DIGITAL TRANSFORMATION:

A MUTUAL UNDERSTANDING

AND STRATEGIC ALIGNMENT PERSPECTIVE

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DECLARATION OF ORIGINALITY

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ABSTRACT

Digital Transformation:

A Mutual Understanding and Strategic Alignment Perspective

Previous studies have shown a positive impact of mutual understanding on IT strategic alignment and its impact on firm performance. However, digital transformation (DX) is changing the way the business operates, communicate and create value and it is on the top of the agendas of CEOs. While DX requires top management support and commitment, no previous research has addressed the mutual understanding between C-level managers on the role of DX, its impact on strategical alignment and contribution of it to firm performance. This research aims to fill this gap. For this, the work of Johnson and Lederer (2010) is extended and previously validated IS instruments are adapted to DX by reviewing the literature and by making in-depth interviews with CIO/CDOs of 4 international companies and 2 IS academics. This research extended the theories of mutual understanding and IT strategic alignment to quantitatively assess the role and contribution of DX. Survey data collected from 45 companies, where 45 CEOs and 123 CxOs participated. Mutual understanding of the role of DX led to DX strategic alignment at aggressiveness, proactiveness, internal and external defensiveness dimensions. On the other hand, aggressiveness, analysis, and internal defensiveness dimensions improve DX contribution metrics. This research also shows that the greatest mutual understanding on the role of DX is between C-level managers primarily in the manufacturing sector in accordance with Industry 4.0. This research will help organizations increase interaction, communication, and collaboration between

different departments and raising awareness about the importance and impact of DX on companies' success.

ÖZET

Dijital Dönüşüm:

Ortak Anlayış ve Stratejik Hizalama Perspektifi

Önceki çalışmalar, ortak anlayışın, bilişim sistemleri (BS) stratejik uyumu ve bunun firma performansına katkısı üzerinde olumlu etkisi olduğunu göstermiştir. Bununla birlikte günümüzde, dijital dönüşüm (DX) CEO'ların gündeminin zirvesinde yer alarak iş yapma, iletişim kurma ve değer yaratma şeklini değiştiriyor. DX üst düzey yönetim desteği ve bağlılığı gerektirmesine rağmen, daha önce yapılan hiçbir araştırma, DX'in rolü ve şirket performansına katkısı konusunda üst düzey yöneticiler arasındaki karşılıklı anlayışı ele almadı. Bu araştırma, DX'in rolü konusunda üst düzey yöneticiler arasındaki karşılıklı anlayışı, stratejik uyum üzerindeki etkisini ve son olarak firma performansına katkısını ölçerek bu açığı doldurmayı amaçlamaktadır. Bu amaçla, Johnson ve Lederer'in (2010) çalışmalarını genişleterek ve daha önce geçerliliği doğrulanmış olan BS enstrümanlarını dijital strateji konusundaki literatürü gözden geçirerek ve 4 uluslararası şirketin CIO/CDO'ları ve 2 BS akademisyeni ile derinlemesine görüşmeler yaparak uyarladık. Bu araştırma, DX'in rolünü ve katkısını nicel olarak değerlendirmek için ortak anlayış ve BT stratejik uyum teorilerini genişletmektedir. Anket verileri, 45 CEO ve 123 CxO'nun katıldığı 45 şirketten toplanmıştır. DX'in rolünün karşılıklı olarak anlaşılması, girişkenlik, proaktiflik, dahili ve harici koşullar boyutlarında DX stratejik uyumu ile sonuçlandı. Öte yandan, girişkenlik, analiz ve dâhili koşullar DX şirket performans ölçütlerini iyileştirdi. Bu araştırma aynı zamanda DX'in rolü konusundaki üst düzey yöneticiler arasındaki en büyük karşılıklı anlayışın, Endüstri 4.0 ile ilişkili olarak imalat sektöründe olduğunu göstermektedir. Bu araştırma,

kuruluşların farklı iş birimleri arasındaki etkileşimi, iletişimi ve iş birliğini artırmalarına ve DX'in şirketlerin başarısı üzerindeki önemi ve etkisi konusunda farkındalık yaratmalarına yardımcı olacaktır.

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ABBREVIATIONS

AGG: Aggressiveness

ANA: Analysis

AVE: Average Variances Extracted

CCO: Chief Commercial Officer

CDO: Chief Digital Officer

CEO: Chief Executive Officer

CFO: Chief Financial Officer

CHRO: Chief Human Resources Officer

CIO: Chief Information Officer

CMO: Chief Marketing Officer

COO: Chief Operating Officer

CR: Composite Reliability

CSO: Chief Strategy Officer

CSO: Chief Sales Officer

CSCO: Chief Supply Chain Officer

CTO: Chief Technology Officer

CxO: C level executives in an organization other than CEO.

DX: Digital Transformation

DXCI: Digital Transformation Intangible Contribution

DXCT: Digital Transformation Tangible Contribution

EXT: External Defensiveness

FUT: Futurity

INN: Innovativeness

INT: Internal Defensiveness

PLS: Partial Least Square

PRO: Proactiveness

RDX: Role of Digital Transformation

RIS: Riskiness

CHAPTER 1

INTRODUCTION

DX is changing the way businesses operate, communicate and create value, which is a cross-functional change that requires processes, products and people to change and adapt to new ways of doing business (Earley, 2014; Bharadwaj, Sawy, Pavlou, & Venkatraman, 2013). Andriole (2017) discusses that DX is costly, time-consuming, risky, vague and hard. Therefore, DX requires top management commitment and many businesses are appointing CDO roles responsible for development, refinement and implementing DX strategy, preparing the company for the digital era and managing the mind shift and cultural changes which DX requires (Haffke, Kalgovas, & Benlian, 2016; Singh & Hess, 2017).

Previous research shows that IS contribution increases with higher mutual understanding and strategic alignment between CEO and CIO (Johnson & Lederer, 2010). However, no research has addressed the mutual understanding between C-level managers on the role and contribution of DX. In this regard, this research aims to measure the mutual understanding between top level managers on the role of DX, its impact on strategical alignment and finally contribution of DX. This research follows a similar strategy to study of Johnson and Lederer (2010) and adapt their scale to DX, where the mutual understanding is measured not only between CEO and CIO but also between CDO, CTO, CMO and CFO who may lead the transformation depending on the strategy, scale and industry of the businesses (Singh & Hess, 2017). Yet, there is a research gap about the mutual understanding on the role of DX among all top management and its contribution to the organization. Therefore, this research addresses the following questions: Does mutual understanding about the

role of DX among CEO and all other C level managers (CIO, CDO, CTO, CFO, CMO, and COO) lead to DX strategic alignment across aggressiveness, analysis, internal defensiveness, external defensiveness, futurity, proactiveness, riskiness, innovativeness dimensions? Does DX strategic alignment in these dimensions lead to enhanced DX contribution to the organizational performance? Accordingly, this thesis will contribute to the literature in two ways. First by developing scales to incorporate DX strategy and secondly, once the data is collected, by investigating the mutual understanding and its impact across different functional C-level managers to gain a holistic view of the DX within organizations, which require a drastic change management (Singh & Hess, 2017). Since a shared understanding between CIO and CDO may lead to better value co- creation (Horlacher, 2016), identifying the gaps between all C-level managers on the role and contribution of DX becomes more important for a successful DX. In addition, sectoral and functional differences on the mutual understanding gap will be studied and then individual roadmaps for each sector and functional level in organizations will be proposed.

Although in recent decades DX has gained strategical importance especially in developed countries, it is also becoming indispensable in some developing countries. In developed countries, organizations are already leveraging digital technologies, investing in business models, and processes to gain competitive advantage in a digital economy (Solis, 2016). With the decline in the price of digital technologies, which is one of the drivers of the DX, Turkish companies have already started to plan their DX strategies in various industries (TÜSİAD, 2017). To foster economic growth, Turkey needs to stay in the DX race, and invest in digital technologies and in their people (TÜSİAD, 2018). Therefore, Turkish manufacturing companies needs to plan and implement digital transformation process effectively to

increase their competitive advantage (Ministries of Industry and Technology, 2018). Turkey is in the early stage of this journey and has a long way to follow, however, there are leading companies who already have made DX investments, formed DX study groups, appointed CDOs to manage this transformational process and started gaining competitive advantage. Accordingly, we have chosen Turkish companies as our sample.

For this research an online questionnaire is developed and a sample of 123 pairs of CEO and CxO data is collected from 45 companies coming from 10 different industries. Results of PLS SEM estimation of the developed model show that mutual understanding of the role of DX led to DX strategic alignment at aggressiveness, proactiveness, internal and external defensiveness dimensions. On the other hand, aggressiveness, analysis, and internal defensiveness dimensions improves DX contribution to firm performance.

The rest of the thesis proceeds as follows: chapter 2 presents the literature on IT strategy alignment, its contribution to firm performance and literature on DX strategy. Chapter 3 gives the conceptual model and the hypotheses development. Chapter 4 presents the questionnaire development and methodology, chapter 6 discusses the findings and section 7 and 9 concludes, where theoretical and practical contributions for future research are presented and discussed.

CHAPTER 2

LITERATURE REVIEW

Businesses are transforming their products, processes and business models with the help of digital technologies that are combinations of information, computing, communication, and connectivity technologies (Bharadwaj et al., 2013). Alignment of digital and business strategy is essential in this context (Matt, Hess, & Benlian, 2015). A stream of research has addressed Information Technology (IT) alignment and its impact on the performance of organizations (Chan, Huff, Barclay, & Copeland, 1997; Johnson & Lederer, 2010; Hansen, Kraemmergaard, & Mathiassen, 2011; Akter, Wamba, Gunasekaran, Dubey, & Childe, 2016; Yeow, Soh, & Hansen, 2018). Yet, Digital business strategy is viewed as a combination of IT strategy and business strategy (Bharadwaj et al., 2013), whereas IT strategies have a focus on efficient management and application of IT infrastructure (Hess, Matt, Benlian, & Wiesböck, 2016). Bharadwaj et al. (2013) define digital business strategy as "digital business strategy is not only a matter of internally optimizing the firm's operations or of externally responding to competitors, but that it also arises from a deep awareness and dynamic responsiveness to the competitive environment" (p.479). In other words, digital business strategies define upcoming business opportunities and strategies based on digital technologies (Matt, et al., 2015). Accordingly, DX strategies include transformational and business-centric orientation which lead the way of DX and guides the managers in this process (Hess, et al., 2016).

Changing consumer needs and demands are driving businesses to redefine their value propositions and integrate digital technologies such as big data, artificial intelligence, cloud computing, internet of things, and machine learning to their

business models in order to provide seamless digital experience to their customers (Earley, 2014; Berman & Dalzell-Payne, 2018). Fitzgerald, Kruschwitz, Bonnet, & Welch (2013) discuss that exploring and exploiting these technologies require a new mindset and many companies have made changes in their organizational structures and have assigned CDOs, who will manage the digitization initiatives and formed DX offices, which are composed of DX leaders from different functional departments. There is also a wave of CTO appointments (Horlacher, 2016; Singh & Hess, 2017). CMOs (Chief Marketing Officers) are also expected to play a role in DX (TÜSİAD, Samsung Electronics, Deloitte, & GfK, 2016). Beyond these roles, CEOs should be proactive and lead DX (Newman, 2018). Accordingly, while CDO or CEO appears as the main role to lead the DX, a successful transformation will require cooperation between CIO as well as the CTO, CMO and other C-level managers. Hence, it is essential to understand the gaps between their mindsets. Digital technologies may bring transformational strategic advantages (Berman and Dalzell-Payne, 2018), and aligning the digital strategy and resources will certainly affect the competitiveness and performance of organizations (Yeow et al., 2018). However, while DX is an organizational change, which requires the contribution of the whole company, strategic alignment requires a shared mind set which would positively influence the decision making that would enhance the contributions of DX (Hansen et al., 2011; Johnson & Lederer, 2010; Tan & Gallupe, 2006).

While Andriole (2017) suggests that DX should be sponsored and strongly supported by top management, Horlacher (2016) shows that coordination and mutual understanding between CDO and CIO improves customer experience, business operations and new business opportunities. Furthermore, strategic alignment between

business strategy and IS strategy has a critical impact on company's performance (Chan et al., 1997; Akter et al., 2016).

In a digital world leveraging the crowd of data and information to create distinctive knowledge has vital importance. Granados and Gupta (2013) argue that while customers, suppliers, competitors and other third parties want to be in the reach of information as much as possible, developing an appropriate transparency strategy with selective information disclosure will create competitive advantage for organizations by having strong relationships with these groups.

Exploiting emerging and upcoming digital technologies and integrating them into business processes are creating new business models or reshaping them, improving operational efficiency, value creation to both customers and organizations, enhance customer experience and engagement and gaining competitive advantage (Morakanyane, Grace, & O'Reilly, 2017; Ross, Sebastian, & Beath, 2017; Delmond, Coelho, Keravel, & Mahl, 2016).

CHAPTER 3

THEORETICAL MODEL AND HYPOTHESES

According to theory of mutual understanding when there is a mutual understanding in the firm, coordination, communication and collaboration would be fostered within the organizations (Aranda, 2010). The aim of this study is to first analyze whether there is a mutual understanding between C-level managers on the role of DX, secondly whether there exists a strategic alignment about the role of DX, and finally whether DX contributes to the performance of the firm.

Mutual understanding on the role of DX is adapted from the scale of Raghunathan, Raghunathan, and Tu (1999), while contribution scale is adapted from Premkumar and King (1992). For assessing DX strategic alignment, STROBE scale from Venkatraman (1989), and STROEPIS from Chan et al. (1997) have been used and the eight strategy dimensions to DX have been adapted. The fit between STROBE and corresponding STROEPIS dimensions is used to measure DX strategic alignment similar to Johnson and Lederer (2010). The eight strategy dimensions are aggressiveness, analysis, internal defensiveness, external defensiveness, futurity, proactiveness, riskiness, and innovativeness. Aggressiveness refers to improving market position of an organization and seeking new markets; analysis refers to conducting analysis of business situations for problem-solving and decision making; internal defensiveness refers to improving the efficiency of business operations; external defensiveness refers to empowering relationships with company with customers, suppliers, and distributers ; futurity refers to forecasting and tracking of trends; proactiveness refers to being in the search of new business opportunities; riskiness refers to consideration of risks and willingness to take risk for

outperforming activities, revenues, market position; innovativeness refers to exploiting digital technologies and develop creative and original product and services (Johnson & Lederer, 2013).

Similar to Johnson and Lederer (2010), in this research it is expected that higher mutual understanding between CEO and other C-level managers increase DX contribution via higher strategic alignment. Figure 1 shows the relationships among variables in this research. C-level managers' mutual understanding about the role of DX is an independent variable. Aggressiveness, analysis, internal defensiveness, external defensiveness, futurity, proactiveness, riskiness, and innovativeness are intervening variables; whereas DX contribution to organizations is a dependent variable. Descriptions of the variables and the way how they were operationalized are presented in the table 1.

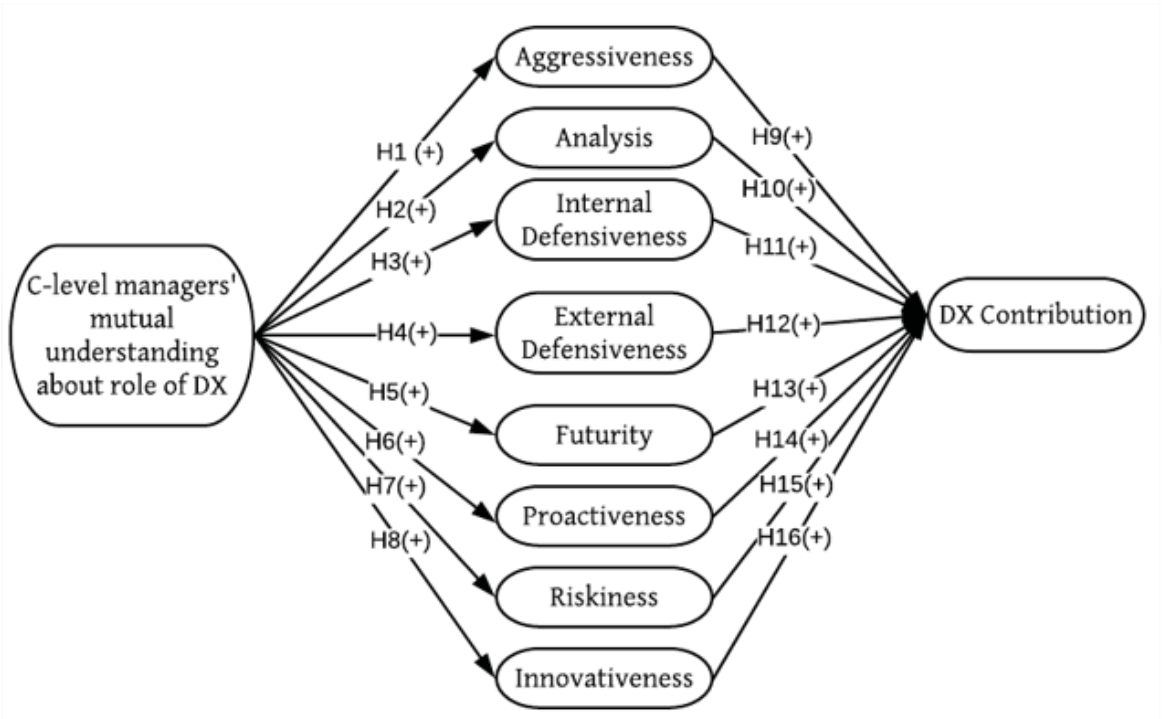

Fig. 1 Theoretical model

Table 1. Key Variable Table

Variable	Description	Operationalization
Mutual understanding about the role of DX	Role of DX measures how leaders are familiar with the concept of DX, the role it has, and the characteristics, drivers, and impacts of it.	Mutual understanding about the role of DX defines shared understanding among all C-level managers about the role of DX. This is measured by the gap between their roles of DX item responses.
Aggressiveness	Aggressiveness DX strategy makes organizations leverage DX to engage in activities which will improve their market position.	Aggressiveness DX strategic alignment dimension is calculated by the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data.
Analysis	Analysis DX strategy makes organizations leverage DX to examine, organize, and present comprehensive, factual information for decision-making,	Analysis DX strategic alignment dimension is calculated by the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data.
Internal defensiveness	Internal defensiveness DX strategy applies to the use of digital solutions to increase productivity of business operations to preserve its market position.	Internal defensiveness DX strategic alignment dimension is calculated by the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data.
External defensiveness	External defensiveness DX strategy helps organizations leverage DX to conduct peripheral activities to preserve the firm's domain.	External defensiveness DX strategic alignment dimension is calculated by the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data.
Futurity	External defensiveness DX strategy enables organizations to leverage digitization to make decisions and conduct activities that reflect long-term consideration.	Futurity DX strategic alignment dimension is calculated by the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data.
Proactiveness	Proactiveness DX strategy includes responding to changing environmental trends prior to competitors.	Proactiveness DX strategic alignment dimension is calculated by the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data.
Riskiness	Riskiness DX strategy applies to the use of DX to help an organization engage in business practices with an uncertain outcome but a potentially high return.	Riskiness DX strategic alignment dimension is calculated by the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data.
Innovativeness	Innovativeness DX strategy applies to the use of DX to help a firm generate creative and imaginative solutions to business problems.	Innovativeness DX strategic alignment dimension is calculated by the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data.
DX Contribution	Contribution of DX to organization performance. It is measured by tangible and intangible elements of DX contribution	It measures to what extent DX has contributed to each of the items for the organization.

Note: Description part (Johnson & Lederer, 2010; Johnson & Lederer, 2013)

3.1 Hypotheses about the relationship between mutual understanding of the role of DX and strategic alignment

According to uncertainty reduction theory, low mutual understanding level between communicators causes greater uncertainty about organizational issues, actions, and attitudes. In the existence of mutual understanding about role of IT, information seeking process for CIO will shorten and CEO and CIO would collaborate and leads to alignment (Johnson & Lederer, 2010). Horlacher (2016) stated that shared understanding between CDO and CIO on the role of digital technologies leads to collaboration of CDO and CIO which will enable DX. DX requires top management commitment and mutual understanding leads to better decision making with the ability of working with different functions in the company (Tan & Gallupe, 2006, Singh & Hess, 2017).

With an underlined aggressiveness dimension of a business strategy, when mutual understanding on the role of DX among top management exists, C-level managers would collaborate to increase their market share with less stress. Therefore, the following hypothesis was proposed:

H1: Mutual understanding about the role of DX among all C-level managers is positively associated to aggressiveness alignment.

With an underlined analysis dimension of a business strategy, organizations take advantage of data, information, and knowledge abundance for better decision making (Bharadwaj et al., 2013; Chan, 1992). When there is a mutual understanding on the role of DX among top management, executives would identify cause of problems and propose various solutions with less effort. Therefore, the following hypothesis was proposed:

H2: Mutual understanding about the role of DX among all C-level managers is positively associated to analysis alignment.

With an underlined internal defensiveness dimension of a business strategy, organizations try to improve the efficiency of their internal processes (Johnson & Lederer, 2010). When mutual understanding on the role of DX among top management exists, top management would collaborate efficiently with less stress, so have more internal defensiveness alignment. Therefore, the following hypothesis was proposed:

H3: Mutual understanding about the role of DX among all C-level managers is positively associated to internal defensiveness alignment.

