# Conference Proceedings

**The Conference proceedings are prepared for publication**

**by**

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# YIRCoF '19

## Yeditepe International Research Conference on Foresight and Futures

"Anticipation: Conceptual, Theoretical and Empirical Issues"

*"In Memory of Prof. Dr. Eng.-M. Atilla Öner"*

**29 - 30** November, **2019**
**Istanbul**

### Invited Speaker

**Roberto Poli**
UNESCO Chair in Anticipatory Systems
University of Trento, Italy

### Important Deadlines:

Abstract Submission: **August 2, 2019**
Send your Abstract (250 words) to: **yuvam@yeditepe.edu.tr**
Notification of Manuscript Acceptance: **August 9, 2019**
Full Paper Submission: **September 27, 2019**

**Conference Venue:** Yeditepe University, Istanbul - Turkey
**Gala Dinner:** Titanic Business Kartal (Compass)
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Yeditepe University Press

YIRCoF'19

Page Design: Savaş Yıldırım
ISBN: 978-975-307-113-0

Yeditepe University Press: 46
Istanbul, 2021

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Views expressed in all papers are those of the authors and not those of Yeditepe University.

Papers presented are listed in the order of presentations.

The papers presented are included in the Conference Proceedings without major editing of the originally submitted manuscripts.

## OPENING SPEECH

**Ayşe Gönül DEMİREL, Assoc. Prof. Dr**
Vice Director- Executive Committee- MARC

*Dear Conference Participants:*

I would like to welcome you all to the "Yeditepe International Research Conference on Foresight and Futures 2019 with this year's theme being Anticipation:Theoretical, Empirical and Conceptual Issues, jointly organized by Yeditepe University Management Applications and Research Center, (MARC), and , the Department of Business Administration.

Management Applications and Research Center (MARC) has been a significant contributor in the field of *Foresight& Futures Studies* since 2009 and has organized several international conferences under the leadership of Prof. Dr. M. Atilla Öner.

*Foresight & Futures Studies* include all efforts to study the future by numerous methods and techniques to explain and predict how organizations and people will behave. These efforts in the field yielded the development and use of numerous scenario planning and foresight tools for social and life sciences with specific applications in public and business management areas. Practical applications involved strategic studies covering long range planning, policy development and technology assessment in several public and industrial sectors.

International research efforts during the past decade have evolved to a wider field called *the Anticipation Science* that encompasses natural, formal and social systems that intentionally or unintentionally use ideas of a future to act in the present, with a broad focus on humans, institutions and human-designed systems.

With recent developments in Artificial Intelligence and advances in Brain & Mind Research, the field has become a major interdisciplinary

research topic and triggered a worldwide effort to understand, mathematically formulate and simulate the decision-making process of living organisms, humans, institutions and social-cultural entities. The field is also being referred as *the Science of Decision-Making*.

UNESCO stresses on being *Future Literate* in understanding the nature of the future and the role it plays in what we humans see and do. The Institution has declared that developing this capacity to imagine the future can be a powerful tool for catalyzing change today and started a a World-wide *Project on Futures Literacy*. The Institution believes that becoming more skilled at designing the systems and processes used to imagine tomorrow is an essential part of empowering humans for crafting new approaches for more inclusive and sustainable development in the World.

Yeditepe Management Applications and Research Center has established partnerships with the University of Trento, Italy, and UNESCO(United Nations Educational, Scientific and Cultural Organization), via Prof. Dr. Roberto Poli - a pioneer in the Anticipation Research field – whom we have the great honor of his presence today.

As you all know, organizing such a conference requires full dedication, care and effort on the part of a large number of people. Therefore, I would like to take this opportunity to express our gratitude to our Dear Rector Prof. Dr. Canan Bingöl. From the beginning, she did not hesitate to provide the needed support for the realization of this conference. Next, as the Conference Organizing Committee, we would like to extend our thanks to Dr. Kemal Tuğcu, AMGEN(emcın)- Our main sponsor, TURNA.com, Orhan Sezgin, Management Application and Research Center Assistants Esra Okyıldız and Dila Seyhan, all assisstants of Business Administration Department, and Didem Bayındır, Director of Yeditepe University Publishing.

