoberg, Wollersheim, &Krcmar\(2012\)](#), [Leimeister et al. \(2010\)](#), and [Son et al., \(2011\)](#). Risks of CC were indicated by [AlZain et al. \(2012\)](#) and [Iyer\(2014\)](#).

The third classification is business benefits and barriers of CC ([Aljabre, 2012](#); [Garrison, Wakefield, & Kim, 2015](#); [Marston et al., 2011](#); [Trigueros-Preciado, Pérez-González, & Solana-González, 2013](#)). SWOT analysis of CC for different types of sectors was explained by [Perdana& Suharjito \(2017\)](#), and [Tripathi & Nasina\(2017\)](#). PEST analysis was applied by [Antoo, Gobin, & Cadarsaib\(2015\)](#), and [Neves et al. \(2011\)](#).

The fourth classification is market research. There are two categories: organizational and individual. As for the organizational, [Charlebois, Palmour, & Knoppers\(2016\)](#), [Hassan, Nasir, & Khairudin\(2017\)](#) and, [Sallehudin, Razak, & Ismail\(2015\)](#) examined implementation success of technology adoption in specific regions. [Al-Ajmi et al.\(2018\)](#); [Mohammed, Ibrahim, & Ithnin\(2016\)](#); [Tripathi & Singh\(2017\)](#); [Tripathi & Nasina\(2017\)](#) analyzed the fit and viability of CC to enhance the benefits of CC. Diffusion of Innovation (DOI) pioneered by [Rogers\(1983\)](#) and TOE (Technological, organizational and environmental) invented by [Tornatzky& Fleischer \(1990\)](#) were applied to specify the factors influencing CC adoption at the organizational level. For the individual category, [Giyane & Buckley\(2015\)](#), [Mathur & Dhulla, \(2014\)](#), and [Sarah Hashim & Bin Hassan\(2015\)](#) monitored the behavioral intentions to adopt CC. [Ali, Wood-Harper, & Mohamad\(2018\)](#), [Ali, Gongbing, & Mehreen\(2018\)](#), [Arapaci\(2017\)](#), [Moh, et al.\(2015\)](#), and [Yuvraj\(2016\)](#) observed the system usability and the ease of use. Theory of Reasoned Action (TRA) by [Fishbein&Ajzen \(1975\)](#), Technology Acceptance Model (TAM) by [Fred\(1985\)](#) and Unified Theory of Acceptance and Use of Technology (UTAUT) by [Venkatesh & Davis\(2000\)](#) were driven to assess important factors affecting CC adoption at the individual level.

DIFFUSION OF INNOVATION (DOI) THEORY AND ITS STUDIES

Diffusion of Innovation (DOI) theory was pioneered by [Rogers\(1983\)](#) that expresses the five processes of knowledge, persuasion, decision, implementation, and confirmation for the social system environment, including time and communication channel context. [Rogers\(1983\)](#) also clarified that relative advantage, compatibility, complexity, trialability, observability are the key characteristics of explaining the rate of adoption. Trialability and observability factors are not considered using due to the fact that CC studies in DOI theory are a technology that is focused on the system adoption, not the process adoption ([Sahin, 2006](#)). The disadvantage of this theory is that the external environment is excluded from the adoption ([Lyytinen & Damsgaard, 2001](#)).

There are three DOI studies of CC adoption. One of the studies has been made to Malaysian small and medium companies (SMCs) by [Hassan & Nasir\(2017\)](#). It was a quantitative survey that was asked 137 mid-to-senior level of executives in Malaysian SMEs and a factor analysis approach was designed to assess factors affecting the adoption. [Hassan & Nasir\(2017\)](#) inferred that complexity negatively influenced adoption. The second study was investigated through genomics research by [Charlebois et al.\(2016\)](#) in Germany. It was a qualitative survey that administered 20 semi-structured interviews with genomic researchers, cloud service providers and patient advocates to understand how key stakeholders manage the various ethical and legal issues while adopting CC in Canada, Germany, Spain, UK, US east and US west. [Charlebois et al. \(2016\)](#) concluded that trust issues played a key role in the adoption. The third and the last research was conducted by [Sallehudin, Razak, & Ismail\(2015\)](#) through the public sector of Malaysia. It was a survey of 730 IT officers in Malaysian

ministries and government bodies. Perceived advantages, compatibility and IT knowledge had a huge impact on the adoption.