With an underlined external defensiveness dimension of a business strategy, organizations try to establish strong relationships with their customers, suppliers, and distributors, so that they can preserve their domain in the market (Chan, 1992). When mutual understanding on the role of DX among top management exists, executives would collaborate and have higher external defensiveness alignment. Therefore, the following hypothesis was proposed:

H4: Mutual understanding about the role of DX among all C-level managers is positively associated to external defensiveness alignment.

With an underlined futurity dimension of a business strategy, organizations tend to be future-oriented and focus on long-term planning (Johnson and Lederer, 2010). When mutual understanding on the role of DX among top management exists, executives would be less in the need of information searching and have greater futurity alignment. Therefore, the following hypothesis was proposed:

H5. Mutual understanding about the role of DX among all C-level managers is positively associated to futurity alignment.

With an underlined proactiveness dimension of a business strategy, organizations try to identify, utilize, and implement new revenue models to benefit from market opportunities (Hess et al., 2016). When mutual understanding on the role of DX among top management exists, C-level managers would collaborate efficiently and have greater proactiveness alignment. Therefore, the following hypothesis was proposed:

H6: Mutual understanding about the role of DX among all C-level managers is positively associated to proactiveness alignment.

With an underlined riskiness dimension of a business strategy, organizations engage in business practices with uncertain outcome, but increased return (Johnson & Lederer, 2010). When mutual understanding on the role of DX among top management exists, C-level managers would have greater riskiness alignment. Therefore, the following hypothesis was proposed:

H7: Mutual understanding about the role of DX among all C-level managers is positively associated to riskiness alignment.

With an underlined innovativeness dimension of a business strategy, organizations employ innovative solutions; leverage digitalized innovative products and services (Bharadwaj et al., 2013; Hess et al., 2016). When mutual understanding on the role of DX among top management exists, C-level managers would have greater innovativeness alignment. Therefore, the following hypothesis was proposed:

H8: Mutual understanding about the role of DX among all C-level managers is positively associated to innovativeness alignment.

3.2 Hypotheses about the relationship between alignment and DX contribution to firm performance

To enable DX process, capabilities that digital technologies possess, should be coupled by other factors, such as culture, strategy and digitally savvy human capital. So that, organizations can leverage from value creation to both customers and organizations (Morakanyane et al., 2017). However, existence of alignment between digital strategy and resources has vital impact on the competitiveness and performance of organizations (Yeow et al., 2018).

When there is strategic alignment on DX, this alignment will have tangible and intangible contributions to organizations. Alignment has been conceptualized with eight dimensions in this research. Hence, the following eight hypotheses were proposed:

H9: There is a positive relationship between aggressiveness alignment and DX contribution to organizational performance.

H10: There is a positive relationship between analysis alignment is positively related to DX contribution to organizational performance.

H11: There is a positive relationship between internal defensiveness alignment and DX contribution to organizational performance.

H12: There is a positive relationship between external defensiveness alignment and DX contribution to organizational performance.

H13: There is a positive relationship between futurity alignment and DX contribution to organizational performance.

H14: There is a positive relationship between proactiveness alignment and DX contribution to organizational performance.

H15: There is a positive relationship between riskiness alignment and DX contribution to organizational performance.

H16: There is a positive relationship between innovativeness alignment and DX contribution to organizational performance.

CHAPTER 4

RESEARCH METHODOLOGY

The data of this research is collected via an online survey of paired CEOs and other C-level managers including but not limited to CIOs and CDOs. Accordingly, while there are many qualitative studies in the literature about the DX strategic alignment topic, a quantitative approach was chosen as a data analysis method.

4.1 Scale development

In this study, Johnson and Lederer (2010) model and questionnaire is used and adapted to DX. Initially, the role of IT instrument (Raghunathan et al., 1999; Johnson & Lederer, 2010) was adapted to role of DX and new scale items were added by referring to the value creation and capture properties of DX (Bharadwaj et al., 2013, Morakanyane et al., 2017). Similarly, contribution of IS instrument (Premkumar & King, 1992; Johnson & Lederer, 2010) was adapted to DX by referring to previous works of Chan (1992), Morakanyane et al. (2017), Stieglitz and Brockmann (2012), and Zhu, Dong, Xu, & Kraemer (2006). Finally, the alignment of DX instruments is adapted for the CEO and CxO respectively from STROBE (Venkatraman, 1989) and STROEPIS (Chan et al., 1997) strategy dimensions by referring to digital strategy dimensions discussed in Chan (1992), Bharadwaj et al. (2013) and Hess et al. (2016). Accordingly, while Johnson and Lederer (2010) measurement items were adapted to fit DX context, also new items have been added regarding DX.

The survey items used in this research were adapted from the instrument of Johnson and Lederer's (2010) study, in which the content validity of each scale item was examined. However, to conduct the content validity of each instrument first, 2 IS

professors in Boğaziçi University reviewed the scale. Secondly, 4 experienced CDOs and CIOs from reputable companies in different sectors pilot-tested the survey.

To address the research questions, first the questionnaire of Johnson and Lederer (2010) need to be developed to incorporate dimensions of DX strategy. In-depth interviews were made with the CDO/CIOs of 4 reputable companies located in Turkey, who have started their DX investments, to develop the scales. Table 2 presents the details of the companies. While automotive and clothing companies are manufacturing establishments of big multinationals, finance and dried fruit companies are Turkish companies that operate internationally. Automotive company operates as a joint venture of a big Turkish holding company and a US company, and recently went through an organizational restructuring to appoint CDO and a DX office. On the other hand, the cloth manufacturer, the largest production plant of the multinational company, has been selected as the plant to start DX of the company's business model. Both companies have started their DX journey in the past 2-3 years and lead DX in their respective industries. The CIO of the finance company has been selected as the "Best CIO" by CIO magazine for his accomplishments on DX while the DX of the dried fruit has been recently recognized by IDC CIO Awards for their smart warehouse project. Accordingly, the sample of CIO/CDOs comes from diverse industries and from different scaled companies at different levels of DX journey.

Table 2. Sample Overview

DX Lead	**Industry**	**Revenues (in €)**	**Employees**
CDO/CIO	Automotive	5bn-10bn	>5000
COO/CIO	Finance	200mn-500mn	>100 and <= 1000
CIO	Dried fruit, nut	5000-10000	<=100
CIO	Clothing	1bn - 5bn	>1000and <=5000

Afterwards, the feedbacks of the CDO/CIOs were asked about the survey. According to their feedbacks, some improvements and additions to the scale items have been made and the wording of some items has been changed.

In the survey, the demographic variables relevant to the all C-level managers are controlled. Two online surveys were developed in this study, one for the CEO and one for the CxO of the organization. Both surveys had same set of questions for the role of DX and DX contribution surveys, and different sets of questions for business and DX strategy. The final set of scale items are 13 for role of DX, 18 for contribution of DX and respectively 36 in CEO instrument, 52 in CxO instrument for alignment.

All the items in role of DX, business strategy and DX strategy alignment questionnaires were measured using a 5-point Likert scale of 1 (*strongly disagree*) to 5 (*strongly agree*). Similar to Johnson and Lederer (2010) in order to measure CEO-CxO mutual understanding, the absolute values of the differences between the CEO and CxO responses of each company for each item were calculated, which served as indicators in the CEO-CxO mutual understanding construct. A lower value implies greater mutual understanding and vice versa a larger value implies a gap.

As mentioned by Johnson and Lederer (2010), according to interaction perspective, two variables are combined to impact a third. Similarly, in this study DX alignment was calculated for each dimension the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data.

All the items in DX contribution questionnaires were measured using a scale of 1 (*no extent*) to 5 (*great extent*). However, while the scale of Johnson and Lederer (2010) focused on 4 tangible metrics, our metrics included a total of 18 items both

tangible and intangible. Accordingly, in the analysis we use two separate metrics; tangible DXC and intangible DXC as revealed by the CFA analysis. The CxO data were used to measure the dependent variable DX contribution to the organization, because CDO should have a leading role in a DX journey with commitment of whole top management (Haffke et al., 2016; Singh & Hess, 2017). CEO data were used solely for validation and comparative purposes.

Appendix A presents the questionnaire, where the constructs developed from the literature are given in bold and constructs added by CIO/CDO feedback are given in italic. Appendix B presents the Turkish questionnaire that has been shared with C-level managers of the companies.

4.2 Data collection

The aim of the research is to assess the mutual understanding of C-level managers about DX and its impact on performance. Therefore, it is decided to gather a sample representative of all industries and services sector in Turkey.

Similar to Johnson and Lederer (2010) the aim was to collect valid survey results from at least 200 groups of CEOs and CxOs. For survey data collection Information Foundation of Turkey (Türkiye Bilişim Vakfı), TÜSİAD, Union of Ministers of Turkey (Türkiye Bakanlar Birliği), Borsa Istanbul, Chamber of Industry (Sanayii Odasi), Ministries of Development, Industry and Technology (Kalkınma, Sanayi ve Teknoloji Bakanlıkları) have been contacted. These institutions lead the DX ecosystem with their reports such as “Digital Technologies and Economic Growth” report of TUSIAD (2018), “Digital Turkey” from Ministries of Industry and Technology (2018), and “Digitalization Index – Turkey Results” from co-working of Accenture, Boğaziçi University, ODTU and Information Foundation of Turkey

(2015). The common goal of these studies were to evaluate the position of major sectors of Turkey in DX and try to draw a road map to benefit from DX to encourage the growth and development of the country. Negotiations have been held with those institutions to share the survey with their partners.

Furthermore, a database of the C-level managers of top 500 companies that operate in Turkey have been built from LinkedIn website. This database includes the company, the names, titles, and contact information of these managers. To collect all this information of C-level managers, the Listed Companies on Borsa Istanbul, which are traded on the Equity Market, Koc Group Companies and the companies, from which the executives have been reached were taken as resources.

According to TÜSİAD (2017) consumer products, automotive, machinery production, health, logistic, electronic, and programming sectors are the industries, which will be affected by DX in short term. Turkey needs effective road map to achieve Industry 4.0 (TÜSİAD, 2017). Accordingly, top 500 companies from various sectors such as banking, telecommunication, manufacturing, textile etc. were communicated to define sectoral differences and propose individual roadmaps for each sector.

The survey has been developed on SurveyMonkey and separate survey links were created for each company. For distribution of the survey, the CEOs of the companies have been contacted, and kindly asked for their participation in the survey and to share the survey link with all the other C-level managers and the directors in the absence of C-level managers at a specific role. At intervals of two weeks, follow-up emails have been sent to the CEO's, who didn't answer the surveys yet, and kindly asked to send a reminder to the other C-level executives in their company.

Accordingly, CEO's of 260 companies for whom we were able to identify the names and emails of its upper management, were invited to participate the survey. We were able to collect data with a return rate of 23% (62 companies participated). However as the responses of 17 CxOs were missing these companies had to be removed from our sample since at least one CxO participation from each company was mandatory for our research design. Finally, responses from 45 companies have been collected with a response rate of 17%, which includes 45 CEO answers and matched pairs of 123 C-level executive answers. As an average, 3 to 4 surveys from each company have been collected. Similar data structure is observed in the Leader Member Exchange Model studies in the literature, in which leader and subordinate data were collected from the same companies and analyzed together (Pei, Pan, Skitmore, & Feng, 2018; Waismel-Manor, Tziner, Berger, & Dikstein, 2010).

4.3 Demographic profile of sample

Tables 3-5 summarize the demographics of participating companies. The companies which chose "other" as their sector is assigned to related industries according to the KOSGEB's (2019) "Supported Industries Report".

Table 3 shows that more than half of the companies operate in manufacturing and wholesale/retail sectors. The table 4 presents data collected from companies which vary in number of employees and size; the sample includes both small and medium sized companies, and big companies. Table 5 shows that both CEOs and CxOs have spent a long time in the sector their company operates and in the company they are working for. Besides, the education part of the table shows us the top management of these companies is highly educated.

Table 3. Industries of Companies

Industry	Percent	Frequency
Manufacturing	29.4%	15
Wholesale/Retail	27.5%	14
Finance/Audit/Consultancy	13.7%	7
Energy/Chemistry	7.8%	4
Administrative and Support Service Activities	5.9%	3
Construction/Real Estate	3.9%	2
Transportation/Warehouse	3.9%	2
Professional / Scientific and Technical Activities	3.9%	2
Health	2.0%	1
Mining	2.0%	1

Table 4. Company Size

Gross Revenue	Less than 250 million TL	250 – 500 million TL	500 million – 1 billion TL	1 – 2.5 billion TL	2.5 – 5 billion TL	5 – 10 billion TL	More than 10 billion TL	
	11 (24.4%)	6 (13.3%)	3 (6.7%)	8 (17.8%)	3 (6.7%)	6 (13.3%)	8 (17.8%)	
Total Assets	Less than 500 million TL	500 million – 1 billion TL	1 – 2 billion TL	2 - 5 billion TL	5 - 10 billion TL	10 - 20 billion TL	More than 20 billion TL	
	17 (37.8%)	4 (8.9%)	2 (4.4%)	8 (17.8%)	6 (13.3%)	3 (6.7%)	5 (11.1%)	
Total Employees	1-50	51-100	101-250	251-1000	1001-2500	2501-5000	5001-10000	More than 10000
	9 (20.0%)	4 (8.9%)	7 (15.6%)	5 (11.1%)	10 (22.2%)	8 (17.8%)	1 (2.2%)	1 (2.2%)

Table 5. Experience and Education

		CEO		CxO	
		Frequency	Percent	Frequency	Percent
Average years in position in current company	Less than 1 year	3	6.7	25	20.2
	1-3 years	16	35.6	42	33.9
	4-6 years	6	13.3	22	17.7
	6-8 years	2	4.4	10	8.1
	8-11 years	3	6.7	12	9.7
	11-15 years	3	6.7	6	4.8
	More than 15 years	11	24.4	5	4.0
Average years in company	Less than 1 year	0	0.0	15	12.1
	1-5 years	9	20.0	31	25.0
	5-10 years	4	8.9	22	17.7
	More than 10 years	31	68.9	54	43.5
Average years in industry	Less than 10 years	7	15.6	44	35.5
	10-15 years	2	4.4	18	14.5
	15-20 years	8	17.8	20	16.1
	More than 20 years	27	60.0	40	32.3
Average years in IS	No IS experience	18	40.0	46	37.1
	Less than 1 year	3	6.7	6	4.8
	1-3 years	5	11.1	6	4.8
	3-6 years	2	4.4	13	10.5
	6-8 years	1	2.2	11	8.9
	More than 8 years	15	33.3	40	32.3
Education	High School	3	6.7	3	2.4
	Bachelor	15	33.3	51	41.1
	Master/MBA	22	48.9	55	44.4
	Doctorate	4	8.9	13	10.5

CHAPTER 5

ANALYSIS

5.1 Initial findings

The CEOs and other C-level managers generally agreed about the contribution of DX to organization performance. A multivariate analysis of variance (MANOVA) was applied to test whether there is a significant difference between CEO and CxO responses. The factors used in MANOVA were obtained from CFA analysis conducted in the "Reliability and validity" section. With Wilks' lambda of 0.933 and significance value of 0.894, which is greater than 0.05, which are presented in the table 6, it can be interpreted that there are no significant differences between responses of CEOs and CxOs. So, this makes reasonable to use CxO data for hypotheses testing.

Table 6. Multivariate Analysis of Variance

Multivariate Tests						
Effect		Value	F	Hypothesis df	Error df	Sig.
Contribution of DX (CEO/CxO)	Pillai's Trace	0.067	.602	18	150	0.894
	Wilks' Lambda	0.933	.602	18	150	0.894
	Hotelling's Trace	0.072	.602	18	150	0.894
	Roy's Largest Root	0.072	.602	18	150	0.894

In the study of Johnson and Lederer (2010), data were collected via postal survey. There, a time-trend exploration was used to assess non-response bias; in it, late respondents were seen as non-respondents. Since in this research, the data were

collected via online survey only in 2 months, which is a way shorter time period than time needed to collect postal survey data. This is why, there was no need to try to assess non-response bias and apply a time trend analysis in this research.

The second investigation was done on the descriptive statistics such as mean and standard deviation of variables and constructs shown in table 7 and table 8. As table 7 shows the combined values of Role of DX items are calculated as absolute differences between CEO and the other C level executives' answers. The lower values of combined variables show the highest mutual understanding between C-level managers. The most mutual understanding on role of DX was showed by pairs of executives for "DX will help us leverage value from information through efficient use of data" (RDX5) with the score 0.58. They had also high mutual understanding on the items "DX will help us effectively capture value through business models in networks" (RDX10) and "DX will help us effectively capture appropriate value through developing the platforms of new business models"(RDX11) with the score 0.61. On the other hand, the least mutual understanding is exhibited for "DX will contribute to offer significant new features to the existing product line/services" (RDX7).

As table 8 shows CEOs gave internal defensiveness, external defensiveness, analysis and aggressiveness strategy dimensions higher scores compared to CxOs, whereas CxOs rated analysis dimension more important than CEOs. It can be interpreted that CEOs see DX as a holistic strategy which will foster organizations compete for market share, search new opportunities, maintain strong relationships with customers and increase efficiency of business operations. On the other hand, it seems that the other C-level managers leverage DX to reach factual information,

which will enable decision making process, find new opportunities to create value for both company and the customers.

In the table 8, the DX strategy alignment dimensions are calculated as combined variables, which are calculated for each dimension the mean of the product of the items for its strategy dimensions. The highest DX strategic alignment is shown between CEO and other C-level managers for the analysis and internal defensiveness dimensions with the scores 20.11 and 19.04, which are followed by aggressiveness dimensions with the score 18.70. The least rated strategy dimension is riskiness.

According to table 6, there are no significant differences between responses of CEOs and CxOs to DX Contribution items. This is why CxO data were chosen for further analysis and hence combined variables for DX contribution weren't calculated. As seen in the table 7, the mean factor values of DX tangible contribution (3.48) and DX intangible contribution (4.13) of CxO data are very close to the mean DX tangible (3.53) and DX intangible (4.19) factor values of CEO data. This shows that, the CEOs and CxOs generally agree on the contribution of DX to the organization.

Table 7. Variables and Descriptive Statistics - 1

Factor/Item	CxO				CEO				Combined			
	min	max	mean	SD	min	max	mean	SD	min	max	mean	SD
F1: role of DX	1	5	4,23	0,80	1	5	4,17	0,85	0	3	0,67	0,70
RDX2	NA	NA	NA	NA	1	5	4,27	0,89	NA	NA	NA	NA
RDX4	1	5	4,26	0,77	NA	NA	NA	NA	NA	NA	NA	NA
RDX5	1	5	4,54	0,64	1	5	4,36	0,86	0	4	0,58	0,75
RDX6	1	5	4,20	0,89	1	5	4,24	0,83	0	3	0,66	0,72
RDX7	1	5	4,15	0,94	1	5	4,20	0,92	0	4	0,78	0,73
RDX8	1	5	4,34	0,77	2	5	4,33	0,71	0	4	0,67	0,71
RDX9	1	5	3,95	0,94	1	5	3,82	1,03	0	3	0,75	0,72
RDX10	1	5	4,05	0,73	1	5	4,09	0,79	0	3	0,61	0,64
RDX11	1	5	4,24	0,78	1	5	4,13	0,87	0	3	0,61	0,69
RDX12	1	5	4,36	0,78	2	5	4,11	0,83	0	3	0,70	0,64
RDX13	NA	NA	NA	NA	2	5	4,18	0,78	NA	NA	NA	NA
F10: tang. cont.	1,14	5,00	3,48	0,86	1,29	5,00	3,53	0,85	NA	NA	NA	NA
DXCT1	1	5	3,59	0,89	1	5	3,58	0,78	NA	NA	NA	NA
DXCT2	1	5	3,37	0,83	2	5	3,42	0,89	NA	NA	NA	NA
DXCT3	1	5	3,26	0,87	1	5	3,24	0,91	NA	NA	NA	NA
DXCT6	1	5	3,31	0,87	1	5	3,47	0,76	NA	NA	NA	NA
DXCT7	1	5	3,97	0,84	1	5	4,07	0,78	NA	NA	NA	NA
DXCT9	1	5	3,52	0,94	1	5	3,56	1,08	NA	NA	NA	NA
DXCT11	2	5	3,37	0,79	2	5	3,36	0,74	NA	NA	NA	NA
F11: int. cont.	1,50	5,00	4,13	0,82	1,83	5,00	4,19	0,82	NA	NA	NA	NA
DXCInt12	1	5	4,08	0,93	2	5	4,07	0,89	NA	NA	NA	NA
DXCInt13	1	5	4,07	0,79	2	5	4,31	0,73	NA	NA	NA	NA
DXCInt14	1	5	4,07	0,82	2	5	4,16	0,80	NA	NA	NA	NA
DXCInt15	2	5	3,89	0,82	2	5	3,96	0,74	NA	NA	NA	NA
DXCInt17	2	5	4,35	0,83	1	5	4,31	0,95	NA	NA	NA	NA
DXCInt18	2	5	4,34	0,76	2	5	4,33	0,83	NA	NA	NA	NA

Note: The items deleted in the reliability and validity analysis are marked NA or not presented in this table. So, corresponding combined variables are not calculated for these items.