We hope this will be an enriching experience for you all, Thank you all again for joining us today

Now, I would like to invite Prof. Poli to the podium to make his speech.

# ANTICIPATION IN AVIATION SAFETY MANAGEMENT SYSTEMS

**Nihan Güneş ÇAĞIN[1], Özlem ŞENVAR[2]**

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**Abstract**

Safety management systems require anticipation, preparedness and the ability to minimize risks. The organizational models of safety management focus on proactive approaches for immediate preventive actions considering all possible outcomes of the hazard identifications and risk analyses before accidents happen. When the causes are determined, the majority of the events can be anticipated, controlled, and prevented if the right actions were taken on time. This study presents a literature review on safety management systems involving anticipation concepts, more specifically focusing on aviation. Future directions along with recommendations are emphasized within broader perspectives.

**Keywords:** Anticipation, Safety Management Systems, Aviation

## 1. Introduction

The volume of air transport has grown dramatically when analyzed historically and this has raised the total number of aviation accidents resulting in huge losses in terms of fatalities, injuries, damage, reputation, legal sanctions, and economic downturn of a national air transport industry. This has led to a series of improvements in operational and technical issues enhancing the overall safety over time (Janic, 2000). However, Cole (1997) and Mineata (1997) discussed that further improvements on safety are getting diminished over time, meaning that if the same accident rate is applied to the future increase in air transport, total accidents will boom inevitably.

Risk is a measure of uncertainty and defined as "the probability that a certain event involving a specific hazard will result in a specified outcome" (Fuller and Vassie, 2004, p.p. 24). In addition, the uncertainty with quantified risk need to be evaluated by human judgments based on subjective criteria (Royal Society, 1992). An airline may change the probability of the occurrence of an accident and the severity of the possible consequences by implementing human (such as rest times and breaks, continuous training, limited workload and time pressure), organizational (such as authorities and responsibilities, procedures, audit and inspection), technical (such as line/base maintenance, trouble shooting, defect analysis and repair, application of airworthiness directives and service bulletins), and environmental (such as legal requirements of national and international civil aviation authorities, information on weather conditions and air traffic, and bird strike avoidance) measures to control the associated risks. Here, risk management is the key to anticipate aviation incidents before happening through effective risk assessment and risk mitigation strategies.

Safety management systems need to be anticipated, well prepared and able to diminish risks. The organizational models of safety management

focus on proactive approaches for immediate preventive actions considering all possible outcomes of the hazard identifications and risk analyses before accidents happen. When the causes are identified, the majority of the events can be anticipated, controlled, and prevented if the right actions were taken on time. In this study safety management systems involving anticipation concepts are handled, more specifically focusing on aviation.

**2. Safety Management Systems**

Safety Management System (SMS) comprises of safety, management and system. Safety deals with unsafe situations, events and their causes; management relates to organizational safety activities and control of operational risks; and the system provides the framework for modelling safety management elements. The Plan-Do-Check-Act (PDCA) cycle is the most practical part of a SMS, although it was first introduced for the implementation of the Quality Management System (QMS) by Deming in the 1950s. Its application has turned out to be a continuous improvement cycle and a management tool (Moen and Norman, 2006) since that time and is widely spread today for the effective control of all processes within an organization.

The basic objective of a safety management system is to control hazards and mitigate risks by utilizing safety barriers. Safety barriers are leveraged by resources, such as human, organizational, technical, and environmental resources. With the help of these resources, good functioning of barriers is ensured through "installation, implementation, maintenance and monitoring of barriers" (Li & Guldenmund, 2018). Safety barriers can decrease risks by both mitigating the likelihood of unwanted event and the severity of the loss. Control actions and feedback loops are needed to avoid the failure of safety barriers. An organizational management should supply necessary resources and controls

for the effective and efficient application of barriers in a SMS (Leveson, 2004; Leveson et al., 2012).