TECHNOLOGICAL, ORGANIZATIONAL AND ENVIRONMENTAL (TOE) MODEL AND ITS STUDIES

Technological Organizational and Environmental (TOE) Framework is often used as a significant indicator in the CC adoption theories.

There are several studies adopted the TOE framework. [Al-Hujran et al.\(2018\)](#) did a qualitative research approach to identify the main challenges of services by six in-depth interviews for developing countries and found that perceived relative advantage, security, privacy, trust, and compatibility found significantly important in a technological context. The integration requirement was accepted as an important indicator in an organizational context. [Ahmad & Waheed\(2015\)](#) carried out qualitative exploratory research, analyzed with NVIVO tool for implementing a successful cloud environment in IT and Telecom sector for developing countries and found that data backup, social media, remote access, storage, and ease of use affect CC adoption in a technological context. Knowledge management, CRM, document collaboration and licensing were significant organizational factors. Awareness, user training and electricity shortfall were found as affecting the adoption externally. [Alshamaila, Papagiannidis, & Li\(2013\)](#) did qualitative exploratory research by conducting semi-structured interviews with 15 different SMEs in the northeast of England to contribute SMEs to a competitive advantage over large enterprises (LE). Relative advantage, compatibility, complexity, trialability, observability, uncertainty, geo-restriction, security concerns and cost savings influence the adoption in technological context. Firm size, top management support and innovativeness prior IT experience significantly affected adoption in organizational context. Market scope, supplier computing support and industry types were found as significant factors for environmental context. [Bhuyan & Dash\(2018\)](#) conducted quantitative exploratory research with 250 Indian hospitals running multiple regression analyses for Indian hospitals to increase the awareness issues of adoption and found that technical barriers had a significant impact on CC adoption in a technological context. Human resources and costs influenced the adoption in an organizational context. [Bhuyan & Dash\(2018\)](#) identified legal and regulatory factors as a neutral effect in the environmental context. [Karkonasasi et al.\(2016\)](#) carried out quantitative ANOVA analysis in 41 companies administering a 25 question survey to Malaysian SMEs. Security, privacy and reliability of the cloud were significant factors in the technological aspect. Top management support was a significant factor in the adoption of the organizational aspect. [Gutierrez, Boukrami,&Lumsden\(2015\)](#) conducted a quantitative study including logistic regression analysis through 257 business and IT professionals to determine the factors affecting managers' decisions in UK organizations. Complexity directly affected the adoption in the technological aspect. Technological readiness was only significant in the organizational aspect. Trading partner pressure was accepted as an environmental aspect. [Hassan et al.\(2017\)](#) did quantitative research through 90 Malaysian SMEs in service sector to examine the importance of top management support and employee knowledge on CC adoption. The perceived benefit of adoption was accepted as a technological factor. IT resources were found important for organizational aspects. External pressure was considered an important factor in the environmental aspect. [Pathan et al.\(2017\)](#) did multiple regression and confirmatory factor analysis (CFA) to test the CC adoption model in Pakistani SMEs. Relative advantage, compatibility and complexity affected the adoption in technological context. Managerial support and firm size influenced the adoption as an organizational factor. Competitive pressure and regulatory support were found as important factors in environmental context. [Akhusama & Moturi\(2016\)](#) applied regression analysis to 33 CRM and SaaS users for Kenyan insurance sector. [Akhusama & Moturi\(2016\)](#) affirmed that characteristics of available CC Technology had primarily significant impact on adoption in technological aspect. Structures and processes of e-client critically affected the adoption in organizational aspect. Clients, competitors and regulations were significantly important in environmental aspect.

INTEGRATED DOI AND TOE THEORY AND ITS STUDIES

There is an integrated framework of DOI and TOE model to explore, assess and determine the factors and barriers of CC adoption.

There is an integrated framework of DOI and TOE model to explore, assess and determine the factors and barriers of cloud computing adoption ([Oliveira, Thomas.& Espadanal, 2014](#); [Amini & Bakri, 2015](#); [Alismaili et al., 2016](#); [Alkhalil, Sahandi.& John, 2017](#); [Deil & Brune, 2017](#); [Almubarak, 2017](#); [Bhuyan & Dash, 2018](#)).