Table 8. Variables and Descriptive Statistics - 2

Factor/Item	CxO				CEO				Combined			
	min	max	mean	SD	min	max	mean	SD	min	max	mean	SD
F2:aggresiveness	1,00	5,00	4,01	0,77	3,00	5,00	4,44	0,64	4,67	25,00	18,70	4,17
AGG1	1	5	4,24	0,68	3	5	4,64	0,57	5	25	20,30	3,96
AGG2	1	5	4,28	0,67	3	5	4,64	0,57	5	25	20,18	4,02
AGG3	1	5	3,53	0,81	NA	NA	NA	NA	NA	NA	NA	NA
AGG5	1	5	4,14	0,82	NA	NA	NA	NA	NA	NA	NA	NA
AGG6	1	5	3,85	0,87	3	5	4,04	0,77	4	25	15,62	4,55
F3: analysis	2,00	5,00	4,46	0,63	2,50	5,00	4,33	0,71	9,00	25,00	20,11	4,05
ANA1	2	5	4,48	0,62	NA	NA	NA	NA	NA	NA	NA	NA
ANA2	2	5	4,50	0,62	2	5	4,22	0,77	8	25	19,80	4,21
ANA3	2	5	4,49	0,62	3	5	4,44	0,66	10	25	20,41	3,89
ANA4	2	5	4,45	0,64	NA	NA	NA	NA	NA	NA	NA	NA
ANA5	2	5	4,38	0,67	NA	NA	NA	NA	NA	NA	NA	NA
F4: int. def.	1,50	5,00	4,24	0,67	3,00	5,00	4,38	0,57	5,50	25,00	19,04	3,86
INT1	1	5	4,11	0,72	3	5	4,07	0,65	4	25	16,75	3,97
INT2	2	5	4,41	0,63	3	5	4,47	0,55	8	25	19,91	3,62
INT3	1	5	4,11	0,78	NA	NA	NA	NA	NA	NA	NA	NA
INT4	2	5	4,08	0,65	NA	NA	NA	NA	NA	NA	NA	NA
INT5	2	5	4,40	0,58	3	5	4,47	0,55	6	25	19,39	3,99
INT6	1	5	4,33	0,66	3	5	4,51	0,55	4	25	20,11	3,85
F5: ext. def.	1,17	5,00	4,02	0,83	2,25	5,00	4,35	0,76	4,00	25,00	17,66	4,75
EXT1	1	5	3,88	0,85	2	5	4,38	0,72	5	25	16,41	4,99
EXT2	1	5	3,88	0,88	3	5	4,29	0,69	5	25	16,78	4,87
EXT3	1	5	4,04	0,76	NA	NA	NA	NA	NA	NA	NA	NA
EXT4	1	5	4,18	0,79	3	5	4,44	0,62	3	25	18,89	4,37
EXT5	2	5	4,20	0,74	1	5	4,29	0,99	3	25	18,55	4,78
EXT6	1	5	3,91	0,94	NA	NA	NA	NA	NA	NA	NA	NA
F6: futurity	1,71	5,00	4,19	0,71	3,00	5,00	3,98	0,66	8,00	25,00	16,94	4,03
FUT1	1	5	3,91	0,83	NA	NA	NA	NA	NA	NA	NA	NA
FUT2	1	5	4,32	0,71	NA	NA	NA	NA	NA	NA	NA	NA
FUT3	2	5	4,19	0,72	3	5	3,98	0,66	8	25	16,94	4,03
FUT4	2	5	4,26	0,65	NA	NA	NA	NA	NA	NA	NA	NA
FUT5	2	5	4,24	0,69	NA	NA	NA	NA	NA	NA	NA	NA
FUT6	2	5	4,28	0,70	NA	NA	NA	NA	NA	NA	NA	NA
FUT7	2	5	4,15	0,71	NA	NA	NA	NA	NA	NA	NA	NA
F7: proactiveness	1,25	5,00	3,99	0,82	1,33	5,00	4,00	0,73	2,67	25,00	16,50	4,32
PRO1	1	5	4,01	0,83	1	5	4,00	0,83	1	25	16,68	4,78
PRO2	1	5	3,74	0,86	NA	NA	NA	NA	NA	NA	NA	NA
PRO3	2	5	4,15	0,70	2	5	3,89	0,61	6	25	16,48	3,71
PRO4	1	5	3,87	0,87	NA	NA	NA	NA	NA	NA	NA	NA
PRO5	1	5	3,97	0,86	1	5	4,11	0,75	1	25	16,33	4,49
PRO6	1	5	3,99	0,84	NA	NA	NA	NA	NA	NA	NA	NA
PRO7	1	5	4,04	0,84	NA	NA	NA	NA	NA	NA	NA	NA
PRO8	2	5	4,11	0,77	NA	NA	NA	NA	NA	NA	NA	NA
F8: riskiness	1,83	5,00	4,10	0,73	1,00	5,00	3,24	0,94	3,50	25,00	12,39	4,14
RIS1	1	5	3,97	0,83	NA	NA	NA	NA	NA	NA	NA	NA
RIS2	2	5	4,18	0,70	NA	NA	NA	NA	NA	NA	NA	NA
RIS3	2	5	3,98	0,77	1	5	3,40	0,94	4	25	13,13	4,25
RIS4	2	5	4,08	0,73	1	5	3,09	0,95	3	25	11,66	4,02
RIS5	2	5	4,17	0,65	NA	NA	NA	NA	NA	NA	NA	NA
RIS6	2	5	4,21	0,73	NA	NA	NA	NA	NA	NA	NA	NA
F9:innovativeness	1,50	5,00	4,23	0,71	3,00	5,00	4,14	0,56	7,00	25,00	17,39	3,96
INN1	2	5	4,08	0,72	3	5	4,02	0,58	8	25	16,55	3,77
INN2	3	5	4,29	0,61	NA	NA	NA	NA	NA	NA	NA	NA
INN3	2	5	4,15	0,74	3	5	4,22	0,47	8	25	17,84	3,89
INN4	1	5	4,25	0,71	3	5	4,18	0,61	5	25	17,78	4,20
INN5	1	5	4,41	0,68	NA	NA	NA	NA	NA	NA	NA	NA
INN6	1	5	4,37	0,70	NA	NA	NA	NA	NA	NA	NA	NA
INN7	1	5	4,30	0,70	NA	NA	NA	NA	NA	NA	NA	NA
INN8	1	5	3,98	0,81	NA	NA	NA	NA	NA	NA	NA	NA

Note: The items deleted in the reliability and validity analysis are marked NA or not presented in this table. So, corresponding combined variables are not calculated for these items.

5.1.1 Sectoral differences

The third investigation was about sectoral differences on mutual understanding level about the role of DX among top management, shown in the table 9 and 10. As in descriptive statistics tables above, the role of DX item values were calculated as absolute differences between CEO and the other C level executives' answers in different industries, and factor values were calculated as a mean of the item values. The least values show the highest mutual understanding between C-level managers.

Before interpreting descriptive statistics we have conducted Kruskal Wallis nonparametric test to see whether there are significant sectoral differences on mutual understanding about the role of DX. As table 10 presents, except for the RDX5 "DX will help us leverage value from information through efficient use of data." there are no significant sectoral differences on mutual understanding. For RDX5 the most mutual understanding on the role of DX was showed by the pairs of executives in wholesale/retail sector with the 0.34. This is followed by the Manufacturing and Energy/Chemistry sectors with the score 0.40.

Table 9 shows that the most mutual understanding on the role of DX was observed between the pairs of executives in wholesale/retail sector with the mean score 0.51 and standard deviation 0.590. In this industry the average minimum distance between item responds in survey was 0, which means exact mutual understanding and the average maximum distance between item responds in survey was 2. In Wholesale /retail sector the most mutual understanding on the role of DX was showed by the pairs of executives with the mean score 0.51. The second highest mutual understanding on the role of DX was showed in the Manufacturing and Energy/Chemistry sectors with the mean score 0.68. The least mutual understanding on the role of DX was showed in the Finance/Audit/Consultancy sector with the

mean score 0.76. In this industry the most mutual understanding was indicated unlike other industries for “DX will affect culture within our organization.” (RDX6) with the score 0.58.

Table 9. Sectoral Differences in Mutual Understanding on the Role of DX between Different C-level Managers

Factor/Item	Mutual Understanding in Manufacturing Sector (N=35)				Mutual Understanding in Wholesale/Retail Sector (N=47)			
	min	max	mean	SD	min	max	mean	SD
F1: role of DX	0	3	0.68	0.73	0	2	0.51	0.590
RDX5	0	4	0.40	0.775	0	2	0.34	0.522
RDX6	0	2	0.80	0.759	0	2	0.57	0.617
RDX7	0	2	0.57	0.608	0	2	0.66	0.635
RDX8	0	2	0.69	0.631	0	2	0.49	0.585
RDX9	0	3	0.86	0.879	0	2	0.55	0.619
RDX10	0	3	0.63	0.690	0	2	0.53	0.546
RDX11	0	3	0.69	0.796	0	2	0.45	0.583
RDX12	0	3	0.77	0.690	0	2	0.51	0.585
Factor/Item	Mutual Understanding in Finance/Audit/Consultancy Sector (N=19)				Mutual Understanding in Energy/Chemistry (N=11)			
	min	max	mean	SD	min	max	mean	SD
F1: role of DX	0	2	0.76	0.64	0	3	0.68	0.73
RDX5	0	2	0.84	0.688	0	4	0.40	0.775
RDX6	0	3	0.58	0.838	0	2	0.80	0.759
RDX7	0	2	0.95	0.705	0	2	0.57	0.608
RDX8	0	2	0.74	0.653	0	2	0.69	0.631
RDX9	0	2	0.84	0.602	0	3	0.86	0.879
RDX10	0	2	0.74	0.562	0	3	0.63	0.690
RDX11	0	2	0.68	0.582	0	3	0.69	0.796
RDX12	0	1	0.68	0.478	0	3	0.77	0.690

Note: The items deleted in the reliability and validity analysis are not presented in this table.

Table 10. Kruskal Wallis Test

Test Statistics[a,b]								
	RDX5	RDX6	RDX7	RDX8	RDX9	RDX10	RDX11	RDX12
Kruskal-Wallis H	8,331	3,144	4,488	2,686	3,226	2,302	2,277	5,098
df	3	3	3	3	3	3	3	3
Asymp. Sig.	0,04	0,37	0,213	0,443	0,358	0,512	0,517	0,165

Note: a. Kruskal Wallis Test, b. Grouping Variable: Industry

5.1.2 Functional differences

The next analysis was done on the mutual understanding on the role of DX between CEO and different C-level executive groups, shown in the table 11. The mutual understanding combined values presented in the table 11 were calculated the same way as done in the table 7.

The most mutual understanding on the role of DX was showed by the pairs of CEO and CDO/CTO/CIO with the factor score 0.57, which is understandable because CEO's should be involved in DX process and strategy and CDOs are mostly appointed to the roles responsible for development, refinement and implementing DX strategy, preparing the company for the digital era and managing the mind shift and cultural changes which DX requires (Haffke et al., 2016; Singh & Hess, 2017). In the absence of CDO, CTOs or CIOs take over these responsibilities. Here the gap between CEOs and CDO/CTO/CIOs is pretty low; this can be interpreted as there is mutual understanding between CEOs and CDO/CTO/CIOs on the role of DX. The second most mutual understanding on the role of DX was showed by the pairs of CEO and COO with the factor score 0.58, which is very close to the score mentioned for the group CEO and CDO/CTO/CIOs. This is not surprising, because the COO is someone who implements the digital transformation and cultivates a DX sourced culture change in the organization in coordination with CEO (Bloching et al., 2015). This followed with the pairs of CEO and CSCO/CCOs with the score 0.67, and with

the pairs of CEO and CMO/CSOs with the score 0.70. The least mutual understanding on the role of DX was observed for the pairs of CEO and CFOs with the score of 0.74, for the pairs of CEO and CHRO with the score of 0.85, and for the pairs of CEO and CSO with the score of 0.96. Nevertheless, caution must be executed when interpreting the results pertaining to the pairs of CHRO, and CSO due to lower number of observations.

Table 11. Mutual Understanding on the Role of DX between Different C-level Managers

Factor/Item	Mutual Understanding and Strategic Alignment between CEO and CDO/CTO/CIO (N=23)				Mutual Understanding and Strategic Alignment between CEO and CMO/CSO-Chief Sales Officer (N=26)			
	min	max	mean	SD	min	max	mean	SD
F1: role of DX	0	2	0,57	0,603	0	3	0,70	0,796
RDX5	0	1	0,57	0,507	0	4	0,62	0,898
RDX6	0	2	0,52	0,593	0	2	0,50	0,583
RDX7	0	2	0,70	0,559	0	4	0,85	0,925
RDX8	0	2	0,52	0,665	0	4	0,77	0,992
RDX9	0	3	0,74	0,810	0	2	0,96	0,774
RDX10	0	2	0,43	0,590	0	3	0,69	0,736
RDX11	0	1	0,52	0,511	0	3	0,77	0,815
RDX12	0	2	0,52	0,593	0	2	0,46	0,647

Factor/Item	Mutual Understanding and Strategic Alignment between CEO and CFO (N=20)				Mutual Understanding and Strategic Alignment between CEO and COO (N=24)			
	min	max	mean	SD	min	max	mean	SD
F1: role of DX	0	2	0,74	0,705	0	2	0,58	0,668
RDX5	0	4	0,65	0,933	0	2	0,38	0,647
RDX6	0	2	0,65	0,745	0	3	0,63	0,824
RDX7	0	3	1,00	0,725	0	2	0,67	0,702
RDX8	0	2	0,80	0,523	0	2	0,42	0,584
RDX9	0	2	0,90	0,718	0	2	0,46	0,658
RDX10	0	2	0,50	0,607	0	3	0,67	0,702
RDX11	0	2	0,75	0,716	0	3	0,54	0,721
RDX12	0	2	0,65	0,671	0	2	0,92	0,504

Factor/Item	Mutual Understanding and Strategic Alignment between CEO and CHRO (N=5)				Mutual Understanding and Strategic Alignment between CEO and CSCO/CCO (N=9)				Mutual Understanding and Strategic Alignment between CEO and CSO-Chief Strategy Officer (N=3)			
	min	max	mean	SD	min	max	mean	SD	min	max	mean	SD
F1: role of DX	0	2	0,85	0,575	0	2	0,67	0,603	0	2	0,96	0,736
RDX5	0	1	0,60	0,548	0	2	0,78	0,833	0	2	1,00	1,000
RDX6	1	2	1,40	0,548	0	2	0,78	0,667	0	1	0,67	0,577
RDX7	0	1	0,40	0,548	0	2	0,56	0,726	1	2	1,33	0,577
RDX8	1	2	1,20	0,447	0	2	0,67	0,707	0	1	0,67	0,577
RDX9	0	2	1,00	0,707	0	1	0,56	0,527	0	2	1,00	1,000
RDX10	0	1	0,60	0,548	0	1	0,56	0,527	1	2	1,33	0,577
RDX11	0	1	0,60	0,548	0	1	0,33	0,500	0	2	1,00	1,000
RDX12	0	2	1,00	0,707	1	2	1,11	0,333	0	1	0,67	0,577

Note: The items deleted in the reliability and validity analysis are not presented in this table.

In addition, in the table 12, DX strategic alignment scores among different C-level manager pairs are presented. DX strategic alignment dimensions are calculated by the mean of the product of the items for its business strategy dimension from CEO data and the items for the corresponding DX strategy dimension from CxO data. Higher values signal better alignment. Overall, all pairs have shown similar alignment patterns. However, once analyzed by function differences can be seen.

The highest strategic alignment between CEO and CDO/CIO/CTO is observed for the aggressiveness dimension, while the rest of the pairs had the highest alignment for the analysis dimension. For the analysis and internal defensiveness dimensions CEO – CHRO pairs had the highest alignment followed by CEO - CSO pairs. This is not surprising, because chief strategy officers are executives who analyze how digital disruptors think and see the company's home industry (Bloching et al., 2015). By leveraging digital technologies human resources can interest and hire young generation, and also within the help of rich information on cloud environments enable effective communication between leaders and subordinates (Larkin, 2017). For aggressiveness dimension these are followed by the pairs of CEO and CMO/CSO with the score 19.67 and by the pairs of CEO and CDO/CTO/CIO with the score 19.38. For analysis dimension, the next highest DX strategic alignment was observed between the pairs of CEO and CMO/CSO with the score 20.33. For internal defensiveness dimension the second most DX strategic alignment was shown by the pairs of CEO and COO with the score 19.15. On the other hand, the highest DX strategic alignment for external defensiveness dimension was measured between CEOs and CMO/CSOs (Chief Sales Officer) with the score 18.43. For futurity dimension the most DX strategic alignment was observed within the pairs of CEO and COO with the score 17.79 and within the pairs of CEO and

CSCO/CCO with the score 17.78. The pairs of CEO and CSCO/CCO has shown the highest DX strategic alignment for the proactiveness dimension with the score 17.85. In addition, the highest DX strategic alignment on riskiness dimension was measured between CEOs and COOs with the score 13.27. Lastly, the pairs of CEO and CMO/CSO showed the highest DX strategic alignment on the innovativeness dimension with the score 18.59. To summarize, although some of the groups has shown higher DX strategic alignment, generally the table 12 can be interpreted as there is DX strategic alignment among all C-level managers.

Table 12. DX Strategic Alignment between Different C-level Pairs

Factor/Item	DX Strategic Alignment between CEO and CDO/CTO/CIO (N=23)		DX Strategic Alignment between CEO and CMO/CSO-Chief Sales Officer (N=26)		DX Strategic Alignment between CEO and CFO (N=20)		DX Strategic Alignment between CEO and COO (N=24)		DX Strategic Alignment between CEO and CHRO (N=5)		DX Strategic Alignment between CEO and CSCO/CCO (N=9)		DX Strategic Alignment between CEO and CSO-Chief Strategy Officer (N=3)	
	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
F2: aggressiveness	19,38	3,322	19,67	3,501	18,35	3,667	17,53	4,354	20,47	2,620	18,15	4,381	19,67	3,272
AGG1	22,09	3,356	20,88	3,374	19,90	2,789	19,58	4,117	21,20	3,834	18,00	4,000	21,67	2,887
AGG2	20,61	3,408	20,88	3,756	19,50	3,678	19,83	3,953	21,00	2,236	19,67	3,317	21,67	2,887
AGG6	15,43	3,203	17,23	3,374	15,65	4,534	13,17	4,993	19,20	1,789	16,78	5,826	15,67	4,041
F3: analysis	18,93	3,412	20,33	4,008	19,83	4,487	20,02	3,479	21,70	3,961	20,00	3,609	21,67	2,887
ANA2	18,61	2,996	20,15	4,125	18,95	5,094	19,63	3,609	22,20	4,087	20,22	3,193	21,67	2,887
ANA3	19,26	3,828	20,50	3,891	20,70	3,881	20,42	3,348	21,20	3,834	19,78	4,024	21,67	2,887
F4: int. def.	18,89	3,762	19,00	4,038	19,13	3,521	19,15	3,978	19,90	2,587	18,78	3,134	20,59	3,148
INT1	16,09	3,218	16,69	4,203	17,05	3,517	17,21	3,822	18,20	2,490	15,89	2,848	18,67	2,309
INT2	19,35	3,214	19,85	3,977	19,80	3,205	19,96	3,724	21,00	2,236	21,22	3,114	21,67	2,887
INT5	19,65	4,539	19,08	4,758	19,20	3,847	19,88	3,530	19,20	1,789	18,78	3,667	20,33	4,509
INT6	20,48	4,077	20,38	3,213	20,45	3,517	19,54	4,836	21,20	3,834	19,22	2,906	21,67	2,887
F5: ext. def.	17,17	5,168	18,43	4,782	18,06	4,127	16,42	5,017	19,35	3,444	18,36	3,886	18,75	2,694
EXT1	16,65	5,245	18,15	4,814	17,20	3,861	14,08	5,838	17,00	4,796	16,22	3,193	15,00	5,000
EXT2	16,17	4,951	18,46	5,069	17,25	4,241	15,29	5,171	19,00	2,236	17,22	4,324	18,33	2,887
EXT4	18,00	5,410	18,42	4,892	18,85	4,133	19,29	3,237	21,00	2,236	20,33	4,387	20,00	0,000
EXT5	17,87	5,066	18,69	4,352	18,95	4,273	17,00	5,823	20,40	4,506	19,67	3,640	21,67	2,887
F6: futurity	15,78	3,741	16,85	3,781	16,10	4,712	17,79	4,283	17,20	2,588	17,78	3,833	20,00	0,000
FUT3	15,78	3,741	16,85	3,781	16,10	4,712	17,79	4,283	17,20	2,588	17,78	3,833	20,00	0,000
F7: proactiveness	15,10	3,952	17,71	3,656	16,68	4,174	15,68	5,084	18,60	2,157	17,85	3,095	16,67	2,309
PRO1	15,22	4,306	17,19	4,656	17,35	4,308	16,88	5,605	18,20	2,490	17,44	3,712	18,67	2,309
PRO3	15,43	3,300	17,15	2,664	16,25	4,411	15,29	4,544	18,40	2,191	19,22	2,906	15,67	0,577
PRO5	14,65	4,249	18,77	3,648	16,45	3,804	14,88	5,102	19,20	1,789	16,89	2,667	15,67	4,041
F8: riskiness	11,80	4,942	12,21	3,882	12,53	3,987	13,27	3,622	12,70	3,580	11,61	4,559	13,84	5,235
RIS3	12,43	5,316	13,08	3,949	13,30	3,975	14,25	4,089	14,40	4,159	11,11	2,804	14,67	6,110
RIS4	11,17	4,569	11,35	3,815	11,75	3,998	12,29	3,155	11,00	3,000	12,11	6,314	13,00	4,359
F9: innovativeness	17,30	3,616	18,59	3,827	17,23	3,665	16,03	4,469	18,13	2,057	17,93	2,972	17,11	3,849
INN1	16,00	3,618	18,15	3,379	15,65	4,196	16,00	4,273	17,60	2,191	16,44	3,127	15,67	4,041
INN3	17,74	3,374	18,31	4,135	18,55	3,561	17,29	4,154	17,60	2,191	18,11	2,261	17,33	4,619
INN4	18,17	3,857	19,31	3,968	17,50	3,236	14,79	4,978	19,20	1,789	19,22	3,528	18,33	2,887

5.2 Reliability and validity

Confirmatory factor analysis (CFA) have been conducted in SmartPLS3 to validate the role of DX, business strategy, and DX contribution constructs. One CFA was used to assess the data collected from the CEO, and the other CFA was used to assess the data collected from the CxOs (CIO, CDO, COO, CFO, CMO, CSO, CHRO, CTO, and CSCO). To assess internal reliability Cronbach's alpha and composite reliability (CR) scores were used. To check convergent validity factor loadings were inspected. Lastly, variance extracted test and Heterotrait-Monotrait ratio were used to check discriminant validity.