Major SMS components in aviation are safety policy and objectives, safety risk management, safety assurance, and safety promotion (ICAO, 2018). Safety policy and objectives include management commitment, safety accountability and responsibilities, appointment of key safety personnel, coordination of emergency response planning, and SMS documentation; safety risk management consists of hazard identification, safety risk assessment and mitigation; safety assurance involves safety performance monitoring and measurement, the management of change, and continuous improvement of the SMS; and safety promotion contains training and education, and safety communication. The success and sustainability of the SMS can be evaluated by a performance assessment through measuring safety performance indicators (SPIs), performing planned and unplanned internal and external audits to detect deviations from standards and potential hazards to take corrective and preventive actions, and organizing management review meetings for top managers in regular time periods to review safety goals and policies, and set targets for continuous improvement (ISO, 2018).

## 3. Anticipation in Aviation Safety Management

Anticipation is a future-oriented attitude for decision-making and action in the present. (Poli, 2017). With an anticipation of a harm or damage, a safety manager may intervene the work processes and activities by taking required measures before any negative consequence arises from an adverse event. Defining a risk such as probability of an aircraft crash, has a prospect of loss, therefore, safety professionals act immediately to control over this organizational risk by considering various factors to prevent a disaster from happening in an organizational setting. The belief that the outcome of a future accident can be impeded is contingent

on one's own risk perception and culture. Similarly, acceptable levels of risks are determined depending on the cultures and perceptions of employees, organizations, and societies.

To anticipate risks, evaluation of safety performance should be based upon both lagging and leading measures of various risk factors. There should be an association between reactive and proactive indicators in order to anticipate effectively and act proactively. It also helps organizations to focus first on safety critical factors, and not to waste time, energy, and resources on unrelated issues. Common measures of aviation safety performance are the accident and incident numbers; degree of harm to people such as fatalities and injuries per aircraft kilometers or passenger kilometers; and damage to equipment, components, aircraft, and facilities in a specific time period. In a socio-technical setting such as airline operations in aviation industry, there are multiple factors including human, organizational, technical, and environmental elements that interact with each other in an unpredictable way and may lead to an aviation accident. Hence, safety-critical operational data from various parts (maintenance, engineering, flight crew/cabin crew operations, ground operations) and different levels of an airline should be collected and analyzed in risk management to control risks by taking necessary precautions for the avoidance of any disaster.

## 4. Conclusion

Most aviation service providers have processes in place to mitigate risk to an acceptable level. In fact, every operator has a "safety management system" in place; however, when we refer to an aviation safety management system, commonly called SMS, we refer to the formal processes and methodologies to manage safety in air carriers. When aviation safety management systems include anticipation, safety risks can be better managed before any adverse event happens. With an anticipation of a

harm or damage, a safety manager may intervene the work processes and activities by taking required measures before any negative consequence arises from an adverse event.

Anticipatory aviation safety management systems should provide systematic ways of understanding aviation operations including human, technical, organizational, and environmental elements to minimize risks and prevent accidents in a pre-event (proactive) approach. For further researches, anticipatory aviation SMSs must be handled in broader perspectives and applied in practice to see the challenges and opportunities of managing safety risks in complex and uncertain environment of aviation industry.

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# ANTICIPATION FOR CUSTOMER ANALYTICS

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**Abstract**

In the digitalization era, enterprises are required to proactive customer relationships via analytical techniques to execute customer treatment strategies based on predictive analytics drawing on a wealth of data about customer behaviors. Nowadays, predictive analytics with automatic decision making concepts are integrated for better understanding preferences of customers, segmenting customers, promoting right products to right customers, improving customer experience, and driving revenue. Customer value anticipation becomes inevitable for understanding customer requirements and expectations. Anticipation can provide capacities in shaping customer perceptions and expectations to make sense of novelty by enlarging and enhancing the analytical and operational approaches to incorporate decision making. In this regard, customer analytics is handled within the perspective of the process by which data from customer behavior utilized to make key business decisions through market segmentation and predictive analytics in order to maximize organizational throughput and maintain long lasting relationships with customers. From this standpoint, this study aims to provide an overview for customer analytics considering anticipation, customer experience and big data analytics involving strategic decision making processes for customer loyalty

and relationships. Moreover, customer experience quality is discussed for anticipating customer expectation.