In Indian private hospitals, [Bhuyan&Dash\(2018\)](#) applied a quantitative-based study including a confirmatory factor analysis to 189 IT implementation and user experts. [Bhuyan&Dash\(2018\)](#) asserted that relative advantage, compatibility, and complexity were assessed and all were accepted for DOI theory. Technology readiness selected as a technological framework of TOE theory and was proved that it significantly affected the adoption. Top management and organizational size influenced as an organizational framework of TOE theory and were proved. Competitive pressure was introduced as an environmental factor and was not supported.

In UK companies, [Alkhalil, Sahandi.& John\(2017\)](#) did a quantitative and qualitative based 6 based question interview to 12 interviewees, exploratory and confirmatory factor analysis to form the decision model to migrate through cloud computing. [Alkhalil, Sahandi.& John\(2017\)](#) reported that relative advantage, complexity, trialability, and probable risks were investigated and all supported except trialability determinant. Compatibility and firm size were selected as technological determinant and compatibility were only supported. Technology readiness, internal social network, external

social network and top management support were specified as organizational determinants and internal social network and top management support were found significantly important. Increasing provider's configuration, regulation, uncertainty regarding the market were selected as environmental determinants and were not supported.

In Portuguese companies, [Oliveira, Thomas, & Espadanal\(2014\)](#) applied quantitative confirmatory factor analysis and multiple regression analysis from 369 firms in Portugal companies for the manufacturing and service sector. [Oliveira, Thomas, & Espadanal\(2014\)](#) asserted that unlike security concerns, cost savings, relative advantage, complexity and cost savings, relative advantage and complexity were only supported. Technology readiness was the only determinant of the technological framework and accepted. Top management support and firm size were also the determinants of organizational framework and both were accepted. Competitive pressure and regulatory support of environmental framework were not accepted. For manufacturing sector, cost savings, relative advantage and technology readiness factors are significantly important for the adoption. For the service sector, cost savings, complexity, technology readiness, top management support and firm size have a huge influence on the adoption.

In Saudi university hospitals, [Almubarak\(2017\)](#) designed a qualitative and quantitative model approach to 4 Saudi university hospitals and applied ANOVA and Sidak tests to analyze the factors influencing the adoption. [Almubarak\(2017\)](#) acknowledged that relative advantage and compatibility of DOI theory were found important for CC adoption. Decision maker's context such as Innovator's innovativeness and Innovator's knowledge in IT were accepted as important determinants. Top Management Support and organizational readiness were found significantly important determinants. Environmental factors such as competitive pressure and regulations and rules were not accepted.

In Australian SMEs, [Alismailli et al.\(2016\)](#) did a qualitative multi-criteria decision Approach (MCDA) from 15 organizations to rank the criteria affecting the cloud computing adoption. [Alismailli et al.\(2016\)](#) affirmed that security and privacy and cost savings were found significantly important for CC adoption. Competitive pressure was the only factor that not considered as affecting CC adoption.

In German SMEs, [Deil & Brune\(2017\)](#) formed a qualitative semi-structured interview design from 16 German SMEs, using the MAXQDA 11Plus software tool for PaaS users. For PaaS, [Deil & Brune\(2017\)](#) stated that Relative advantage, complexity, and compatibility were important determinants of DOI theory. Technological readiness and fast broadband internet access were selected as technological determinants and fast broadband internet access was the only supported factor. From an organizational aspect, top management support, support of non-it employees and firm size were selected as determinants and top management support was the only determinant to be accepted. Competitive pressure and regulatory support of environmental factors were not supported.

In Malaysian SMEs, [Amini & Bakri\(2015\)](#) did a secondary research analysis from literature. [Amini & Bakri\(2015\)](#) expressed that relative advantage, compatibility, security concerns, cost savings were significant determinants of DOI theory. Technology readiness was an important factor in the technological framework for CC adoption. Top manager support was a significant factor in an organizational framework. Competitive pressure and regulatory support were supported.

PROPOSED FRAMEWORK

DOI Constructs

Relative advantage is defined as “*the degree to which an innovation is perceived as being better than the idea it supersedes*” ([Rogers, 1983, p. 15](#)). Economic profitability, social prestige, and benefits of technology are expressed as the degree of relative advantage. The more companies have a fast rate of adoption, the more possibility of CC adoption companies will have. The more companies have security and privacy concerns, the less level of relative advantage companies will have. The more companies have cost savings, the high level of relative advantage companies will have.