5.2.1 Reliability and validity of the CxO data

Initial CFA results required case wise deletion of some items. The indicators below 0.4 should be removed from the model, indicators with loadings above 0.7 should retain. On the other hand, the Indicators with the outer loadings between 0.4 and 0.7 need consideration before deletion (Hair, Hult, Ringle, & Sarstedt, 2016).

While dropping the indicators with loading between 0.4 and 0.7, after removing each indicator, every time the Cronbach's alpha, average variances extracted (AVE) and composite reliability scores have been checked. If there is no significant increase in the Cronbach's alpha, AVE and CR values, it is preferred to keep the items. All the survey items are available in the appendix A and associated with the abbreviations used in the tables. The deleted items are also specified with * in the appendix A. Initial CFA values of the CxO data are presented in the appendix tables C1 and C2.

After deleting RDX2, RDX3, RDX13 and reversed of RDX1 items, Cronbach's alpha increased from 0.888 to 0.919, and AVE increased from 0.485 to 0.607, and CR increased from 0.914 to 0.933 for the role of DX variable.

After deleting AGG4 item with a factor loading 0.381, Cronbach's alpha increased from 0.818 to 0.851, AVE increased from 0.540 to 0.628, and CR increased from 0.871 to 0.894 for aggressiveness strategy dimension variable.

After deleting DXCT4, DXCT5, DXCT8, and DXCT10 items Cronbach's alpha decreased from 0.895 to 0.867, and AVE increased from 0.487 to 0.557, and CR decreased from 0.912 to 0.898 for DX tangible contribution variable.

After deleting DXCI16 item with a factor loading 0.675, Cronbach's alpha increased from 0.885 to 0.879, and AVE increased from 0.593 to 0.624, and CR decreased from 0.910 to 0.909 for DX intangible contribution variable.

As tables 13 and 14 show, most of the loadings exceed 0.7 and all of them exceed 0.65. And all the loadings are significant ($p<0.001$). As seen in the table 15 all the AVE scores are above 0.5. Thus, the convergent validity of the CxO data was supported.

As table 15 shows the correlations between the latent variables (those below the diagonal in the table) were lower than the square root of the AVE scores on the diagonal. And all the square root of the AVE scores on the diagonal exceeds 0.71. Heterotrait-Monotrait Ratio scores (those above the diagonal) are below 0.85, which is the most conservative HTMT value (Kline, 2011). So, the discriminant validity of the CxO constructs was generally supported.

Table 15 also includes the Cronbach alpha (α) and composite reliability (CR) scores which exceed 0.70, the minimum preferred level. So that, the reliability of the CxO constructs was ensured.

Table 13. Factor Analysis for CxO Data - 1

Factor/item	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
F1:role of DX											
RDX4	**0.705**	0.330	0.206	0.233	0.343	0.318	0.260	0.267	0.296	0.285	0.240
RDX5	**0.683**	0.173	0.310	0.268	0.322	0.276	0.209	0.269	0.309	0.148	0.239
RDX6	**0.731**	0.564	0.427	0.478	0.526	0.561	0.509	0.368	0.475	0.386	0.405
RDX7	**0.847**	0.573	0.329	0.419	0.454	0.439	0.472	0.379	0.537	0.432	0.448
RDX8	**0.792**	0.400	0.350	0.393	0.365	0.349	0.323	0.353	0.346	0.337	0.327
RDX9	**0.785**	0.570	0.378	0.462	0.489	0.441	0.510	0.433	0.426	0.356	0.409
RDX10	**0.794**	0.555	0.349	0.401	0.482	0.412	0.492	0.431	0.446	0.405	0.432
RDX11	**0.840**	0.590	0.369	0.407	0.525	0.482	0.529	0.466	0.502	0.467	0.507
RDX12	**0.818**	0.499	0.437	0.465	0.434	0.426	0.449	0.399	0.561	0.450	0.349
F2: aggressiveness											
AGG1	0.485	**0.838**	0.451	0.553	0.590	0.529	0.564	0.441	0.525	0.535	0.467
AGG2	0.578	**0.852**	0.416	0.477	0.637	0.585	0.654	0.443	0.500	0.518	0.503
AGG3	0.389	**0.722**	0.234	0.451	0.479	0.507	0.561	0.265	0.390	0.499	0.317
AGG5	0.477	**0.767**	0.414	0.520	0.541	0.534	0.624	0.390	0.625	0.455	0.413
AGG6	0.567	**0.777**	0.354	0.463	0.599	0.471	0.583	0.452	0.542	0.460	0.473
F3: analysis											
ANA1	0.443	0.410	**0.844**	0.500	0.465	0.545	0.392	0.526	0.500	0.527	0.488
ANA2	0.302	0.347	**0.895**	0.495	0.439	0.493	0.407	0.541	0.451	0.470	0.445
ANA3	0.350	0.411	**0.878**	0.535	0.505	0.558	0.413	0.572	0.483	0.507	0.413
ANA4	0.460	0.481	**0.848**	0.546	0.522	0.584	0.446	0.594	0.507	0.524	0.537
ANA5	0.390	0.379	**0.829**	0.544	0.535	0.580	0.454	0.627	0.481	0.465	0.449
F4: int. def.											
INT1	0.445	0.531	0.550	**0.782**	0.616	0.627	0.457	0.512	0.377	0.538	0.518
INT2	0.243	0.190	0.497	**0.687**	0.347	0.448	0.249	0.505	0.357	0.347	0.394
INT3	0.468	0.670	0.532	**0.859**	0.652	0.691	0.685	0.595	0.627	0.537	0.463
INT4	0.356	0.452	0.343	**0.719**	0.482	0.593	0.480	0.414	0.427	0.290	0.308
INT5	0.315	0.344	0.387	**0.764**	0.401	0.460	0.336	0.459	0.454	0.333	0.439
INT6	0.486	0.552	0.459	**0.769**	0.569	0.558	0.510	0.494	0.646	0.453	0.445
F5: ext. def.											
EXT1	0.498	0.592	0.481	0.607	**0.833**	0.630	0.560	0.558	0.407	0.476	0.447
EXT2	0.497	0.524	0.481	0.492	**0.869**	0.556	0.563	0.572	0.375	0.448	0.411
EXT3	0.528	0.651	0.527	0.587	**0.888**	0.606	0.644	0.638	0.516	0.518	0.541
EXT4	0.431	0.390	0.493	0.545	**0.695**	0.546	0.476	0.537	0.351	0.383	0.431
EXT5	0.438	0.646	0.406	0.536	**0.714**	0.577	0.587	0.489	0.546	0.429	0.465
EXT6	0.284	0.602	0.301	0.458	**0.697**	0.516	0.570	0.458	0.418	0.439	0.335
F6: futurity											
FUT1	0.406	0.569	0.502	0.546	0.605	**0.783**	0.664	0.534	0.502	0.563	0.355
FUT2	0.631	0.696	0.419	0.585	0.637	**0.672**	0.632	0.474	0.540	0.438	0.408
FUT3	0.343	0.487	0.495	0.581	0.590	**0.833**	0.602	0.516	0.436	0.419	0.383
FUT4	0.407	0.494	0.619	0.634	0.501	**0.804**	0.520	0.539	0.587	0.450	0.465
FUT5	0.282	0.426	0.448	0.492	0.504	**0.763**	0.579	0.471	0.387	0.327	0.293
FUT6	0.374	0.356	0.521	0.579	0.500	**0.793**	0.554	0.543	0.428	0.350	0.398
FUT7	0.406	0.472	0.480	0.576	0.565	**0.777**	0.515	0.563	0.441	0.377	0.455
F7: proactiveness											
PRO1	0.550	0.623	0.422	0.483	0.576	0.606	**0.843**	0.447	0.586	0.459	0.314
PRO2	0.414	0.589	0.363	0.443	0.606	0.544	**0.798**	0.462	0.541	0.350	0.263
PRO3	0.374	0.498	0.461	0.604	0.617	0.692	**0.720**	0.671	0.568	0.364	0.333
PRO4	0.389	0.648	0.376	0.485	0.603	0.586	**0.848**	0.581	0.590	0.408	0.350
PRO5	0.443	0.613	0.395	0.468	0.614	0.589	**0.856**	0.561	0.624	0.426	0.368
PRO6	0.534	0.656	0.378	0.465	0.496	0.603	**0.826**	0.500	0.616	0.465	0.425
PRO7	0.487	0.672	0.374	0.462	0.613	0.587	**0.855**	0.497	0.632	0.396	0.268
PRO8	0.392	0.558	0.426	0.542	0.568	0.681	**0.713**	0.561	0.538	0.473	0.340

Table 14. Factor Analysis for CxO Data - 2

Factor/item	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
F8: riskiness											
RIS1	0.462	0.532	0.523	0.568	0.634	0.628	0.716	**0.792**	0.572	0.413	0.353
RIS2	0.392	0.449	0.600	0.540	0.539	0.525	0.535	**0.829**	0.510	0.468	0.401
RIS3	0.388	0.406	0.480	0.482	0.589	0.560	0.540	**0.798**	0.444	0.457	0.409
RIS4	0.305	0.301	0.512	0.463	0.526	0.562	0.476	**0.813**	0.475	0.426	0.432
RIS5	0.424	0.464	0.512	0.570	0.535	0.493	0.468	**0.782**	0.476	0.516	0.532
RIS6	0.385	0.290	0.585	0.512	0.521	0.493	0.447	**0.806**	0.494	0.421	0.507
F9: innovativeness											
INN1	0.349	0.392	0.405	0.368	0.339	0.418	0.524	0.531	**0.666**	0.388	0.391
INN2	0.420	0.524	0.473	0.468	0.380	0.484	0.538	0.533	**0.792**	0.510	0.498
INN3	0.467	0.492	0.414	0.420	0.409	0.428	0.532	0.452	**0.722**	0.425	0.363
INN4	0.308	0.489	0.459	0.499	0.465	0.516	0.576	0.444	**0.774**	0.388	0.374
INN5	0.535	0.600	0.522	0.604	0.523	0.522	0.558	0.465	**0.801**	0.489	0.481
INN6	0.497	0.536	0.471	0.568	0.449	0.502	0.522	0.462	**0.837**	0.478	0.407
INN7	0.465	0.434	0.379	0.571	0.432	0.521	0.588	0.494	**0.822**	0.370	0.306
INN8	0.404	0.479	0.286	0.349	0.374	0.411	0.635	0.369	**0.666**	0.363	0.243
F10: tang. cont.											
DXCT1	0.330	0.433	0.406	0.389	0.395	0.377	0.363	0.382	0.407	**0.719**	0.527
DXCT2	0.334	0.506	0.526	0.434	0.423	0.453	0.408	0.455	0.415	**0.821**	0.530
DXCT3	0.418	0.539	0.399	0.329	0.426	0.420	0.404	0.368	0.399	**0.778**	0.544
DXCT6	0.291	0.331	0.438	0.491	0.361	0.342	0.352	0.468	0.461	**0.688**	0.437
DXCT7	0.497	0.488	0.470	0.448	0.503	0.457	0.407	0.499	0.524	**0.743**	0.634
DXCT9	0.362	0.558	0.404	0.498	0.499	0.465	0.495	0.385	0.420	**0.760**	0.509
DXCT11	0.257	0.353	0.390	0.321	0.350	0.329	0.248	0.373	0.303	**0.708**	0.448
F11: int. cont.											
DXCInt12	0.447	0.580	0.450	0.491	0.459	0.496	0.451	0.403	0.426	0.567	**0.712**
DXCInt13	0.399	0.542	0.532	0.451	0.508	0.435	0.394	0.492	0.400	0.666	**0.834**
DXCInt14	0.437	0.546	0.504	0.467	0.513	0.366	0.381	0.425	0.454	0.682	**0.861**
DXCInt15	0.295	0.304	0.384	0.414	0.330	0.298	0.244	0.405	0.402	0.493	**0.767**
DXCInt17	0.368	0.310	0.369	0.377	0.363	0.413	0.199	0.402	0.338	0.482	**0.767**
DXCInt18	0.369	0.339	0.341	0.387	0.393	0.370	0.252	0.422	0.365	0.418	**0.756**

Table 15. Correlation of Latent Variables and Reliability Statistics for CxO Data

	α	CR	AVE	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
F1	0.919	0.933	0.607	**0.779**	0.681	0.485	0.551	0.621	0.564	0.575	0.528	0.606	0.515	0.525
F2	0.851	0.894	0.628	0.635	**0.793**	0.531	0.698	0.836	0.742	0.849	0.575	0.742	0.717	0.608
F3	0.911	0.934	0.738	0.459	0.476	**0.859**	0.679	0.639	0.709	0.538	0.739	0.617	0.650	0.593
F4	0.859	0.894	0.586	0.518	0.621	0.611	**0.765**	0.770	0.832	0.667	0.737	0.709	0.624	0.639
F5	0.874	0.906	0.619	0.575	0.722	0.576	0.686	**0.787**	0.816	0.811	0.785	0.627	0.652	0.627
F6	0.890	0.914	0.602	0.543	0.662	0.645	0.744	0.728	**0.776**	0.827	0.755	0.685	0.607	0.567
F7	0.924	0.938	0.655	0.560	0.753	0.493	0.608	0.721	0.755	**0.809**	0.733	0.807	0.569	0.440
F8	0.890	0.916	0.645	0.491	0.509	0.667	0.653	0.693	0.674	0.657	**0.803**	0.690	0.635	0.615
F9	0.896	0.917	0.582	0.572	0.653	0.566	0.638	0.555	0.625	0.727	0.616	**0.763**	0.630	0.561
F10	0.867	0.898	0.557	0.483	0.621	0.583	0.563	0.572	0.550	0.520	0.563	0.567	**0.746**	0.777
F11	0.879	0.909	0.624	0.495	0.554	0.548	0.568	0.563	0.516	0.415	0.551	0.512	0.699	**0.770**

Note: Below the diagonal there are the correlations between latent variables. On the diagonal there are the square roots of the AVE scores. Above the diagonal, there are Heterotrait-Monotrait Ratio scores.

Figure 2 shows the path model of CxO data after some items were eliminated in reliability and validity analysis.

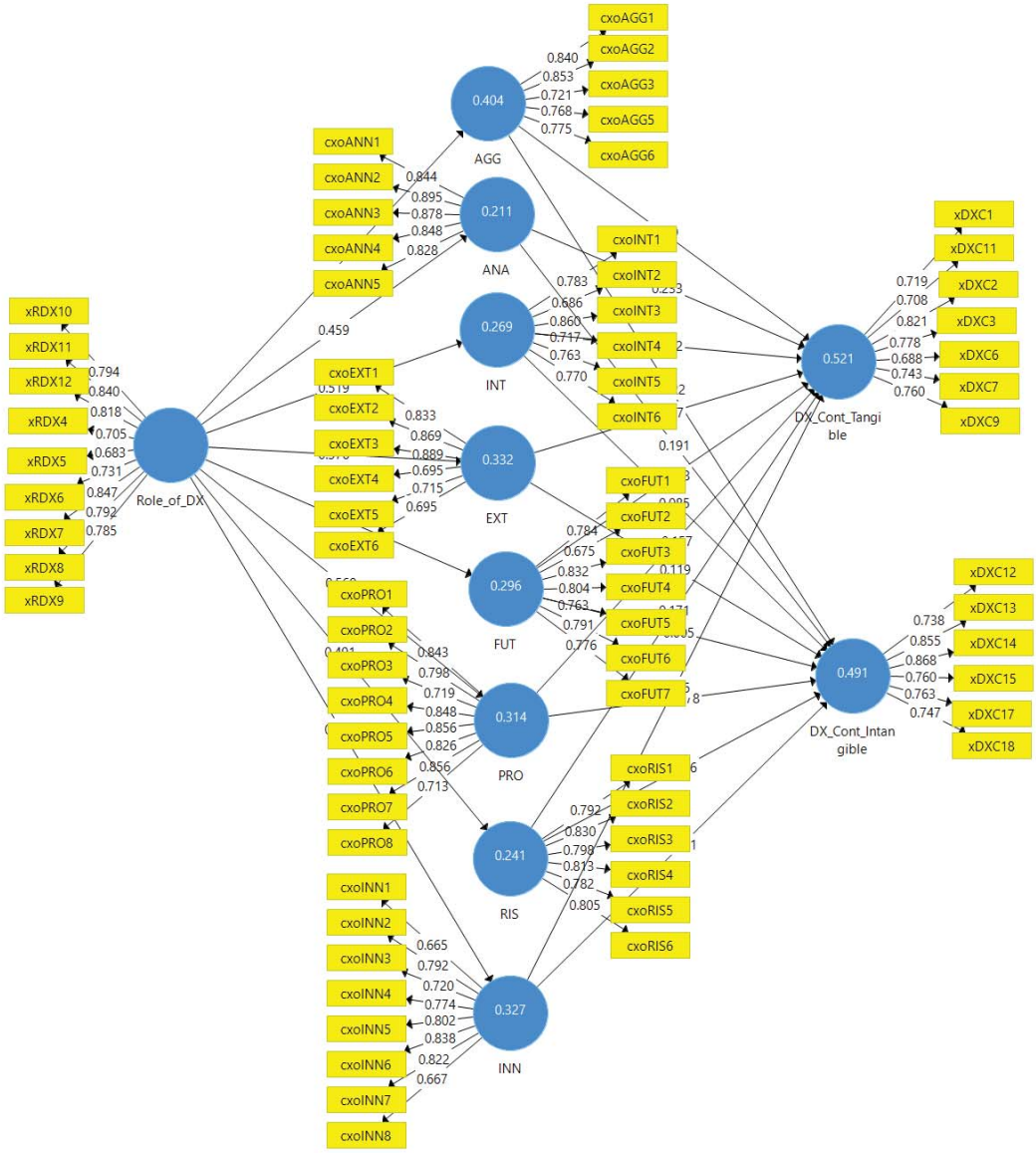

Fig. 2 Path model of CxO data

5.2.2 Reliability and validity of the CEO data

CFA has been conducted for the role of DX variables and eight strategy dimension variables on the CEO data. Since it is decided to use the CxO data to measure DX contribution, CFA for DX contribution variables weren't conducted. Initial CFA

results required case wise deletion of some items. Initial CFA values of the CEO data are presented in the appendix tables C3 and C4.

After deleting RDX3, RDX4, and reversed of RDX1 items, Cronbach's alpha increased from 0.891 to 0.906, and AVE increased from 0.470 to 0.540, and CR increased from 0.912 to 0.921 for the role of DX variable.

After deleting AGG3 item, Cronbach's alpha decreased from 0.677 to 0.650, AVE increased from 0.398 to 0.526, and CR increased from 0.691 to 0.761 for the aggressiveness strategy dimension variable. When the Cronbach's alpha value is 0.650, and AVE reached to 0.526, it is accepted reliable and valid in order to prevent lose more items.

After deleting ANA1 item, Cronbach's alpha increased from 0,570 to 0.645, AVE increased from 0.503 to 0.717, and CR increased from 0.721 to 0.833 for the analysis strategy dimension variable. When the Cronbach's alpha value reached to 0.645, it is accepted reliable and valid in order to prevent lose more items.

After deleting INT3 item, Cronbach's alpha decreased from 0,721 to 0.680, AVE increased from 0.456 to 0.506, and CR decreased from 0.802 to 0.799 for the internal defensiveness strategy dimension variable. When the Cronbach's alpha value reached to 0.506, it is accepted reliable and valid in order to prevent lose more items.