**Keywords:** Anticipation; Big data analytics; Decision making; Customer value; Customer journey.

## 1. INTRODUCTION

In today's competitive market, many market oriented companies invest their resources in analysing market trends and then discussing future customer expectations with customers. To satisfy customer expectations and reach customer value anticipation, the combination of customer information, human interactions and organizational resources and transforming the operational resources within dynamic business capabilities are essentials (Madhavaram & Hunt, 2008). Awhile ago, Jayachandran et al. (2004) argued the significant effects of anticipating changing customer needs.

The presence of rivalry firms who sell similar services and products on a market defines the level of competition in such markets. In most instances, market competition might motivate competitive firms to increase their sales, achieve higher revenue streams, and increase market share through an effective utilization of the marketing mix, rather than might collapse rivalry firms.

A wide range services might be obtained from enormous range of organizations such as public enterprise, voluntary agency, business-to-customer and business-to-business. All organizations have two fundamental targets which are minimizing cost and earning the most of profits. Along with these aims, customer satisfaction level can enhance sales and affect customer loyalty, customer recommendations and repurchase (Wilson et al., 2008).

Companies have to anticipate customer expectations and needs and make prospective analyses that can be considered to launch new products and services. Flint et al., (2011), Li et al., (2011) found that customers who perceive that their service firms are able to anticipate their future needs are usually satisfied with their service firms. A new brand strategy which is future-driven requires to be formed and carried on in order to constitute more powerful organizations and to achieve the pre-

ferred level that link organizations, customers and society to each other (Högström et al., 2015).

The structure of the paper is as follows. First, the topics of anticipating customer expectations or needs, customer value anticipation and anticipating customer experience are reviewed and explained with the support of literature. Afterwards the customer experience quality is discussed.

## 2. LITERATURE REVIEW

For a better appreciation of the hypothetical and empirical concepts that underpin this study, this section presents relevant literature on anticipating customer expectations or needs, customer value anticipation, anticipating customer experience.

### 2.1. Anticipating Customer Expectations/Needs

In today's world, agile response to the customers' requests or needs is not adequate. Additionally, proactive responses to their latent and future expectations are sufficiently important.

Parasuraman et al. (1988) state that expectations can be defined as customers' estimates of what will likely be the result of a recent transaction. Tyron (1994) associates customer expectations and anticipation as "anticipation of results in the future related with previous experience, current circumstances or other information sources".

After a while later, Parasuraman et al. (1991) proposed customer expectation into two parts as desired and adequate. In the desired level, the service level is the one which a customer hopes to get. On the other side, adequate expectation is the lowest level of service which a customer accepts. The gap between the levels corresponds to customer satisfaction (Hsieh, Y.-H. & Yuan, S.-T., 2019).

Customer satisfaction is widely accepted as a measurement of how a product or services from the organizations to fail to meet, or to meet

or to exceed customers' expectation. If the product or service fails to meet customers' expectation, customers will surely have a low level of satisfaction. If the product or services meet with customers' expectation, customers will surely have a medium to high level of satisfaction. However, if the product or service exceed customers' expectation, customer will certainly have a high level of satisfaction and behave positively to the product, service, or even the organization that provides the product or service. Because of these circumstances, customer satisfaction has became an crucial statement to pay attention for companies and researches as well (Seligman, 2018).

According to Levesque and McDougall (1995) customer satisfaction is a general customer behavior to a service provider with distinct levels of specificity in various products or services. The objectives of this philosophy is value creation for consumers, anticipating and executing their desires and being responsible to fulfill customers' expectations.