H1: Relative advantage (RA) will positively affect cloud-computing adoption.

H1a: Security and privacy (SPC) concerns will negatively affect the relative advantage of CC

H1b: Cost savings (CS) will positively affect the relative advantage of CC.

Complexity is described as “*the degree to which CC is perceived as being relatively difficult to understand and use*” ([Rogers, 1983, p. 15](#)). The least companies have complexity, the less possibility of CC adoption companies will have.

H2: Complexity (COMPX) will negatively affect cloud-computing adoption.

Compatibility is defined as “*the degree to which CC is perceived as consistent with the existing values, past experience, and needs of companies*” ([Rogers, 1983, p. 15](#)). The more companies have compatibility, the more possibility of CC adoption companies will have.

H3: Compatibility (COMP) will positively influence cloud-computing adoption.

TOE Constructs

Technological context concerns with increasing the amount of organizational productivity. Technological Readiness is described as “technology characteristics availability in the organization for the adoption of technology” (Oliveira, Thomas, & Espadanal, 2014). The more companies have technological readiness, the more possibility of CC adoption companies will have.

H4: Technological readiness (TR) will positively affect cloud-computing adoption.

The organizational context deals with resource availability over CC adoption. Top Management Support is defined as “the decision-makers who influence the adoption of innovation” (Lai, Lin, & Tseng, 2014). Firm size is considered to be one of the main factors affecting innovation (Lippert & Govindrajulu, 2006; Son et al., 2011). The more companies have top management support, the more possibility of CC adoption companies will have. The more companies have a firm size, the more possibility of CC adoption companies will have.

H5: Top management support (TMS) will positively affect cloud-computing adoption.

H6: Firm size (FS) will positively affect cloud-computing adoption.

Environmental context exhibits the ability to access resources compared with competitors and interactions with the government. Competitive pressure, business partner, external supports are the key attributes of CC adoption in the environmental context (Alhammadi, 2016). The more companies have a competitive pressure, the more possibility of CC adoption companies will have. The more companies have regulatory support, the more possibility of CC adoption companies will have.

H7: Competitive pressure (CP) will positively influence cloud-computing adoption.

H8: Regulatory support (RS) will positively influence cloud-computing adoption.

Each observed variable tested the unobserved variables built by Oliveira, Thomas, & Espadanal (2014)’s model as shown in Figure 1.

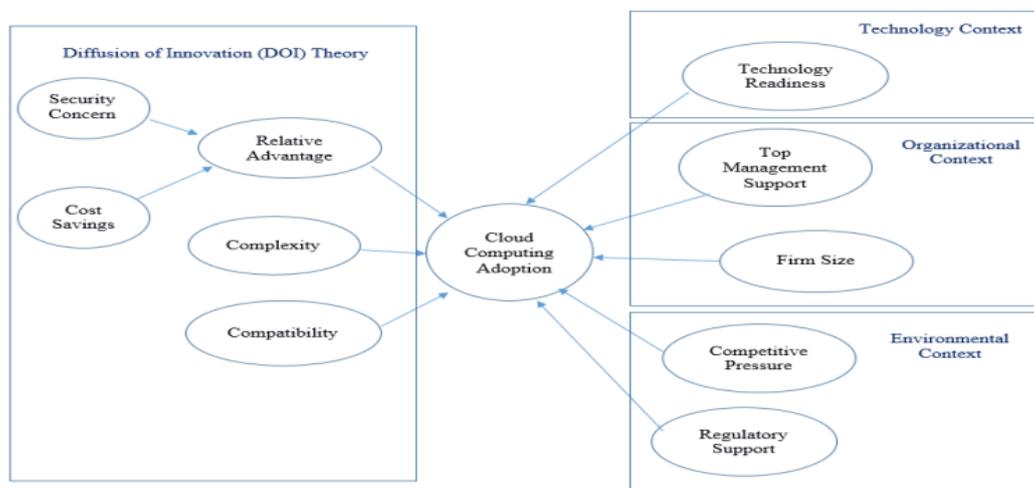


Figure 1: Research model

Source: Oliveira, Thomas, & Espadanal(2014).