After deleting EXT3 and EXT6 items, Cronbach's alpha decreased from 0,761 to 0.757, AVE increased from 0.402 to 0.535, and CR increased from 0.776 to 0.817 for the external defensiveness strategy dimension variable. After deleting FUT2 and FUT3 items, Cronbach's alpha, AVE, and CR values increased from -0.316, 0.251, and 0.257 to 1.000.

After deleting PRO2 and PRO4 items, Cronbach's alpha increased from 0.631 to 0.673, AVE increased from 0.395 to 0.623, and CR increased from 0,750 to

0.827 for the proactiveness strategy dimension variable. When the Cronbach's alpha value reached to 0.673, it is accepted reliable and valid in order to prevent lose more items.

After deleting RIS1 and RIS2 items, Cronbach's alpha increased from 0.595 to 0.767, AVE increased from 0.433 to 0.804, and CR increased from 0,742 to 0.891 for the riskiness strategy dimension variable.

After deleting INN2, INN8 and INN9 items, Cronbach's alpha decreased from 0.685 to 0.653, AVE increased from 0.308 to 0.577, and CR increased from 0,686 to 0.801 for the innovativeness strategy dimension variable. Then, it is accepted reliable and valid in order to prevent lose more items.

As table 16 shows, most of the factor loadings exceed 0.7 and all of them exceed 0.5. And most of the loadings are significant ($p<0.001$). As seen in the table 17 all the AVE scores are above 0.5. Thus, the convergent validity of the CEO data was generally supported.

As table 17 shows the correlations between the latent variables (those below the diagonal in the table) were lower than the square root of the AVE scores on the diagonal. And all the square root of the AVE scores on the diagonal exceeds 0.71. Heterotrait-Monotrait Ratio scores (those above the diagonal) are below 0.85. So, the discriminant validity of the CEO constructs was generally supported.

Table 17 also includes the Cronbach alpha (α) and composite reliability (CR) scores which mostly exceed 0.70, the minimum preferred level. There also items with Cronbach's alpha values less than 0.7, but above 0.6, which is also acceptable (Griethuijsen et al., 2014). No items were deleted to increase Cronbach's alpha, because it would cause loss of important survey items. Thus, the reliability of the CEO constructs was generally proved.

Figure 3 shows the path model of CEO data after some items were eliminated in reliability and validity analysis.

Table 16. Factor Analysis for CEO Data

Factor/item	F1	F2	F3	F4	F5	F6	F7	F8	F9
F1: role of DX									
RDX2	**0.805**	0.173	0.342	0.273	0.157	0.166	0.271	-0.059	0.089
RDX5	**0.668**	-0.052	0.307	0.215	0.000	0.257	-0.055	-0.168	0.238
RDX6	**0.778**	-0.063	0.314	0.173	-0.045	0.135	0.163	-0.008	0.257
RDX7	**0.709**	0.076	0.371	0.281	-0.113	0.158	0.136	-0.086	0.128
RDX8	**0.705**	0.140	0.302	0.351	0.027	0.359	0.013	-0.043	0.425
RDX9	**0.753**	0.274	0.430	0.219	0.153	0.297	0.359	-0.095	0.026
RDX10	**0.763**	0.091	0.327	0.250	0.081	0.179	0.524	-0.101	0.041
RDX11	**0.787**	0.265	0.339	0.181	0.138	0.244	0.570	-0.169	0.049
RDX12	**0.670**	-0.016	0.138	0.205	0.232	0.129	0.160	-0.109	0.049
RDX13	**0.697**	-0.014	0.425	0.292	0.319	0.320	0.130	-0.132	0.278
F2: aggressiveness									
AGG1	0.097	**0.516**	0.049	0.211	0.055	0.197	0.042	-0.008	0.116
AGG2	0.051	**0.681**	0.175	0.534	0.405	0.160	0.223	-0.079	0.243
AGG6	0.158	**0.924**	0.213	0.176	0.129	0.137	0.261	-0.079	0.215
F3: analysis									
ANA2	0.260	0.110	**0.735**	0.194	0.369	0.281	0.211	0.031	0.105
ANA3	0.476	0.256	**0.946**	0.492	0.389	0.233	0.121	-0.342	0.189
F4: int. def.									
INT1	0.297	0.122	0.425	**0.858**	0.461	0.162	0.212	-0.047	0.246
INT2	0.230	0.364	0.293	**0.796**	0.291	0.219	0.441	-0.271	0.281
INT5	0.127	0.191	0.116	**0.547**	0.198	0.219	0.180	0.155	0.206
INT6	0.237	0.423	0.298	**0.633**	0.231	-0.157	0.224	-0.034	0.079
F5: ext. def.									
EXT1	0.043	0.134	0.311	0.182	**0.511**	0.018	-0.040	-0.032	0.241
EXT2	0.048	0.459	0.435	0.448	**0.735**	0.313	0.259	-0.096	0.166
EXT4	0.089	0.450	0.393	0.302	**0.776**	0.302	0.301	-0.053	0.052
EXT5	0.158	0.009	0.299	0.345	**0.857**	0.115	0.191	-0.160	0.284
F6: futurity									
FUT3	0.318	0.173	0.284	0.117	0.252	**1.000**	0.284	-0.182	0.230
F7: proactiveness									
PRO1	0.368	0.343	0.195	0.418	0.345	0.293	**0.971**	-0.134	-0.059
PRO3	0.281	0.036	0.477	0.357	0.380	0.164	**0.562**	-0.254	0.420
PRO5	0.262	0.187	0.114	0.239	0.162	0.237	**0.929**	-0.030	-0.017
F8: riskiness									
RIS3	-0.180	0.029	-0.175	-0.062	-0.076	-0.133	-0.096	**0.941**	-0.077
RIS4	-0.030	-0.264	-0.312	-0.231	-0.228	-0.216	-0.077	**0.850**	-0.099
F9: innovativeness									
INN1	0.190	0.290	0.517	0.338	0.245	0.298	-0.084	-0.094	**0.627**
INN3	0.162	0.179	0.026	0.138	0.084	0.090	-0.040	-0.167	**0.851**
INN4	0.152	0.202	0.084	0.238	0.330	0.236	0.002	0.069	**0.781**

Table 17. Correlation of Latent Variables and Reliability Statistics for CEO Data

	α	CR	AVE	F1	F2	F3	F4	F5	F6	F7	F8	F9
F1	0.906	0.921	0.540	**0.735**	0.213	0.544	0.416	0.237	0.320	0.487	0.163	0.314
F2	0.650	0.761	0.526	0.147	**0.725**	0.295	0.641	0.594	0.267	0.310	0.207	0.418
F3	0.645	0.833	0.717	0.464	0.230	**0.847**	0.536	0.667	0.373	0.556	0.340	0.407
F4	0.680	0.799	0.506	0.330	0.364	0.433	**0.711**	0.560	0.321	0.626	0.308	0.546
F5	0.757	0.817	0.535	0.135	0.257	0.455	0.438	**0.732**	0.283	0.472	0.199	0.515
F6	1.000	1.000	1.000	0.319	0.189	0.283	0.147	0.237	**1.000**	0.363	0.221	0.335
F7	0.673	0.827	0.623	0.395	0.253	0.329	0.448	0.367	0.304	**0.790**	0.297	0.346
F8	0.767	0.891	0.804	-0.133	-0.089	-0.253	-0.101	-0.144	-0.182	-0.181	**0.897**	0.207
F9	0.653	0.801	0.577	0.214	0.267	0.189	0.287	0.276	0.232	0.124	-0.094	**0.759**

Note: Below the diagonal there are the correlations between latent variables. On the diagonal there are the square roots of the AVE scores. Above the diagonal, there are Heterotrait-Monotrait ratio scores.

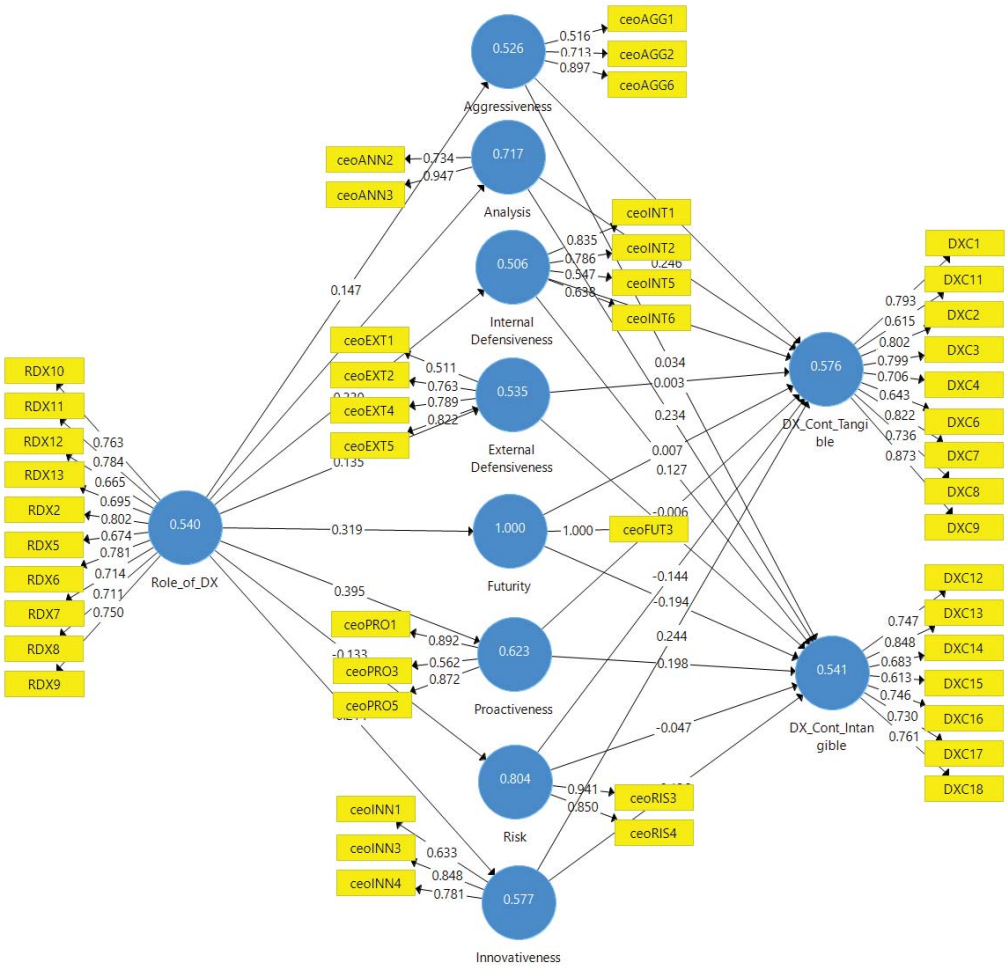

Fig. 3 Path model of CEO data

5.3 Model fit

Hypotheses have been tested on the final model; the model fit was assessed on this one. According to smartPLS model fit evaluation notes a good model fit has a standardized RMS residual (SRMR) value less than 0.8 or 0.1, NFI value greater than 0.9, and rms theta close to 0 or less than 0.12 for fully reflective models. The model had 0.221 SRMR value, 0.446 NFI, and 0.153 rms theta value. Fit indices were observed for each execution, though re-specifications was done, it didn't improve further. PLS-SEM's predictive power is way stronger than other methods such as covariance-based (CB) SEM. Since goodness of fit measures are viable when the disparity measured between the empirical correlation matrix and the model-implied correlation matrix is being minimized, which is not done by PLS-SEM, it is better not to apply them until more literature propose to use them for PLS-SEM (Hair, Sarstedt & Ringle, 2019). Thus, it was decided to proceed with the existing model.

5.4 Hypothesis testing

To test the hypothesis, partial least square (PLS) analyses have been performed on SmartPLS 3 for theory confirmation, which provided information as to where relationships exist or not.

The CEO/CxO mutual understanding of the role of DX construct is an exogenous variable. Strategic alignment and DX contribution are endogenous variables. All the constructs are kept as reflective, where the indicators are caused by the latent variable.

Table 18 shows loadings for each indicator. The indicators marked with * are newly added survey items as a result of literature review and with feedbacks of

experts, which is one of the contribution of this research to the literature. Except the indicators RDX7, RDX9, RDX10, RDX11 all the indicators were significant, with $p<0.001$. These indicators with nonsignificant loadings were eliminated, and then moved to hypothesis testing.

Mutual understanding among top management led to alignment of aggressiveness, internal defensiveness, external defensiveness and proactiveness strategy dimensions with significance values less than 0.05, confirming hypotheses (H1, 3, 4, 6). However, mutual understanding between C-level managers did not lead to DX strategy alignment for the dimensions of analysis, futurity, riskiness, and innovativeness. The impact of DX on the alignment of these dimensions is not fully comprehended by the C-level managers.

Regarding the impact of strategic alignment on DX contribution, DX strategic alignment on aggressiveness dimension led to both tangible and intangible DX contribution with the significance values less than 0.05 confirming H9. While the impact of mutual understanding on analysis dimension was not significant, DX strategic alignment on analysis dimension led to higher tangible DX contribution. C-level managers see the value of analysis alignment of DX strategy as a tangible contribution to organization performance confirming H10. Lastly, DX strategic alignment on internal defensiveness dimension led to intangible DX contribution with the significance value 0.019 confirming H11. We fail to confirm the hypotheses; H12, 13,14,15,16 as external defensiveness, futurity, proactiveness, riskiness, and innovativeness dimensions didn't lead to significant DX contribution. Table 19 shows the R square values and the path coefficients. Figure 4 respectively presents the path diagram of final research model with r-square scores and total

effects, and figure 5 represents final theoretical model with r-square and t-statistic values for the supported hypothesis.

Table 18. PLS Analysis Result and Loading of the Indicators

Indicator	Loadings	Indicator	Loadings
Mutual Understanding on the Role of DX		DX Strategy Alignment Dimensions	
*CEO-CxO RDX5	0.602	CEO-CxO AGG1	0.881
*CEO-CxO RDX6	0.592	CEO-CxO AGG2	0.900
CEO-CxO RDX7	0.429	*CEO-CxO AGG6	0.691
CEO-CxO RDX8	0.677	CEO-CxO ANN2	0.928
*CEO-CxO RDX9	0.289	CEO-CxO ANN3	0.928
*CEO-CxO RDX10	0.300	CEO-CxO EXT1	0.722
*CEO-CxO RDX11	0.484	CEO-CxO EXT2	0.882
*CEO-CxO RDX12	0.735	CEO-CxO EXT4	0.832
DX Contribution		*CEO-CxO EXT5	0.777
CxO DXC_Tangible1	0.716	CEO-CxO INT1	0.770
CxO DXC_Tangible2	0.833	CEO-CxO INT2	0.784
CxO DXC_Tangible3	0.789	*CEO-CxO INT5	0.616
*CxO DXC_Tangible6	0.682	CEO-CxO INT6	0.723
*CxO DXC_Tangible7	0.736	CEO-CxO FUT3	1.000
*CxO DXC_Tangible9	0.756	CEO-CxO PRO1	0.880
*CxO DXC_Tangible11	0.712	CEO-CxO PRO3	0.755
*CxO DXC_Intangible12	0.723	*CEO-CxO PRO5	0.908
*CxO DXC_Intangible13	0.857	CEO-CxO RIS3	0.939
*CxO DXC_Intangible14	0.873	CEO-CxO RIS4	0.825
*CxO DXC_Intangible15	0.757	CEO-CxO INN1	0.832
*CxO DXC_Intangible17	0.766	CEO-CxO INN3	0.878
*CxO DXC_Intangible18	0.750	*CEO-CxO INN4	0.700

Note:* represents the survey items added by this research.

Table 19. R Square Values and the Path Coefficients

		AGG	ANN	EXT	INT	FUT	PRO	RISK	INN	DXCT	DXCI
R square		0.078	0.024	0.079	0.057	0.009	0.066	0.002	0.023	0.396	0.377
Indicator Loadings	RDX	-0.279*	-0.156	-0.239*	-0.280*	-0.097	-0.257*	0.041	-0.153		
	AGG									0.377*	0.338*
	ANA									0.190*	0.114
	INT									0.179	0.278*
	EXT									-0.149	0.079
	FUT									0.062	-0.016
	PRO									0.083	-0.094
	RISK									0.100	0.065
	INN									-0.012	0.012
	DXCT										
	DXCI										

Note: *p<0.05

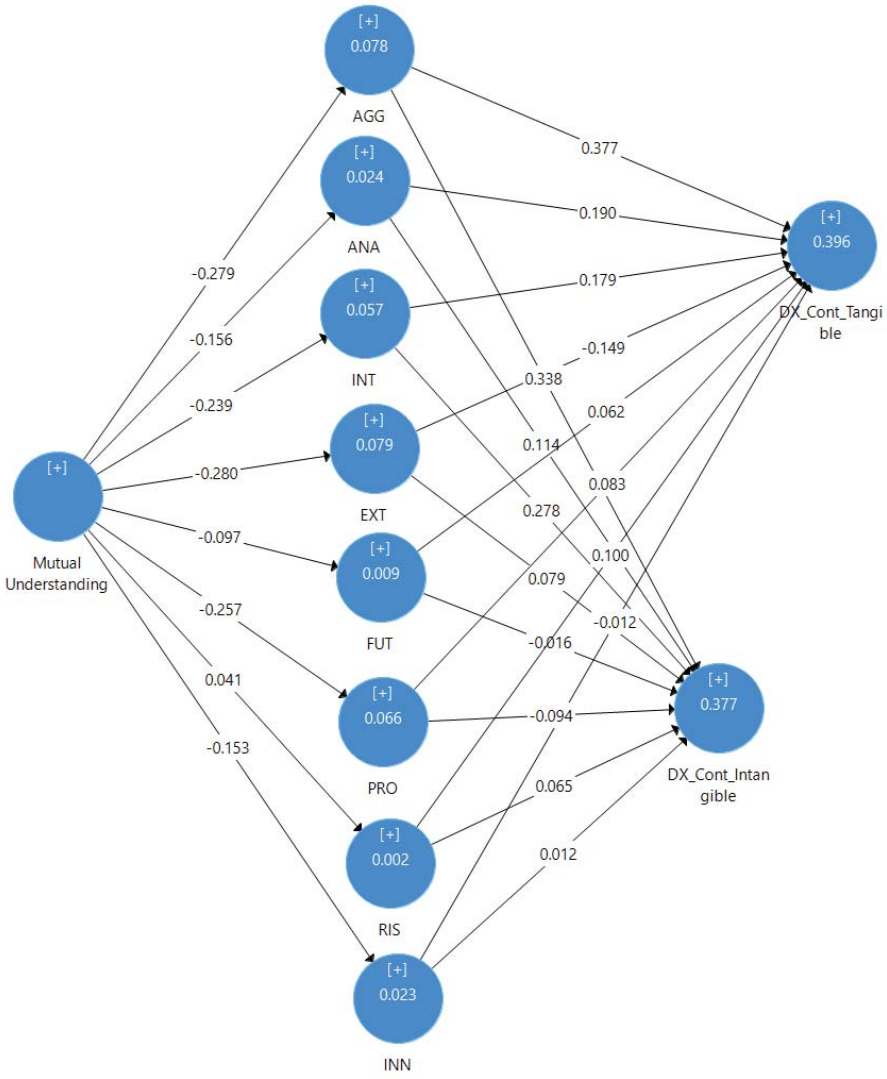

Fig. 4 Path diagram of final research model with r-square scores and total effects

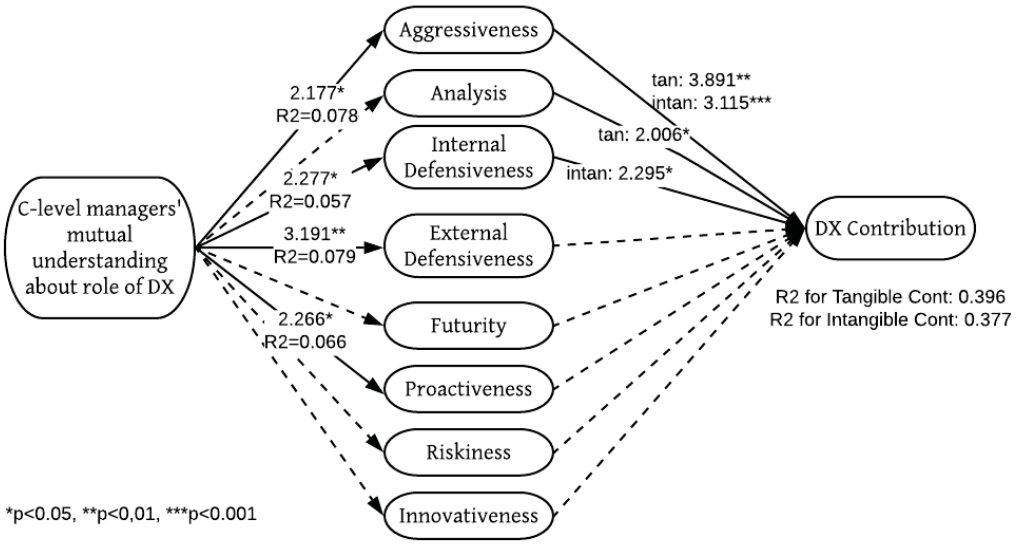

Fig. 5 Final theoretical model with r-square and t-statistic values

5.5 Robustness test

The model of this study was reflective, in which reflective indicators were considered to be caused by the construct. In contrast, in formative measurement models, causal indicators are believed to form the construct by means of linear combinations. Formative indicators are usually not interchangeable, when one of them eliminated the meaning of the construct usually changes, because each indicator of a formative construct determines the meaning of the construct (Hair et al., 2017). Therefore, the DX contribution constructs could be taken formative.