Customer satisfaction and service quality alike are important criteria for organizations's achivements in the sector (Parasuraman et al., 1988; Dominici, G., & Guzzo, R. 2010). In the marketing area, customer satisfaction is supposed as the baseline of the optimum performance level and estimated standard of perfection for all campanies (Munusamy and Chelliah, 2011). Fečiková (2004) emphasises the significance of this term with following words "the customer is always right". To evaluate the rate of customer repuchase and the loyalty of customers, satisfaction level can lead organizations.

The top five reasons which makes customer satisfaction much important can be briefly explained as follows. As mentioned above, it is a leading indicator for customer repurchase intentions and customer loyalty. Due to the fact that customer acquisition is much more expesive than customer retention, customer churn rate can be pursued and decreased with customer satisfaction. On the other side, customer lifetime

value can be improved. The effects of word of mouth can be positively improved. Some qualitative methods can be used to measure customer satisfaction which affects the further operations (Tikkanen et al., 2000).

### 2.2. Anticipating Customer Value

Customer value takes into consideration the drivers of customer value which include points of differentiation, product function, service, marketing, price, existing relationships or experience, personal bias from experience and upbringing, as well as quality (Christian, 2018). Customarily, quality and price are considered the ideal measures of customer value.

Customer value anticipation is the ability of firms to predict ahead of time what customers will want next after the current economic encounter has ended. Anticipating customer future needs will serve as a strategic tool to achieving sustainable market leadership and firm performance (Kandampully & Duddy, 1999).

The nature of customer desired value has been investigated to build enhanced operations to anticipate or predict changes in customer value (Flint et al., 2002). As could be inferred in literature, Flint et al., (2011) were apparently the first to come out with a definition of customer value anticipation in a study that sought for an empirical investigation into the relationship among customer value anticipation, customer satisfaction and customer loyalty. Drawing on the definition of Flint et al. (2011), Yu et al. (2014) also defined customer value anticipation as the customer's overall evaluation of the service provider's ability to meet the customer's future needs.

Customers have expectations from suppliers to anticipate their requirements. The power of the customers in the supply chain properties of buyer-seller connections, the dynamism of industry, cultural factors (Overby et al., 2004) and customers' future desires form an important

parf of effective conditions of customer value (Lemon et al., 2002). According to Ballantyne & Varey (2008), from the point of a server provider, customer value anticipation is related with the proficiency for agile response to changing customer expectations.This extensive engagement ought let for deeper understanding of organizational culture, decision making processes, structure, business strategies, performance metrics and so on. Therefore, suppliers can sufficiently anticipate the customer value (Woodruff, 1997). and customer insights such as what customer will desire in the future on account of active management of co-creation and extensive engagement.

The outcome of some review of literature shows that customers perception changes constantly, particularly in an era where competition is stiff and complex (Flint et al., 2002). This calls for a more collaborative and customer specific approach to creating and deploying customer value (Vargo & Lusch, 2014). This lets to make customers feel needed and converting passive receivers through active drivers and improvers in the open market (Yu et al., 2014).

### 2.3. Anticipating Customer Experience

The exponential growth and exploding volume of data results from enoumous amount of connected devices. Anticipatory systems provide the best way to interact with customers considering their aspects, preferences of the past, present and future actions. Most interface systems currently used do not use existing data to predict future needs and to create anticipatory experiences, however they benefits from the reacted actions in the present. People's consumption processes consist of planning, imagining, consumption and remembering processes. The positive feelings they experience before consumption can also increase the overall customer experience (Dixon et al., 2017). Haryanto et al. (2017) state that future anticipatory works increase customer expectations. Further-

more, it is proposed that defining trends for the future operations leads the today's preparations (Adam, 2008).