METHODOLOGY

A survey was conducted in Izmir that is the third most populated city in Turkey. A questionnaire was developed from Oliveira, Thomas, & Espadanal(2014)’s work from the literature. 25 questions were asked. 21 out of 25 questions were Likert scale measurement that was used on levels ranging from “strongly disagree” to “strongly agree”. 4 out of 25 questions were about company features of Izmir that are company size, sector, market scope, and IT decision obtained from Gutierrez, Boukrami, & Lumsden(2015) and Oliveira, Thomas, & Espadanal(2014)’s work. The proposed random sampling method has been used to specify companies as an adopter or non-adopter in Izmir.

The unit of analysis is at the organization level in Turkey. The respondents are IT decision-makers or entrepreneurs of companies. Data is collected from companies from mid-2018 to early 2019 in Izmir by doing an online questionnaire via Google Forms. 506 companies were selected from the Izmir Chamber of Commerce and Aegean Chamber of Commerce and they were sent e-mails to gather data. 176 companies responded validly. Company characteristics are shown in Table 1.

Structural Equation Modelling (SEM) was used to assess the research model. Confirmatory factor analysis technique was applied to obtain the results of the hypothesis. SmartPLS 3.0 software was used to gather data empirically. Firstly, reliability and validity tests were measured for measurement model 1 and measurement model 2 to apply to the structural model. Secondly, after reliable and valid factors were assessed, CR (t) values were either higher or less than ± 1.96 . Those exceeding 1.96 were accepted factors. Finally, the fit model was set and it is shown in Table 3 with correlation matrices.

Data

Data were collected from the cloud (56.8 %) and non-cloud adopters (43.2 %) companies. Market regions of the sample were (59.1%) at international and (40.9 %) at national. Sectors of the sample were in the production sector (24.4%) and in the service sector (75.6%). 65.9 %, 34.1 %, 21.0 % and 11.4 % of companies were micro-sized companies, small-sized companies, medium-sized companies and large-sized companies, respectively.

Table 1: The company features characteristics (n=176)

Company Features	Frequency	Percent
Company Size		
Micro Size (1-9)	64	65,9
Small Size (10-49)	55	34,1
Medium Size (50-249)	20	11,4
Large Size (249 and above)	37	21,0
Sector		
Production Sector	43	24,4
Service Sector	133	75,6
Market Scope		
National	104	59,1
International	72	40,9
IT Decision		
Cloud Adopter	100	56,8
Non-Cloud Adopter	76	43,2

Source: Developed by authors

Reliability and Validity

Validity and reliability measures were taken to show how accurately the construct reflects what it intends to measure and show the consistency of the results obtained, respectively. All items were found as reliable and valid.

For the integrated DOI and TOE model, the composite reliability (CR) values, as shown in Table 2, described which the construct indicators indicated the latent construct and they ranged from 0.838 to 0.970. These indicators exceeded the recommended value of 0.7 (Arifin, 2018). In addition, the average variance extracted (AVE), which reflected the overall amount of variance in the indicators accounted for by the latent construct, ranged between 0.721 and 0.943. These indicators exceeded the recommended value of 0.5 (Arifin, 2018). Moreover, the Cronbach's alpha (CA), which reflected the overall amount of variance in the indicators accounted for by the latent construct, ranged between 0.622 and 0.939. These indicators exceeded the recommended value of 0.7 (Bonett & Wright, 2015).

As a result, FS and RS were eliminated as there was the only indicator left to measure factors. TR and CP were also eliminated due to the fact that Cronbach's alpha values of TR and CP were below this level. The average variance extracted (AVE), the composite reliability (CR) values and the Cronbach's alpha (CA) were also in the expected values for validity and reliability in Table 2. CR, AVE and CA scores exhibited that RA, SPC, CS, COMPX, and COMP of DOI theory and TMS of TOE theory can be measured for a structural model.

Table 2: Reliability and validity of constructs for the DOI model (measurement model 1) and TOE model (measurement model 2)

1-DOI	CR	AVE	Cronbach's Alpha
RA 4 Items left (5 Items)	0.917	0.736	0.939
SPC (3 Items)	0.919	0.79	0.871
CS 2 Items left (3 Items)	0.838	0.721	0.622
COMPX 3 Items left (4 Items)	0.909	0.769	0.851

COMP (4 Items)	0.93	0.768	0.9
CCA (2 Items)	0.97	0.943	0.939
2- TOE	CR	AVE	Cronbach's Alpha
TMS (3 Items)	0.9	0.75	0.835
CCA (2 Items)	0.97	0.943	0.939

Source: Developed by authors

RESULTS

There are three independent constructs (COMP, COMPX, and TMS) and one dependent constructs (CCA) in the result section.