For robustness test, the DX tangible and intangible constructs were switched from reflective to formative. Since the validity and reliability of the Role of DX and strategy dimensions constructs were assessed earlier in this study, they were not analyzed again. For DX tangible and intangible contribution constructs first collinearity statistics were checked. The VIF values of all the DX contribution indicators were above 3.0, so none of them were eliminated. Then, significance and

relevance of formative indicators were checked. For relative contribution of indicators to construct outer weights were checked, the indicators with nonsignificant outer weights were candidates for deletion. Before item dropping, absolute contribution of them were assessed via checking outer loadings of formative indicators. The indicators with outer loadings below 0.5 were dropped, which are DXCT11 (Monetization), DXCI15 (Agility), DXCI17 (Security), and DXC18 (Mobility). As seen in the table 20, after dropping items VIF values stayed above 3.0. Table 21 and 22 show that, although the outer weights of all the indicators are insignificant, the outer loadings are all above 0.5. So, it is decided to keep the remaining items.

Table 20. Collinearity Statistics

Indicator	VIF
DXCT1	1.692
DXCT2	2.711
DXCT3	2.466
DXCT6	1.638
DXCT7	1.877
DXCT9	1.696
DXCI12	1.643
DXCI13	2.546
DXCI14	2.657
DXCI18	1.435

Table 21. Outer Weights

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
DXCT1	0.005	0.006	0.221	0.023	0.981
DXCT2	0.446	0.420	0.287	1.551	0.121
DXCT3	0.095	0.050	0.256	0.372	0.710
DXCT6	0.217	0.217	0.209	1.035	0.301
DXCT7	0.227	0.212	0.255	0.892	0.373
DXCT9	0.283	0.255	0.216	1.309	0.191
DXCI12	0.210	0.155	0.284	0.742	0.458
DXCI13	0.376	0.313	0.324	1.160	0.246
DXCI14	0.473	0.441	0.286	1.657	0.098
DXCI18	0.103	0.160	0.327	0.315	0.753

Table 22. Outer Loadings

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
DXCT1	0.623	0.564	0.172	3.633	0.000
DXCT2	0.865	0.786	0.142	6.086	0.000
DXCT3	0.750	0.667	0.163	4.597	0.000
DXCT6	0.699	0.648	0.148	4.732	0.000
DXCT7	0.744	0.675	0.187	3.978	0.000
DXCT9	0.777	0.705	0.156	4.974	0.000
DXCI12	0.741	0.664	0.183	4.057	0.000
DXCI13	0.903	0.820	0.140	6.448	0.000
DXCI14	0.933	0.858	0.110	8.517	0.000
DXCI18	0.617	0.596	0.236	2.612	0.009

After assessing collinearity issues and relative and absolute importance of indicators, hypothesis tests were conducted. Table 23 shows similar results to hypothesis test results with reflective DX contribution constructs. Mutual understanding among top management led to aggressiveness, internal defensiveness, external defensiveness, and proactiveness dimensions of DX strategic alignment with the significance values less than 0.05. Mutual understanding between C-level managers on the role of DX did not lead to analysis, futurity, riskiness, and innovativeness dimensions of DX strategic alignment.

DX strategic alignment on aggressiveness dimension led to both tangible and intangible DX contribution with the significance value less than 0.05 (H9). Although, with reflective constructs DX strategic alignment on analysis dimension led tangible DX contribution and DX strategic alignment on internal defensiveness dimension led to intangible DX contribution, in formative constructs these hypotheses and the other hypotheses were not confirmed.

With formative DX tangible and intangible constructs, similar results were obtained, but hypothesis test results didn’t improve further. It can be concluded that robustness of the model was obtained to some extent.

Table 23. Hypothesis Testing

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Mutual Understanding -> AGG	-0.280	-0.289	0.132	2.127	**0.034**
Mutual Understanding -> ANA	-0.156	-0.175	0.108	1.438	0.151
Mutual Understanding -> INT	-0.246	-0.275	0.111	2.217	**0.027**
Mutual Understanding -> EXT	-0.282	-0.295	0.095	2.967	**0.003**
Mutual Understanding -> FUT	-0.097	-0.119	0.099	0.985	0.325
Mutual Understanding -> PRO	-0.259	-0.273	0.116	2.223	**0.026**
Mutual Understanding -> RIS	0.039	0.034	0.098	0.394	0.694
Mutual Understanding -> INN	-0.156	-0.172	0.106	1.467	0.143
AGG -> DX_Cont_Intangible	0.410	0.389	0.135	3.034	**0.002**
AGG -> DX_Cont_Tangible	0.362	0.329	0.149	2.437	**0.015**
ANA -> DX_Cont_Intangible	0.174	0.141	0.160	1.092	0.275
ANA -> DX_Cont_Tangible	0.216	0.204	0.139	1.559	0.119
INT -> DX_Cont_Intangible	0.266	0.262	0.155	1.720	0.086
INT -> DX_Cont_Tangible	0.201	0.227	0.188	1.071	0.284
EXT -> DX_Cont_Intangible	-0.002	0.015	0.131	0.014	0.989
EXT -> DX_Cont_Tangible	-0.203	-0.208	0.169	1.202	0.229
FUT -> DX_Cont_Intangible	-0.087	-0.076	0.120	0.728	0.467
FUT -> DX_Cont_Tangible	0.067	0.070	0.128	0.523	0.601
PRO -> DX_Cont_Intangible	0.024	0.010	0.253	0.097	0.923
PRO -> DX_Cont_Tangible	0.111	0.096	0.180	0.615	0.539
RIS -> DX_Cont_Intangible	0.017	0.043	0.108	0.160	0.873
RIS -> DX_Cont_Tangible	0.105	0.110	0.114	0.920	0.358
INN -> DX_Cont_Intangible	-0.079	-0.052	0.190	0.416	0.677
INN -> DX_Cont_Tangible	-0.020	0.003	0.134	0.153	0.879

CHAPTER 6

DISCUSSION OF FINDINGS

In this research it has been found that mutual understanding among C-level managers of organizations on the role of DX lead to DX strategic alignment for the 4 dimensions of strategy; aggressiveness (H1), internal defensiveness (H3), external defensiveness (H4), and proactiveness (H6). Mutual understanding between CEO and the other C-level managers however did not lead to DX strategic alignment for the remaining dimensions; analysis (H2), futurity (H5), riskiness (H7), and innovativeness (H8).

The survey data were answered by C-level managers who have different roles and responsibilities in the organizations from different industries. Generally in Turkey IT, Strategy, and DX leaders are mostly familiar with the concept of DX and the role it has. The other executives are only aware of DX, but may not have deep knowledge about characteristics, drivers, and impacts of it. When it was discussed shortly with the managers of two companies, they associated digital, technology, and digitalization words with aggressive strategies, proactive decisions, increased efficiency, market share, and competitiveness, which define aggressiveness, internal defensiveness, external defensiveness, and proactiveness dimensions. This may explain why the 4 of 8 hypotheses; mutual understanding about the role of DX leads to DX strategic alignment on analysis, futurity, riskiness, and innovativeness dimensions are not supported.

This study showed that DX strategic alignment would positively relate to tangible DX contribution to organization's performance for aggressiveness, analysis dimensions and intangible DX contribution to organization's performance for

aggressiveness and internal defensiveness dimensions of strategy. By nature DX strategic alignment on aggressiveness dimension led to both tangible and intangible DX contribution, because aggressiveness can be both evaluated with tangible and intangible measures. And, analysis dimension can be mostly measured by tangible items. On the other hand, internal defensiveness can be mostly defined by intangible items.

Turkey has recently passed the planning phase and moving to the investment phase in the DX journey, so organizations may be are aware of predicted outcomes of DX but generally haven't experienced the contributions of DX yet (TÜSİAD, 2017). This may explain why the hypotheses about DX strategic alignment lead to DX contribution were supported only to some extent.

Sectoral differences on the mutual understanding between C-level managers on the role of DX were also observed. The highest mutual understanding was found in the wholesale/retail industry, in which organizations are more customer oriented. This enables them track digital technologies and transform their selves digitally to serve their customers in a better manner so that they could gain competitive advantage. The second highest mutual understanding was measured in manufacturing and energy/chemistry industries, where Industry 4.0 is on the top of their agenda and hence companies are trying to employ people with high digital abilities and people who can adapt their selves to rapid technological changes (Digital Platform of Turkey & PwC, 2019). So that they can decrease their costs, increase efficiency of their processes, increase product and service quality in order to compete in the market.

When mutual understanding level of different business functions was compared by measuring the mutual understanding gap between C-level pairs, the

differences between different groups were pretty low. However, the highest mutual understanding on the role of DX was measured between CEOs and CDO/CTO/CIOs, who have the leadership responsibility of DX journey of the organizations, and between CEOs and COOs, who has responsibility to implement DX. These findings are encouraging, but may not be sufficient to have a successful DX. All the top management should have higher mutual understanding about the role of DX. CEO and CDO/CTO/CIOs should coordinate and cooperate to involve whole company into this process. They should convey the DX culture in the whole organization and lead the change management, so that everybody can understand the role, characteristics, drivers, and transformational areas of DX and then work for DX not against it.

CHAPTER 7

PRACTICAL IMPLICATIONS

Mutual understanding about the role of DX between C-level managers led to DX strategic alignment for four of the eight dimensions. These findings show the importance of top management commitment to DX. When CEOs involve CDOs, CIOs or CTOs to serve as leaders of DX, COOs commit to implementing the DX, CFOs invest in digital initiatives without hindering ongoing operations, and CDOs analyze the competitive environment and define the digital disrupters, then DX strategic alignment emerges in the organizations.

It has been proved that there is no significant difference between views of CEOs and CxOs about contribution of DX to firm performance. So, all the C-level managers are sharing common views about DX contribution. And also they agree with the contribution of DX to organization performance. But even so DX strategic alignment led to DX contribution for three of the eight dimensions, which are aggressiveness, analysis and internal defensiveness. These findings show us to some extent the pairs of executives agree on how that DX contribution is achieved. By understanding the differences, communication and collaboration between the managers can be improved and thus they can benefit DX in a better manner.

In the light of the findings, CEOs can be suggested to be more involved in DX process. CDO/CIO/CTO might put more effort to foster the transformational culture in the organizations. They should also attach importance to innovativeness by implementing innovative products and solutions, fostering creativity in the companies and leveraging knowledge can be driven from data. In the digital era, companies should be also future oriented; they should be able to plan their DX

investments, and be able to produce their plans, budget allocations and then conform to their plans.

As it has been stated earlier in this research Turkey is still in the early stages of DX, so many organizations are still in the planning phase. So, in time all top management may perform higher mutual understanding on DX and agree with the outcomes of DX strategic alignment.

It is believed that this research will serve as a roadmap to the companies in Turkey, who are at the beginning of their DX journey. Top management of companies should ensure participation of executives from various business units to this journey, so that whole company would participate and contribute to this process. It is believed that wherefore than the gap between business units on the role of DX will decrease. In this way, everybody in the organization would understand the importance of DX, and its contribution to organization's performance.

CHAPTER 8

LIMITATIONS AND FUTURE RESEARCH

The main limitation of this research was the small sample of 45 companies for which data was collected for. The data analysis was made with 123 matched pairs of CEO-CxO, particularly limiting the CEO confirmatory analysis. On the other hand, the data was collected in Turkey, which is a developing country where DX is not fully comprehended by the C-level managers. Since organizations in Turkey are still in the early stages of DX, and defining their DX strategy, a future research with a larger and more representative sample could be beneficial.

CHAPTER 9

CONCLUSION

In this study the importance of mutual understanding on the role and contribution of DX among top management was emphasized. There are such studies in the literature that present the contributions of mutual understanding between CIO and CEO or CDO and CIO about DX or IS to organizations. However, this is the first study that measured the DX strategy alignment among all C-level managers. It may also be the first that adopt the quantitative approach to measure the DX strategy alignment. So, this research contributed literature in many ways; first the model of Johnson and Lederer (2010) was adapted to DX. Then, adding many new items to existing survey of Johnson and Lederer a new survey was developed by conducting deep literature review and due to the valuable remarks of CIO/CDOs who have been met to discuss the study and questionnaire. Online survey data were collected not only from CEOs and CIOs, but also from different C-level managers who should involve in DX journey of an organization. Moreover, DX contribution construct was divided into two variables as tangible contribution and intangible contribution of DX to organization's performance. Besides these, mutual understanding level of C-level managers on the role of DX in different industries was examined and compared and sectoral differences were presented. In addition, mutual understanding level on the role of DX and DX strategic alignment of different business functions were analyzed and compared and so functional similarities and differences have been presented.

In short, while DX is a cross functional strategy and requires top management commitment, this study demonstrated the importance of having DX strategy alignment among top management to enhance firm performance. This research will

definitely help organizations increase interaction, communication and collaboration between different departments and raising awareness about the importance and impact of DX on companies' success.

APPENDIX A

ENGLISH QUESTIONNAIRE

Role of DX (in all C-level instruments). Please indicate the extent to which you agree or disagree with the following statements. * indicates dropped items.

*RDX1: DX is not vital for existence of our organization.
*RDX2: DX will reshape organizational governance significantly.
*RDX3: Our company relies heavily on DX for optimizing the efficiency of operations.
*RDX4: DX will critically affect the way of doing business.
RDX5: DX will help us leverage value from information through efficient use of data.
RDX6: DX will affect culture within our organization.
RDX7: DX will contribute to offer significant new features to the existing product line/services.
RDX8: DX is looked at as a competitive resource.
RDX9: DX will help us leverage value from multisided business models
RDX10: DX will help us effectively capture value through coordinated business models in networks.
RDX11: DX will help us effectively capture appropriate value through developing the platforms of new business models.
RDX12: DX will transform workforce competencies.
**RDX13: DX will help us design lean processes.*

DX Contribution (in all C-level instruments). Please indicate the extent DX has contributed to each of the following for your organization. * indicates dropped items.

Tangible Instruments:	**Intangible instruments:**
DXC1: Return on investment	DXC12: Customer satisfaction
DXC2: Sales revenue	**DXC13: Customer experience**
DXC3: Market share	**DXC14: Company reputation**
*DXC4: Operating efficiency (e.g.: Turnover ratios)	*DXC15: Agility*
***DXC5: Number of Employees**	**DXC16: Product/Service Quality*
DXC6: Process Efficiency (e.g.: Time to Market, FTE Savings)	*DXC17: Security*
DXC7: Employee productivity	DXC18: *Mobility*
***DXC8: Operating Cost**	
DXC9: *Employee turnover*	
**DXC10: Market value*	
DXC11: Monetization	

Business Strategy (in CEO instruments). Please indicate the extent to which you agree or disagree with each statement as it relates to your organization's business strategy. * indicates dropped items.

Aggressiveness	**Futurity:**
CEO-AGG1: We strive to be one of the top three firms in each of our markets.	*CEO-FUT1: Our criteria for budget allocations generally reflect short-term considerations.
CEO-AGG2: We constantly attempt to be ahead of the competition.	*CEO-FUT2: We carry out long-term research to provide us with a future competitive edge.
*CEO-AGG3: We tend to act aggressively in our marketplace.	CEO-FUT3: We tend to be future-oriented (i.e., more focused on the long-term than on the short-term).
CEO-AGG6: We adopt disruptive technologies to redefine existing business models /enter new markets.	**Proactiveness:**
Analysis	CEO-PRO1: We are almost always searching for new business opportunities.
*CEO-ANA1: We require a great deal of factual information to support our day-to-day decision-making.	*CEO-PRO2: We regularly are on the lookout for organizations to acquire/partner
CEO-ANA2: When confronted with major decisions, we typically develop comprehensive analyses of the business	CEO-PRO3: *We use our resources efficiently (e.g.: outsourcing non-value activities)*
CEO-ANA3: We tend to be highly analytical in our decision-making.	*CEO-PRO4: We generally expand capacity ahead of our competitors.
Internal Defensiveness	CEO-PRO5: We seem to be always exploring new business opportunities.
CEO-INT1: We optimize coordination and collaboration among our functions (e.g., finance and marketing).	
CEO-INT2: We possess a constant drive to improve operating efficiency.	**Riskiness:**
*CEO-INT3: We devote a great deal of attention to improving the efficiency of our business operations.	*CEO-RIS1: In general, our mode of operations (i.e., our way of doing business) is riskier than our competitors.
CEO-INT5: We continuously strive to improve business processes.	*CEO-RIS2: We adopt a rather conservative view when making major decisions.
CEO-INT6: We invest in our employees' development.	CEO-RIS3: Our business operations generally follow ‘‘tried" and ‘‘true’’ paths.
External Defensiveness:	CEO-RIS4: We tend to be risk-averse.
CEO-EXT1: We develop strong relationships with our major customers.	**Innovativeness:**
CEO-EXT2: We develop strong relationships with our suppliers (e.g.,	CEO-INN1: We use innovative and imaginative solutions for most business

providers of key services, materials, finance).	problems.
*CEO-EXT3: We put a lot of emphasis on building relationships with major customers.	*CEO-INN2: We are early adopters of innovations.
CEO-EXT4: We put a lot of emphasis on building relationships with major suppliers (e.g., providers of key services, materials, finance).	CEO-INN3: We tend to be creative and original
CEO-EXT5: We enable product and service customization.	**CEO-INN4: We develop innovative products and services**
***CEO-EXT6: We put a lot of emphasis on being compliant with legal regulations.**	*CEO-INN8: *We have a try and fail budget for innovation development.*
	*CEO-INN9: *We are tolerant of making mistakes.*

DX Strategy (in all CxO instruments). Please indicate the extent to which you agree or disagree with the following statements as they relate to your organization. DX;

Aggressiveness:	CxO-FUT3: Assist us with long-term and short-term planning.
CxO-AGG1: Helps us be (or become) one of the top firms in our market (or markets).	CxO-FUT4: Enable us to forecast key indicators of business operations.
CxO-AGG2: Helps us stay ahead of (or catch up with) the competition.	CxO-FUT5: Help us to perform strategic business planning.
CxO-AGG3: Helps us aggressively go after market share.	CxO-FUT6: Help us to perform ‘‘what-if’’ studies of critical issues.
***CxO-AGG4: Helps us scale our business rapidly and cost effectively.**	*CxO-FUT7: Assists us in enterprise resource planning.*
CxO-AGG5: Helps us leverage network effects.	**Proactiveness:**
CxO-AGG6: Helps us leverage disruptive technologies.	CxO-PRO1: Assists in the identification of new business opportunities.
Analysis:	CxO-PRO2: Helps us quickly identify companies we may be interested in acquiring/forming partnerships
CxO-ANA1: Provides us with the facts and figures we need to support our day-to-day decision-making	*CxO-PRO3: Helps us to use our resources efficiently (ex: outsourcing non-value activities)*
CxO-ANA2: Enables us to develop detailed analyses of our present business situation.	CxO-PRO4: Allows us to keep track of our competitors which assist us in pre-empting them if necessary.
CxO-ANA3: Enables us to carry out detailed analyses of major business	CxO-PRO5: Gives us the information we need to grasp opportunities that come our

decisions.	way.
CxO-ANA4: Helps us to take advantage of data, information, and knowledge abundance.	**CxO-PRO6: Helps us to identify / utilize / implement new revenue models (e.g.: Paid content, Freemium)**
CxO-ANA5: Helps us to do quick analyses while making all kinds of business decisions.	**CxO-PRO7: Helps us to speed up the sense and respond cycle**
Internal Defensiveness:	**CxO-PRO8: Helps us to dynamically adjust our prices relative to the competition.**
CxO-INT1: Supports effective coordination and collaboration among functions (e.g., finance and marketing).	**Riskiness:**
CxO-INT2: Improves the efficiency of our business operations.	CxO-RIS1: Helps us to take calculated business risks.
CxO-IND3: Helps us maximize the efficiency of our business operations.	CxO-RIS2: Provides sufficiently detailed information to support conservative decision-making.
CxO-INT4: Helps us to integrate new operations into existing organizational structures.	CxO-RIS3: Provides us with the data we need to steer clear of overly risky business propositions.
CxO-INT5: Improves the efficiency of business processes.	CxO-RIS4: Gives us the information we need to minimize business risks.
CxO-INT6: Helps us develop a new set of skills based on digital technologies.	**CxO-RIS5: Helps us track product and service quality.**
External Defensiveness:	*CxO-RIS6: Helps us do predictive analytics to prevent failures.*
CxO-EXT1: Enable us to develop stronger ties with major customers.	**Innovativeness:**
CxO-EXT2: Enable us to develop stronger ties/to exercise a high degree of bargaining power with major suppliers (e.g., providers of key services, materials, finance).	CxO-INN1: Helps us generate innovative solutions for business problems.
CxO-EXT3: Help us establish strong market links in general (e.g., with customers, suppliers, and distributors).	CxO-INN2: Employs innovative, leading edge technologies.
CxO-EXT4: Helps us bolster the speed of dynamic supply chain orchestration.	CxO-INN3: Increases creativity and originality.
CxO-EXT5: Helps us develop customer centric designs.	CxO-INN4: Enables us to review external technological developments.
CxO-EXT6: Helps us respond to regulatory or legislative changes.	**CxO-INN5: Help us digitalize our user interfaces to the customers (channels / processes)**
Futurity:	**CxO-INN6: Helps us digitize product and services.**
CxO-FUT1: Allow us to adjust budget allocation decisions based on short-term considerations.	*CxO-INN7: Helps us make information centric innovation.*

CxO-FUT2: Represent investments geared at providing us with a future competitive edge.	*CxO-INN8: Helps us develop more accurate products with try and fail.*

APPENDIX B

QUESTIONNAIRE (TURKISH)

Dijital Dönüşüm: Ortak Anlayış ve Stratejik Hizalama Perspektifi

Anketimize Hoş Geldiniz

Bu anket Boğaziçi Üniversitesi Yönetim Bilişim Sistemleri bölümünde yazılmakta olan "Dijital Dönüşüm: Karşılıklı Anlayış ve Stratejik Hizalama Perspektifi" konulu yüksek lisans tezinin bir parçasıdır. Prof. Dr. Ceylan Onay'ın danışmanlığında yürütülmekte olan bu akademik araştırma, CEO/GM ve üst yönetim kadrosu arasındaki Dijital Dönüşüm (DX) anlayışını, strateji uyumunu ve bu uyumun kuruluşun performansına katkısını ölçmek için yapılmaktadır.

Ankette beş bölüm bulunmaktadır ve tamamlaması yaklaşık "10 dakika" sürmektedir. İlk bölüm Bilgi Teknolojileri olgunluğunu ve Dijital Dönüşüm farkındalığını, 2.bölüm Dijital Dönüşümün rolünü, 3.bölüm Dijital Dönüşümün performansa katkısını, 4.bölüm Dijital Dönüşüm ile şirket stratejisi uyumunu ölçmekte ve 5.bölüm demografik bilgileri derlemektedir. Demografik bilgiler bölümünde hem çalıştığınız sirketle ilgili hem de bireysel sorular yer almaktadır.

Ankette kimliğiniz ve iletişim bilgileriniz istenmeyecek ve cevaplarınız gizli tutulacaktır. Araştırmamızın başarısı açısından, sizin ve kuruluşunuzdaki tüm üst yönetim kadronuzun ankete katılmaları ve tüm soruları yanıtlamaları çok önemlidir. Sorularınız ve daha fazla bilgi için sevgi.atacan@gmail.com email adresinden bana ulaşabilirsiniz.

Değerli zamanınız ve desteğiniz için çok teşekkür ederim.

Saygılarımla Sevgi Çavuşyan

Dijital Dönüşüm: Ortak Anlayış ve Stratejik Hizalama Perspektifi

Bilgi Teknolojileri Olgunluğu ve Dijital Dönüşüm Farkındalığı

* 1. Lütfen "BT olgunluğu ve Dijital Dönüşüm farkındalığı" hakkındaki aşağıdaki ifadelere ne ölçüde katıldığınızı çalıştığınız şirketi göz önünde bulundurarak belirtiniz.

	Kesinlikle Katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle Katılıyorum 5
Bilgi teknolojilerinin olgunlaşmış olması dijital dönüşümü mümkün kılmaktadır.	○	○	○	○	○
Dijital dönüşüm stratejimiz açık bir şekilde belirlenmiştir.	○	○	○	○	○
Dijital dönüşüm stratejimiz şirket içerisinde tüm çalışanlarımız ile paylaşılmıştır.	○	○	○	○	○

Dijital Dönüşüm: Ortak Anlayış ve Stratejik Hizalama Perspektifi

Dijital Dönüşümün Rolü

* 2. Lütfen "Dijital Dönüşümün rolü" hakkındaki aşağıdaki ifadelere ne ölçüde katıldığınızı çalıştığınız şirketi/şirketinizi göz önünde bulundurarak belirtiniz."

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Dijital dönüşüm, şirketimizin varoluşu için hayati önem arz etmemektedir.	○	○	○	○	○
Dijital dönüşüm organizasyonel yönetişimi önemli ölçüde yeniden şekillendirecektir.	○	○	○	○	○
Şirketimiz, operasyonların verimliliğini optimize etmek için dijital dönüşüme güvenmektedir.	○	○	○	○	○
Dijital dönüşüm iş yapma şeklimizi kritik bir biçimde etkileyecektir.	○	○	○	○	○
Dijital dönüşüm verinin etkin kullanımı ile bilgiden değer yaratmamıza yardımcı olacaktır.	○	○	○	○	○
Dijital dönüşüm şirketimiz içerisindeki kültürü etkileyecektir.	○	○	○	○	○
Dijital dönüşüm mevcut ürün/hizmet yelpazemize yeni özellikler kazandıracaktır.	○	○	○	○	○
Dijital dönüşüm rekabet avantajı sağlayan bir kaynak olarak görülmektedir.	○	○	○	○	○
Dijital dönüşüm paylaşım ekonomisinden değer yaratmamıza yardımcı olacaktır. (örnek: Uber, Airbnb)	○	○	○	○	○
Dijital dönüşüm ekosistemlerdeki iş modellerinden değer yaratmamıza yardımcı olacaktır.	○	○	○	○	○
Dijital dönüşüm, yeni iş modellerinde geliştirilecek platformlarla değer yaratmamıza yardımcı olacaktır.	○	○	○	○	○
Dijital dönüşüm işgücü yetkinliklerini dönüştürecektir.	○	○	○	○	○
Dijital dönüşüm iş süreçlerini yalınlaştıracaktır.	○	○	○	○	○

Dijital Dönüşüm: Ortak Anlayış ve Stratejik Hizalama Perspektifi

Dijital Dönüşümün Şirket Performansına Katkısı

* 3. Lütfen "Dijital Dönüşümün Şirket Performansına katkısını" çalıştığınız şirketi/şirketinizi göz önünde bulundurarak belirtiniz."

	Hiç 1	Çok az 2	Kısmen 3	Çok 4	Oldukça fazla 5
Yatırımın geri dönüşü (RoI)	○	○	○	○	○
Satış geliri	○	○	○	○	○
Pazar payı	○	○	○	○	○
Operasyonel verimlilik	○	○	○	○	○
Süreç verimliliği (Pazara sürüm süresi, FTE - tam zamanlı çalışan dengi)	○	○	○	○	○
Çalışan sayısı	○	○	○	○	○
Çalışan verimliliği	○	○	○	○	○
İşten ayrılma oranı	○	○	○	○	○
Piyasa değeri	○	○	○	○	○
Operasyonel maliyet	○	○	○	○	○
Parasallaşma	○	○	○	○	○
Şirket itibarı	○	○	○	○	○
Müşteri memnuniyeti	○	○	○	○	○
Müşteri deneyimi	○	○	○	○	○
Ürün ve Hizmet kalitesi	○	○	○	○	○
Güvenlik	○	○	○	○	○
Mobilite	○	○	○	○	○
Çeviklik	○	○	○	○	○

Dijital Dönüşüm: Ortak Anlayış ve Stratejik Hizalama Perspektifi

* 4. Aşağıdaki pozisyonlardan hangisi/hangileri mevcut unvanınızı daha doğru tanımlamaktadır? Eğer birden fazla fonksiyondan sorumluysanız lütfen hepsini işaretleyiniz.

- ☐ CEO (Chief Executive Officer) / Genel Müdür
- ☐ CDO (Chief Digital Officer) / Dijital Faaliyetlerden Sorumlu GMY
- ☐ CIO (Chief Information Officer) / Bilgi Sistemleri GMY
- ☐ CTO (Chief Technology Officer) / Teknolojiden Sorumlu GMY
- ☐ CFO (Chief Finance Officer) / Mali İşlerden Sorumlu GMY
- ☐ CMO (Chief Marketing Officer) / Pazarlama ve Satış Grubu GMY
- ☐ COO (Chief Operations Officer) / Operasyonlardan Sorumlu GMY
- ☐ CSO (Chief Strategy Officer) / Stratejiden Sorumlu GMY
- ☐ CHRO (Chief Human Resources Officer) / İnsan Kaynaklarından Sorumlu GMY
- ☐ Direktör (Organizasyon şemanızda GMY yoksa lütfen sorumlu olduğunuz alanı belirtiniz. örn: Pazarlama)

Dijital Dönüşüm: Ortak Anlayış ve Stratejik Hizalama Perspektifi

Strateji

Lütfen aşağıdaki ifadelere ne ölçüde katıldığınızı şirketinizin stratejisini göz önüne alarak belirtiniz.

* 5. Girişkenlik

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Şirketimizin faaliyet gösterdiği her pazarda en iyi üç firmadan biri olması için çaba gösteriyoruz.	◯	◯	◯	◯	◯
Rekabette öncü olmak için sürekli girişimlerde bulunuyoruz.	◯	◯	◯	◯	◯
Pazarda agresif stratejilerle hareket etme eğilimindeyiz.	◯	◯	◯	◯	◯
Mevcut iş modellerini yeniden tanımlamak ve/veya yeni pazarlara girmek için yıkıcı/yeni teknolojileri deniyoruz.	◯	◯	◯	◯	◯

* 6. Analiz

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Günlük karar alma süreclerimizi desteklemek için doğru ve anlamlı bilgiye ihtiyaç duyuyoruz.	◯	◯	◯	◯	◯
Önemli kararlar almak zorunda kaldığımızda daha önce karşılaşılan senaryolara dayalı kapsamlı analizler kurguluyoruz.	◯	◯	◯	◯	◯
Veriye dayalı karar veriyoruz.	◯	◯	◯	◯	◯

* 7. Dahili Koşullar

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Operasyonel/Fonksiyonel birimlerimiz (finans, pazarlama, satış) arasındaki koordinasyonu ve işbirliğini optimize ediyoruz.	◯	◯	◯	◯	◯
Operasyonel verimliliği arttırma konusunda sürekli gayret gösteriyoruz.	◯	◯	◯	◯	◯
Ticari faaliyetlerimizin verimliliğini arttırmak için yoğun bir mesai harcıyoruz.	◯	◯	◯	◯	◯
İş süreçlerini iyileştirmek için sürekli gayret gösteriyoruz.	◯	◯	◯	◯	◯
Çalışanlarımızın gelişimine önem veriyoruz.	◯	◯	◯	◯	◯

* 8. Harici Koşullar

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Büyük müşterilerimizle güçlü ilişkiler kuruyoruz.	◯	◯	◯	◯	◯
Büyük tedarikçilerimizle güçlü ilişkiler kuruyoruz.	◯	◯	◯	◯	◯
Büyük müşterilerimizle ilişkilerimizi geliştirmeye önem veriyoruz.	◯	◯	◯	◯	◯
Büyük tedarikçilerimizle ilişkilerimizi geliştirmeye önem veriyoruz.	◯	◯	◯	◯	◯
Müşteri odaklı ürün ve hizmet tasarımı yapıyoruz.	◯	◯	◯	◯	◯
Yasal düzenlemelere uyumlu olmaya önem veriyoruz.	◯	◯	◯	◯	◯

* 9. Gelecek Odaklılık

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Bütçe tahsislerimiz genellikle kısa dönemli beklentileri yansıtıyor.	◯	◯	◯	◯	◯
Gelecekte rekabet avantajı elde etmek için uzun vadeli araştırmalar yapıyoruz.	◯	◯	◯	◯	◯
Daha çok geleceğe yönelik hareket etmeye çalışıyoruz.	◯	◯	◯	◯	◯

* 10. Proaktiflik

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Sürekli olarak yeni iş fırsatları bulmaya çalışıyoruz.	◯	◯	◯	◯	◯
Satın alabileceğimiz/ortaklık kurabileceğimiz şirket arayışı içerisindeyiz	◯	◯	◯	◯	◯
Kaynaklarımızı verimli kullanıyoruz. (örn: değer yaratmayan faaliyetlerde dış kaynak kullanımı)	◯	◯	◯	◯	◯
Kapasite arttırımını genellikle rakiplerimizden daha önce gerçekleştiriyoruz.	◯	◯	◯	◯	◯
Her zaman yeni iş fırsatları araştırıyoruz.	◯	◯	◯	◯	◯

* 11. Risk

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Operasyonlarımız rakiplerimizinkinden daha risklidir.	◯	◯	◯	◯	◯
Büyük kararlar alırken tedbirli/ihtiyatlı bir görüş benimsiyoruz.	◯	◯	◯	◯	◯
Operasyonlarımızda genellikle "denenmiş" ve "doğrulanmış" yollar izlenmektedir.	◯	◯	◯	◯	◯
Risk almaktan kaçınan bir eğilim göstermekteyiz.	◯	◯	◯	◯	◯

* 12. Yaratıcılık

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Karşılaştığımız problemler için yenilikçi ve yaratıcı çözümler üretiyoruz.	◯	◯	◯	◯	◯
Yenilikleri en erken benimseyenlerdeniz.	◯	◯	◯	◯	◯
Yaratıcı ve özgün olma eğilimindeyiz.	◯	◯	◯	◯	◯
Yenilikçi ürün ve hizmetler geliştiriyoruz.	◯	◯	◯	◯	◯
İnavosyon için deneme/yanılma bütçesi ayırıyoruz.	◯	◯	◯	◯	◯
İnovasyonu desteklemek için hata yapmaya tolerans gösteririz.	◯	◯	◯	◯	◯

Dijital Dönüşüm Stratejisi

Lütfen aşağıdaki ifadelere ne ölçüde katıldığınızı şirketinizi göz önüne alarak belirtiniz.
Dijital Dönüşüm;

* 13. Girişkenlik

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Şirketimizin faaliyet gösterdiği pazardaki öncü firmalardan biri olmasına yardımcı olur.	◯	◯	◯	◯	◯
Rakiplerimizin önüne geçmek/önünde kalmak için bize yardımcı olur.	◯	◯	◯	◯	◯
Agresif bir şekilde pazar payımızı arttırmamıza yardımcı olur.	◯	◯	◯	◯	◯
İşimizi hızlı ve düşük maliyetli bir şekilde ölçeklendirmemize yardımcı olur.	◯	◯	◯	◯	◯
Ağ etkilerinden yararlanmamıza yardımcı olur. (bir ürünün değerinin daha fazla kullanıcının kullanmasıyla artması örnek: e-posta, sosyal medya)	◯	◯	◯	◯	◯
Yıkıcı teknolojilerden yararlanmamıza yardımcı olur.	◯	◯	◯	◯	◯

* 14. Analiz

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Günlük karar alma süreçlerimizi destekleyen doğru ve anlamlı bilgiye ulaşmamızı sağlar.	◯	◯	◯	◯	◯
Mevcut iş durumumuzun kapsamlı analizlerini yapmamıza yardımcı olur.	◯	◯	◯	◯	◯
Önemli iş kararları alırken detaylı analizler yapmamızı sağlar.	◯	◯	◯	◯	◯
Veri, bilgi ve bilgiden açığa çıkarılmış değer bolluğundan faydalanmamıza yardımcı olur.	◯	◯	◯	◯	◯
Her türlü iş kararımızı alırken hızlı analizler yapmamıza olanak sağlar.	◯	◯	◯	◯	◯

* 15. Dahili Koşullar

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Operasyonel/Fonksiyonel birimlerimiz (finans, pazarlama, satış vb.) arasındaki koordinasyonu ve işbirliğini destekler.	◯	◯	◯	◯	◯
Operasyonlarımızın verimliliğini arttırır.	◯	◯	◯	◯	◯
Ticari faaliyetlerimizin verimliliğini maksimize etmeye yardım eder.	◯	◯	◯	◯	◯
Yeni operasyonları, mevcut organizasyonel yapımıza entegre etmemize yardımcı olur.	◯	◯	◯	◯	◯
İş süreçlerimizin verimliliğini arttırır.	◯	◯	◯	◯	◯
Dijital teknolojilere dayalı yeni beceriler geliştirmemize yardımcı olur.	◯	◯	◯	◯	◯

* 16. Harici Koşullar

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Büyük müşterilerimizle daha güçlü ilişkiler kurmamızı sağlar.	◯	◯	◯	◯	◯
Büyük tedarikçilerimizle daha güçlü ilişkiler kurmamızı sağlar ve pazarlık gücümüzü artırır.	◯	◯	◯	◯	◯
Pazardaki iş ortaklarımızla (müşteri, tedarikçi, distribütör vb.) ilişkilerimizi geliştirmemize yardımcı olur.	◯	◯	◯	◯	◯
Dinamik tedarik zincirinin daha hızlı yönetilmesine yardımcı olur.	◯	◯	◯	◯	◯
Müşteri odaklı tasarımlar yapmamıza yardımcı olur.	◯	◯	◯	◯	◯
Yasal düzenlemelere uyum sağlamamıza yardımcı olur.	◯	◯	◯	◯	◯

* 17. Gelecek Odaklılık

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Bütçe tahsisi kararlarını kısa vadeli değerlendirmelere göre güncellememizi sağlar.	◯	◯	◯	◯	◯
Gelecekte rekabet avantajı yaratır.	◯	◯	◯	◯	◯
Hem kısa hem de uzun vadeli planlama yapmamıza yardımcı olur.	◯	◯	◯	◯	◯
Operasyonlarımızın ana göstergelerini tahmin etmemize olanak sağlar.	◯	◯	◯	◯	◯
Stratejik planlama yapmamıza yardımcı olur.	◯	◯	◯	◯	◯
Kritik konularla ilgili senaryo simülasyonları yapmamıza yardımcı olur.	◯	◯	◯	◯	◯
Kurumsal kaynak planlamasına destek olur	◯	◯	◯	◯	◯

* 18. Proaktiflik

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Yeni iş fırsatları tespit etmemize yardımcı olur.	○	○	○	○	○
Satın alabileceğimiz/iş birliği kurabileceğimiz şirketleri hızla tespit etmemize yardımcı olur.	○	○	○	○	○
Kaynakları verimli kullanmamıza yardımcı olur (örnek: değer yaratmayan faaliyetlerde dış kaynak kullanımı)	○	○	○	○	○
Rakiplerimizi yakından izleyerek gerekli aksiyonları almamıza destek olur.	○	○	○	○	○
Karşılaştığımız yeni iş fırsatlarını yakalama konusunda bize bilgi sağlar.	○	○	○	○	○
Yeni gelir modelleri belirlememize yardımcı olur. (Örnek: Ücretli İçerik, Daha fazla özellik için satın alma opsiyonlu bedeva içerik)	○	○	○	○	○
Trendleri fark edip aksiyon almamızı hızlandırır.	○	○	○	○	○
Rekabete göre dinamik fiyatlama yapmamıza yardımcı olur.	○	○	○	○	○

* 19. Risk

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
Öngörülen riskler almamıza yardım eder.	○	○	○	○	○
Belirsizlik altında karar verirken oldukça detaylı bilgi sağlar.	○	○	○	○	○
Aşırı riskli işlerden kaçınmak için ihtiyaç duyduğumuz verileri bize sağlar.	○	○	○	○	○
Risklerimizi minimize etmek için gerekli bilgileri bize sağlar.	○	○	○	○	○
Ürün ve hizmet kalitesinin takibine yardımcı olur.	○	○	○	○	○
Hataları önlemek için geleceğe dair tahminleme yapmamıza yardımcı olur.	○	○	○	○	○

* 20. Yaratıcılık

	Kesinlikle katılmıyorum 1	Katılmıyorum 2	Ne katılıyorum ne katılmıyorum 3	Katılıyorum 4	Kesinlikle katılıyorum 5
İşte karşılaşılan problemler için yenilikçi ve yaratıcı çözümler üretmemize yardımcı olur.	○	○	○	○	○
İnovatif ve öncü teknolojileri kullanır.	○	○	○	○	○
Yaratıcılığı ve özgünlüğü arttırır.	○	○	○	○	○
Dünyadaki teknolojik gelişmeleri takip etmemizi sağlar.	○	○	○	○	○
Müşterilerimize sunduğumuz kullanıcı arayüzlerimizin dijitalleşmesine yardımcı olur (kanallar, süreçler)	○	○	○	○	○
Ürün ve hizmetlerin dijitalleşmesine yardımcı olur.	○	○	○	○	○
Bilgi temelli inovasyon yapmamıza yardımcı olur.	○	○	○	○	○
Deneme yanılma ile daha doğru ürünler geliştirmemize yardımcı olur.	○	○	○	○	○

Dijital Dönüşüm: Ortak Anlayış ve Stratejik Hizalama Perspektifi

Demografik Bilgiler

Bu bölümde sizin hakkınızda ve çalıştığınız şirket hakkında bazı bilgiler istenmektedir. Bu aşamada verdiğiniz yanıtlar hiçbir şekilde bireysel veya tüzel kişiliğiniz ile ilgili olarak eşleştirilemeyecek şekilde saklanacak ve araştırma sona erdiğinde silinecektir.

* 21. Çalıştığınız şirkette kaç yıldır **mevcut unvanınızla** görev almaktasınız?