Construct of TMS (top management support) is measured by TMS1 (taking part in the cloud adoption process), TMS2 (strong leadership and engagement) and TMS3 (risk involvement). This result's loading items are 0.911, 0.836 and 0.849, respectively.

Construct of COMP (compatibility) is measured by COMP1 (workstyle fit), COMP2 (compatible with current business operations), COMP3 (compatible with the company's corporate culture and value system) and COMP4 (compatible with existing hardware and software in the company). This result's loading items 0.909, 0.869, 0.863 and 0.865, respectively.

Construct of COMPX (complexity) is measured by COMPX1 (a lot of mental effort requirement), COMPX3 (complex for business operations) and COMPX4 (complex for employees of the firm). This result's loading items are 0.785, 1.085 and 0.897, respectively. COMPX2 (complexity frustrates the company) excluded from the study because the loading item is 0.585. Item's loading item exceeded the recommended value of 0.6 (Yahya, Arshad, & Kamaluddin, 2015).

CCA is measured by CCA1 (The number of cloud applications used) and CCA2 (When is cloud adoption planned to use). This result's loading items are 0.969 and 0.972, respectively. All constructs are linked to CCA construct as shown in Figure 2. Model fit, correlation matrices and structural model results are explained below.

Model Fit

The model first was observed for 176 respondents and the results showed that this model has still a SRMR (Standardized Root Mean Square Residual) value of 0.065, which is below 0.08 mentioned by Asparouhov & Muth(2018) and that was a reasonable fit, as shown in Table 3.

Correlation Matrices

The correlation matrices in Table 3 showed the highest level of correlation was between constructs COMP and TMS (0.552). The following high correlations were between COMP and CCA (0.457) as well as TMS and CCA (0.455).

Table 3: Factor correlations matrices of Integrated DOI and TOE model (Structural model) with the square root of the Ave on the diagonal and Fit Model

	COMP	COMPX	TMS	CCA	Fit Model	Values
COMP	1				Chi-Square	243.14
COMPX	0.27	1			SRMR	0,065
TMS	0.552	-0.198	1		NFI	0,839
CCA	0.457	-0.273	0.455	1		

Source: Developed by authors

To test the proposed hypotheses, the measurement model 1 (DOI model) and measurement model 2 (TOE model) were converted to a structural model in SmartPLS 3.0 (Fig.2). Using a standardized regression weight table, the results were exhibited (Table 4). 12 items with 4 factors were in the structural model (Fig. 2).

Structural Model Results

CC adoption using DOI and TOE resulted in $R^2 = 0.412$, i.e. the variables described above in Figure 2 explained 41.2 percent of the variance of CC adoption. For the structural model illustrated in Table 4, the first construct of CC is complexity (H2) is accepted ($p < 0.05$). The second construct of CC is compatibility (H3) is not accepted. The third construct of CC is top management support (H5) is accepted ($p < 0.01$).

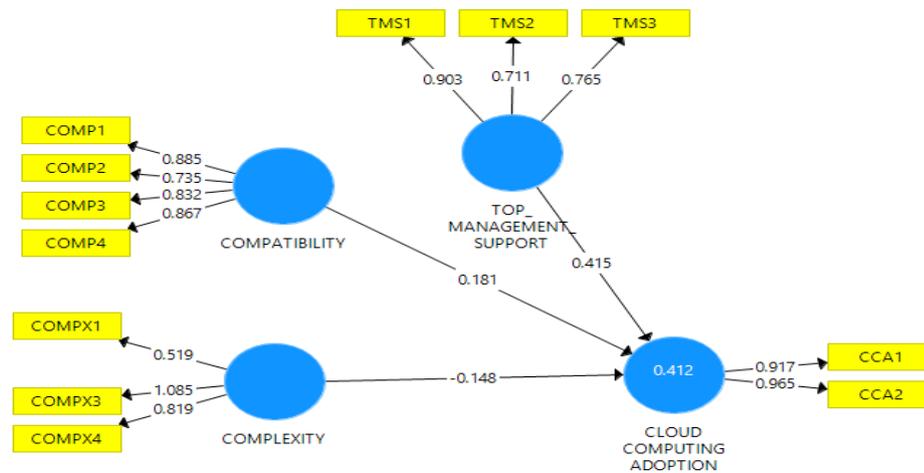


Figure 2: Structural Model in SmartPLS

Source: Developed by authors

Table 4: An Integrated DOI and TOE theory: Constructs for the Structural model

CONSTRUCTS	Path Coefficients	T- Value	Results
H2-COMP (DOI)	0.181	1.151	NOT ACCEPTED
H3-COMPX (DOI)	-0,141	2.260**	ACCEPTED
H5-TMS (TOE)	0.415	2.622***	ACCEPTED
R² 0.412			

Significance at $p < 0.10$ (*), Significance at $p < 0.05$ (**), Significance at $p < 0.01$ (***)

Source: Developed by authors

DISCUSSION

Cloud Computing (CC) plays an important role for businesses in Izmir. This breakthrough technology is spreading but it is still at the early phase

H3: Complexity will negatively influence the CC. (Accepted)

The results performed that complexity for companies in Izmir has a significant hindrance to CC adoption. Cloud systems implementation and running take almost 24 hours instead of six months like traditional computing. The integration and implementation of cloud systems might be hard to use for IT staff in companies. The use of the cloud system is challenging for the non-IT staff. Hence, it brings the integration of complexity issues. The best way to prevent complexity is the lack of legacy systems in companies and high IT governance with interoperability standards. The government should pass laws for a trustworthy environment and policies and the cloud providers might be encouraged to show the clear roadmap to companies individually. Cloud providers should offer trials for companies by complying with regulations, standards, and company policies. Companies might have low awareness of the benefits of this technology. Audit trail meetings should be conducted between the cloud providers and companies to reach a risk-free implementation of cloud solutions. As a result, companies should make a trade-off among the spending time on the trial of this technology with the existing infrastructure with a temporarily high level of IT staff; permanently high level of non-IT staff and with spending time on traditional computing with a permanently high level of IT staffs.

H5: Top management support will positively influence the CC (Accepted)

Top managers must take part in the process of CC adoption actively and form the IS human resource depending on the company's IT needs.

Top managers should be aware of the benefits of this technology and specify a clear vision for the company.

They must create a positive environment for CC adoption by supporting a vision and commitment. They must also know the capabilities and limitations of IT staff. They should conduct market analysis for the adoption and benchmark the competitors to align their businesses with the technology. They should train the staff based on the specific cloud services

which are in use.

In addition, they should be aware of upcoming technologies so that the company will be ready for the integration process in the future with the current one

In the analysis phase, top management should interview the companies who deal with IT infrastructure and should consult with IT decision-makers of the company for available tools and applications conforming to the company's needs. In the design phase, top management should choose a cloud technology, plan the budget and design the process of adoption and migration with IT decision-makers. In the adoption phase, top managers should first select the software and secondly set up the servers with recommended hardware requirements. Finally, they should create the routing with the intranet and install a firewall.

CONCLUSION

Due to the increase in information technology costs and growing data of companies, CC adoption has become of utmost importance and also a challenge for businesses to coordinate IT departments for business processes. Since the utilization of CC in business has become a great advantage for companies and business owners in terms of cost-effectiveness and increased operation pace, companies, which undergo such processes, need to follow a guideline that includes evaluation of all criteria affecting the adoption process either positively or negatively. The proposed CC adoption framework in this paper, suggests an evaluation model combining and selecting from among ten constructs by integrating five constructs from DOI and five constructs from TOE theory. The results indicate that serious consideration of the proposed framework and combined constructs by the decision-makers will help companies undergo a smooth and safe transition to CC utilization, and also, will minimize the risk of dependency to CC providers.

LIMITATION AND STUDY FORWARD

This model is likely to be an area of future studies, which can then be applied not only to a local area of Turkey but also nationwide. The research could be done separately on either business or their sizes within sectors of the countries or in a combined way(s). Environmental factors such as competitive pressure and regulatory support and technological factors such as firm size and technological readiness significantly matter and must be taken into consideration as well.

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