- 1 yıldan az
- 1-3 yıl
- 4-6 yıl
- 6-8 yıl
- 8-11 yıl
- 11-15 yıl
- 15 yıldan fazla

* 22. Çalıştığınız **şirkette** kaç yıldır görev almaktasınız?

- 1 Yıldan Az
- 1-5 Yıl
- 6-10 Yıl
- 10 Yıldan Fazla

* 23. Şirketinizin faaliyet gösterdiği **sektörde** kaç yıldır çalışıyorsunuz?

- 10 yıldan az
- 10-15 yıl
- 16-20 yıl
- 20 yıldan fazla

* 24. **Bilişim sistemleri** alanında kaç yıllık tecrübeniz var?

- 1 yıldan az
- 1-3 yıl
- 4-6 yıl
- 6-8 yıl
- 8 yıldan fazla
- Direkt olarak IS tecrübem yok

* 25. Bitirdiğiniz en yüksek eğitim programı hangisidir?

- Doktora
- MBA
- Yüksek Lisans
- Lisans
- Ön Lisans
- Lise
- Diğer

* 26. Şirketinizin faaliyet gösterdiği ana sektörü işaretleyiniz.(Birden fazla sektörde bulunuyorsanız bulunduğunuz tüm sektörleri işaretleyiniz)

- [ ] Eğitim/Sağlık
- [ ] Kamu
- [ ] Enerji/Kimya
- [ ] Perakende Satış
- [ ] Finans/Denetim/Danışmanlık
- [ ] Üretim
- [ ] İnşaat/Emlak
- [ ] Diğer (lütfen belirtin)

27. Şirketinizin 2017 yılındaki cirosu ne kadardı?

- ( ) 250 milyon TL'den az
- ( ) 2,5 milyar TL - 5 milyar TL
- ( ) 250 milyon TL - 500 milyon TL
- ( ) 5 milyar TL - 10 milyar TL
- ( ) 500 milyon TL - 1 milyar TL
- ( ) 10 milyar TL'den fazla
- ( ) 1 milyar TL - 2,5 milyar TL

28. Şirketinizin 2017 yılı itibariyle varlıklar toplamı ne kadardı?

- ( ) 500 milyon TL'den az
- ( ) 5 milyar TL - 10 milyar TL
- ( ) 500 milyon TL - 1 milyar TL
- ( ) 10 milyar TL - 20 milyar TL
- ( ) 1 milyar TL - 2 milyar TL
- ( ) 20 milyar TL'den fazla
- ( ) 2 milyar TL - 5 milyar TL

* 29. Şirketinizin mevcut çalışan sayısı ne kadardır?

- ( ) 1-49
- ( ) 1000-2499
- ( ) 51-99
- ( ) 2500-5000
- ( ) 100-249
- ( ) 5000-10000
- ( ) 250-999
- ( ) 10000'den fazla

APPENDIX C

CFA INITIAL RESULTS

Table C1. Initial CFA Results of the CxO data

Factor/item	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
F1:role of DX											
rxRDX1	**-0.169**	-0.077	-0.047	-0.003	-0.032	-0.092	-0.113	0.054	-0.064	-0.106	-0.011
xRDX2	**0.525**	0.257	0.209	0.275	0.343	0.354	0.239	0.186	0.228	0.240	0.218
xRDX3	**0.635**	0.352	0.262	0.361	0.384	0.349	0.334	0.295	0.335	0.287	0.317
xRDX4	**0.716**	0.331	0.206	0.231	0.344	0.316	0.261	0.266	0.295	0.305	0.240
xRDX5	**0.691**	0.188	0.310	0.269	0.323	0.277	0.209	0.270	0.309	0.167	0.240
xRDX6	**0.724**	0.549	0.426	0.473	0.527	0.559	0.509	0.365	0.475	0.377	0.404
xRDX7	**0.829**	0.569	0.329	0.414	0.454	0.435	0.472	0.377	0.536	0.405	0.448
xRDX8	**0.801**	0.405	0.350	0.395	0.367	0.347	0.323	0.353	0.346	0.347	0.327
xRDX9	**0.769**	0.563	0.378	0.459	0.491	0.438	0.511	0.430	0.425	0.335	0.408
xRDX10	**0.764**	0.551	0.349	0.398	0.483	0.410	0.492	0.429	0.446	0.390	0.432
xRDX11	**0.830**	0.583	0.369	0.403	0.525	0.479	0.529	0.466	0.503	0.466	0.507
xRDX12	**0.804**	0.499	0.437	0.459	0.435	0.421	0.449	0.398	0.560	0.424	0.349
xRDX13	**0.497**	0.224	0.235	0.408	0.359	0.323	0.180	0.325	0.236	0.319	0.319
F2: aggressiveness											
cxoAGG1	0.468	**0.825**	0.451	0.547	0.589	0.525	0.564	0.438	0.525	0.492	0.466
cxoAGG2	0.562	**0.842**	0.416	0.470	0.636	0.580	0.654	0.441	0.499	0.476	0.502
cxoAGG3	0.389	**0.729**	0.234	0.445	0.478	0.505	0.561	0.262	0.390	0.447	0.317
cxoAGG4	0.194	**0.381**	0.251	0.422	0.362	0.341	0.239	0.384	0.260	0.278	0.230
cxoAGG5	0.443	**0.756**	0.413	0.512	0.542	0.531	0.625	0.388	0.624	0.387	0.412
cxoAGG6	0.567	**0.777**	0.354	0.458	0.598	0.469	0.582	0.450	0.542	0.432	0.472
F3: analysis											
cxoANN1	0.425	0.410	**0.842**	0.499	0.467	0.543	0.393	0.525	0.500	0.517	0.487
cxoANN2	0.307	0.359	**0.895**	0.496	0.440	0.493	0.409	0.541	0.452	0.480	0.445
cxoANN3	0.352	0.418	**0.878**	0.534	0.505	0.557	0.415	0.571	0.483	0.498	0.412
cxoANN4	0.461	0.492	**0.849**	0.547	0.523	0.584	0.448	0.594	0.507	0.542	0.536
cxoANN5	0.399	0.398	**0.831**	0.544	0.537	0.582	0.455	0.628	0.482	0.488	0.449
F4: int. def.											
cxoINT1	0.457	0.536	0.550	**0.780**	0.616	0.625	0.460	0.510	0.377	0.532	0.518
cxoINT2	0.288	0.230	0.498	**0.701**	0.350	0.452	0.252	0.506	0.358	0.420	0.394
cxoINT3	0.467	0.681	0.532	**0.852**	0.652	0.687	0.687	0.592	0.627	0.487	0.463
cxoINT4	0.386	0.475	0.343	**0.721**	0.482	0.595	0.482	0.413	0.427	0.276	0.309
cxoINT5	0.353	0.384	0.388	**0.773**	0.403	0.461	0.338	0.460	0.455	0.360	0.439
cxoINT6	0.473	0.565	0.459	**0.760**	0.569	0.555	0.511	0.491	0.645	0.411	0.445
F5: ext. def.											
cxoEXT1	0.502	0.595	0.481	0.601	**0.831**	0.628	0.560	0.557	0.407	0.449	0.446
cxoEXT2	0.507	0.540	0.481	0.488	**0.868**	0.554	0.563	0.571	0.375	0.420	0.410
cxoEXT3	0.533	0.656	0.528	0.582	**0.889**	0.603	0.645	0.637	0.516	0.508	0.541
cxoEXT4	0.456	0.410	0.493	0.548	**0.699**	0.547	0.479	0.537	0.351	0.389	0.431

cxoEXT5	0.458	0.668	0.406	0.534	**0.715**	0.576	0.588	0.488	0.546	0.423	0.465
cxoEXT6	0.296	0.614	0.301	0.450	**0.693**	0.513	0.571	0.455	0.418	0.383	0.335
F6: futurity											
cxoFUT1	0.409	0.565	0.502	0.539	0.604	**0.778**	0.666	0.532	0.501	0.521	0.354
cxoFUT2	0.620	0.694	0.419	0.577	0.637	**0.665**	0.633	0.470	0.540	0.394	0.407
cxoFUT3	0.366	0.511	0.495	0.580	0.590	**0.834**	0.604	0.516	0.436	0.404	0.383
cxoFUT4	0.409	0.511	0.619	0.633	0.502	**0.806**	0.522	0.538	0.587	0.464	0.465
cxoFUT5	0.304	0.445	0.449	0.493	0.504	**0.767**	0.580	0.471	0.387	0.340	0.293
cxoFUT6	0.397	0.382	0.521	0.582	0.502	**0.798**	0.557	0.544	0.429	0.361	0.398
cxoFUT7	0.438	0.480	0.480	0.577	0.565	**0.781**	0.518	0.563	0.442	0.390	0.455
F7: proactiveness											
cxoPRO1	0.535	0.614	0.422	0.476	0.576	0.604	**0.841**	0.444	0.584	0.410	0.313
cxoPRO2	0.412	0.589	0.363	0.437	0.604	0.542	**0.796**	0.459	0.540	0.282	0.262
cxoPRO3	0.391	0.516	0.462	0.602	0.618	0.692	**0.725**	0.670	0.567	0.362	0.333
cxoPRO4	0.372	0.649	0.377	0.478	0.602	0.585	**0.848**	0.578	0.589	0.351	0.350
cxoPRO5	0.423	0.602	0.396	0.461	0.613	0.588	**0.854**	0.558	0.623	0.371	0.367
cxoPRO6	0.516	0.643	0.379	0.460	0.496	0.601	**0.825**	0.498	0.616	0.420	0.425
cxoPRO7	0.462	0.660	0.374	0.455	0.613	0.584	**0.854**	0.493	0.632	0.344	0.267
cxoPRO8	0.417	0.578	0.426	0.540	0.569	0.679	**0.717**	0.561	0.538	0.433	0.340
F8: riskiness											
cxoRIS1	0.441	0.538	0.524	0.563	0.634	0.627	0.716	**0.786**	0.573	0.375	0.353
cxoRIS2	0.378	0.471	0.600	0.538	0.539	0.524	0.536	**0.826**	0.510	0.453	0.401
cxoRIS3	0.409	0.440	0.481	0.481	0.590	0.560	0.543	**0.799**	0.444	0.467	0.409
cxoRIS4	0.331	0.327	0.513	0.465	0.527	0.563	0.480	**0.818**	0.476	0.461	0.433
cxoRIS5	0.414	0.484	0.512	0.571	0.535	0.492	0.469	**0.780**	0.477	0.508	0.532
cxoRIS6	0.394	0.312	0.585	0.517	0.522	0.495	0.449	**0.809**	0.495	0.456	0.507
F9: innovativeness											
cxoINN1	0.338	0.400	0.405	0.367	0.339	0.419	0.524	0.531	**0.668**	0.392	0.392
cxoINN2	0.419	0.529	0.472	0.466	0.380	0.483	0.538	0.532	**0.795**	0.506	0.498
cxoINN3	0.476	0.489	0.415	0.417	0.409	0.426	0.531	0.450	**0.724**	0.411	0.363
cxoINN4	0.306	0.500	0.459	0.494	0.465	0.515	0.577	0.443	**0.773**	0.371	0.373
cxoINN5	0.522	0.605	0.522	0.599	0.523	0.519	0.559	0.464	**0.800**	0.455	0.481
cxoINN6	0.486	0.538	0.471	0.564	0.450	0.499	0.524	0.461	**0.835**	0.447	0.407
cxoINN7	0.462	0.442	0.378	0.568	0.433	0.520	0.589	0.493	**0.821**	0.363	0.306
cxoINN8	0.391	0.474	0.286	0.343	0.375	0.409	0.634	0.367	**0.663**	0.313	0.242
F10: tang. cont.											
xDXC1	0.333	0.419	0.406	0.390	0.396	0.375	0.364	0.381	0.408	**0.709**	0.526
xDXC2	0.327	0.499	0.525	0.431	0.422	0.451	0.409	0.454	0.415	**0.789**	0.530
xDXC3	0.403	0.526	0.398	0.326	0.427	0.418	0.404	0.367	0.399	**0.738**	0.543
xDXC4	0.268	0.192	0.439	0.292	0.278	0.242	0.103	0.303	0.272	**0.655**	0.545
xDXC5	0.205	0.208	0.420	0.366	0.283	0.351	0.132	0.327	0.281	**0.644**	0.554
xDXC6	0.312	0.354	0.438	0.492	0.362	0.340	0.353	0.468	0.462	**0.691**	0.437
xDXC7	0.489	0.505	0.470	0.444	0.502	0.453	0.408	0.499	0.525	**0.752**	0.634
xDXC8	0.401	0.387	0.302	0.298	0.339	0.341	0.303	0.380	0.299	**0.628**	0.432
xDXC9	0.363	0.555	0.404	0.494	0.499	0.463	0.495	0.384	0.419	**0.726**	0.508
xDXC10	0.247	0.164	0.304	0.309	0.205	0.236	0.104	0.370	0.235	**0.630**	0.502
xDXC11	0.269	0.378	0.390	0.319	0.350	0.328	0.249	0.372	0.303	**0.691**	0.448
F10: int. cont.											

xDXC12	0.431	0.569	0.449	0.485	0.459	0.495	0.451	0.401	0.426	0.555	**0.710**
xDXC13	0.379	0.526	0.532	0.450	0.509	0.433	0.394	0.490	0.401	0.672	**0.833**
xDXC14	0.431	0.549	0.504	0.466	0.514	0.364	0.380	0.424	0.454	0.700	**0.861**
xDXC15	0.304	0.317	0.384	0.416	0.331	0.300	0.243	0.407	0.403	0.542	**0.767**
xDXC16	0.344	0.269	0.309	0.454	0.418	0.377	0.234	0.417	0.353	0.404	**0.675**
xDXC17	0.402	0.330	0.369	0.380	0.366	0.413	0.203	0.406	0.338	0.544	**0.769**
xDXC18	0.393	0.358	0.341	0.388	0.394	0.372	0.255	0.425	0.366	0.481	**0.757**

Table C2. Initial Correlation Values of Latent Variables and Reliability Statistics for CxO Data

	Cronbach's alpha	Composite Reliability	Average Variance Extracted (AVE)
F1: role of DX	0.888	0.914	0.485
F2: aggressiveness	0.818	0.871	0.540
F3: analysis	0.911	0.934	0.738
F4: int. def.	0.859	0.895	0.587
F5: ext. def.	0.874	0.906	0.619
F6: futurity	0.890	0.914	0.604
F7: proactiveness	0.924	0.938	0.655
F8: riskiness	0.890	0.916	0.645
F9: innovativeness	0.896	0.917	0.581
F10: tang. cont.	0.895	0.912	0.487
F11: int. cont.	0.885	0.910	0.593

Table C3. Initial CFA Results of the CEO data

Factor/item	F1	F2	F3	F4	F5	F6	F7	F8	F9
F1: role of DX									
rRDX1	**-0.104**	0.216	-0.224	-0.291	-0.122	0.167	-0.070	0.267	0.029
RDX2	**0.807**	0.199	0.338	0.262	0.182	0.294	0.302	0.040	0.144
RDX3	**0.571**	0.054	0.205	0.213	0.151	0.143	0.077	-0.088	0.197
RDX4	**0.657**	0.210	0.166	0.351	-0.011	0.132	0.111	-0.216	0.284
RDX5	**0.707**	-0.045	0.311	0.224	-0.020	0.313	0.127	-0.199	0.256
RDX6	**0.785**	-0.051	0.314	0.162	-0.019	0.253	0.273	0.044	0.247
RDX7	**0.690**	0.087	0.364	0.280	-0.068	0.268	0.334	-0.035	0.099
RDX8	**0.745**	0.176	0.302	0.349	0.070	0.422	0.194	-0.086	0.425
RDX9	**0.708**	0.281	0.436	0.196	0.142	0.387	0.458	-0.020	0.038
RDX10	**0.724**	0.090	0.311	0.256	0.070	0.209	0.590	-0.058	0.100
RDX11	**0.745**	0.296	0.337	0.139	0.125	0.301	0.549	-0.088	0.083
RDX12	**0.671**	0.028	0.144	0.185	0.196	0.213	0.096	-0.146	0.142
RDX13	**0.719**	-0.003	0.424	0.276	0.287	0.351	0.233	-0.190	0.375
F2: aggressiveness									
ceoAGG1	0.107	**0.537**	0.080	0.199	-0.003	0.177	0.071	-0.036	0.142
ceoAGG2	0.051	**0.713**	0.189	0.530	0.361	0.103	0.236	-0.081	0.296
ceoAGG3	-0.078	**0.208**	0.232	0.158	0.306	-0.022	0.416	0.029	0.161
ceoAGG6	0.139	**0.866**	0.225	0.193	0.209	0.034	0.334	-0.074	0.219

F3:analysis									
ceoANN1	0.045	0.280	**0.285**	-0.055	0.085	0.093	0.033	-0.146	0.069
ceoANN2	0.234	0.058	**0.733**	0.190	0.318	0.282	0.500	0.173	0.092
ceoANN3	0.480	0.226	**0.944**	0.475	0.429	0.215	0.453	-0.214	0.228
F4: int.def.									
ceoINT1	0.347	0.125	0.410	**0.833**	0.377	0.166	0.362	-0.062	0.267
ceoINT2	0.249	0.373	0.286	**0.788**	0.257	0.232	0.534	-0.260	0.299
ceoINT3	0.060	0.190	0.240	**0.521**	0.320	-0.118	0.452	-0.050	0.147
ceoINT5	0.128	0.158	0.114	**0.549**	0.206	0.232	0.284	0.021	0.290
ceoINT6	0.231	0.472	0.302	**0.627**	0.224	-0.028	0.174	-0.009	0.127
F5: ext.def.									
ceoEXT1	0.047	0.114	0.300	0.183	**0.623**	0.089	0.103	-0.029	0.210
ceoEXT2	0.041	0.403	0.443	0.462	**0.751**	0.262	0.411	-0.084	0.212
ceoEXT3	0.012	0.144	0.157	-0.051	**0.498**	0.180	0.026	0.072	0.050
ceoEXT4	0.076	0.409	0.405	0.306	**0.777**	0.206	0.392	-0.040	0.110
ceoEXT5	0.158	-0.029	0.291	0.350	**0.773**	-0.048	0.306	-0.244	0.305
ceoEXT6	-0.058	-0.086	0.097	0.188	**0.105**	0.247	0.030	0.106	-0.109
F6: futurity									
ceoFUT1	0.100	-0.078	-0.012	-0.052	-0.038	**0.049**	-0.133	0.509	-0.136
ceoFUT2	-0.114	0.188	0.122	-0.090	0.345	**-0.061**	0.262	-0.169	0.146
ceoFUT3	0.294	0.181	0.289	0.145	0.217	**0.875**	0.364	-0.263	0.220
F7: proactiveness									
ceoPRO1	0.332	0.332	0.187	0.413	0.288	0.264	**0.750**	-0.156	0.002
ceoPRO2	0.060	0.115	-0.238	0.069	-0.195	0.052	**0.283**	-0.218	-0.092
ceoPRO3	0.283	-0.046	0.464	0.389	0.349	0.051	**0.617**	-0.132	0.352
ceoPRO4	0.294	0.224	0.636	0.267	0.303	0.156	**0.582**	-0.140	0.301
ceoPRO5	0.212	0.155	0.096	0.264	0.131	0.236	**0.783**	-0.020	0.051
F8:riskiness									
ceoRIS1	-0.019	-0.028	0.151	-0.085	-0.185	-0.156	0.044	**0.611**	-0.141
ceoRIS2	-0.025	-0.176	0.068	0.066	0.040	0.014	-0.153	**0.386**	-0.047
ceoRIS3	-0.191	0.031	-0.180	-0.048	-0.045	0.016	-0.256	**0.824**	-0.094
ceoRIS4	-0.061	-0.249	-0.329	-0.180	-0.215	-0.043	-0.193	**0.730**	-0.017
F9: innovativeness									
ceoINN1	0.202	0.272	0.515	0.367	0.330	0.236	0.250	0.033	**0.564**
ceoINN2	0.156	0.240	0.186	0.264	0.209	0.157	0.138	-0.084	**0.536**
ceoINN3	0.193	0.167	0.027	0.137	0.109	-0.040	0.138	-0.185	**0.772**
ceoINN4	0.146	0.200	0.090	0.257	0.362	0.195	0.200	-0.061	**0.758**
ceoINN8	-0.021	0.217	-0.056	-0.016	0.055	0.136	-0.096	-0.194	**0.215**
ceoINN9	-0.104	0.226	0.160	0.118	0.178	0.063	0.020	-0.122	**0.167**

Table C4. Initial Correlation Values of Latent Variables and Reliability Statistics for CEO Data

	Cronbach's alpha	Composite Reliability	Average Variance Extracted (AVE)
F1: role of DX	0.891	0.912	0.470
F2: aggressiveness	0.677	0.691	0.398
F3: analysis	0.570	0.721	0.503
F4: int. def.	0.721	0.802	0.456
F5: ext. def.	0.761	0.776	0.402
F6: futurity	-0.316	0.251	0.257
F7: proactiveness	0.631	0.750	0.395
F8: riskiness	0.595	0.742	0.433
F9: innovativeness	0.685	0.686	0.308

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