Today, for a business organization, one of the most significant leading management goals is to create a strong customer experience (Lemon & Verhoef, 2016). Big data analysis is a concept that supports the customer experience. Automated processes which are associated with important customer touchpoints are combined with the big data insights to enhance customer experience.

Meyer and Schwager (2007) stated that the term of customer experience is an indirect and subjective response of customers in any direct or indirect communication with a company. Indirect contact includes word of mount approvals or condemnations of customers related with advertisements, media coverages or product reviews. Customer experience is a concept that should be aggregately discussed for each direction of the organization's offers (Zomerdijk & Voss, 2009).

Lemon and Verhoef (2016) proposed that customer experience is sufficiently related to previous and current marketing streams such as customer satisfaction, service quality, customer experience management, customer customization, customer engagement.

Most of the companies struggling to analyse the role of customers and their cognitive, affective, emonational, social and physical assessments. Therefore, the crucial prerequisite of analyzing customer experience is capability to think and act as a customer and to examine closely the sense of customer in the customer journey (Havíř, 2017).

There are steps that service providers should follow to improve the customer experience. The existing customers' experiences are examined and look for a pattern in customer experiences by service providers. The reason of this is to understand what customers care about most and what they don't. As a result of the detailed investigations, necessary investments should be made by making targeted investments and thus the im-

provement process should be completed (Spiess et al., 2014).

There are several models to measure customer experience in the literature. SERVQUAL model (Parasuraman et al., 1988), eTailQ (Wolfinbarger & Gilly, 2003), E-S-QUAL model (Parasuraman et al., 2005), Customer Experience Quality Scale (EXQ) model (Klaus & Maklan, 2012). The EXQ model is the latest result of a scientific effort to provide a suitable framework or model for customer experience analysis (Havíř, 2017).

The literature on customer experience management is a more deeper term than customer relationship management. Customer experience management is the operation of strategically executing customers' all experiences associated with a product, service or company (Schmitt, 2010). Homburg et al. argued (2015) about different aspects of customer experience management and customer relationship management. CRM focuses on value extraction while CEM strongly highlights value creation (Lemon & Verhoef, 2016).

## 3. DISCUSSION ON CUSTOMER EXPERIENCE QUALITY

Customer experience quality appears to be natural and subjective responses such as affective, cognitive and behavioral and evaluations of all direct and indirect relations with the servise provider and other customers (Ali et al., 2016). Experience quality is not just a evaluation of product or services of a company, but also assesment of peer-to-peer communication, value co-creation and interactions between supplier and customer are included to the scope of experience quality. According to Lemke et al. (2011) customer experience quality is a perceived attitude about the perfection or superiority of the customer experience.

Alnawas and Hemsley-Brown (2018) define customer experience quality as customer cognitive and emotional assessment of direct and indirect contacts with the service organization, physical environment,

and social environment, along with the psychological, symbolic and cognitive results accorded to the customer from specific encounters.

To truly succeed in delivering maximum value to customers, companies must explicitly find out what drives customer acquisition, customer retention, and customer growth in time (Choo et al., 2018). The studies show that the increase in experience quality positively affected the customer experience and then the customer experience had a positive impact on customer loyalty, customer satisfaction and word of mouth marketing and increased brand value and corporate performance. Thus, a well-designed experience reveals significant differences in the cost reduction and customer retention rates.

Klaus and Maklan (2007) conducted in-depth interviews with customers exploring the underlying dimensions between service quality and experience quality on customer purchasing behaviour in the service-dominant economy. In the in-depth interviews, Klaus and Maklan (2007) have found that delivering experience quality provides consumers with a total variety of functional and emotional benefits which influences consumers purchasing behaviour instead of service quality. Experience-based service encompasses the total customer experience quality, including an integrated dimension of product experience, outcome focus, a moment of truth, and peace-of-mind in hospitality industry (Khan, Garg & Rahman, 2015). Findings from Klaus Maklan and (2011) as well as Klaus and Maklan (2012) on the dimensions of POMP (Peace-of-mind, outcome focus, moments-ot-truth, and product experience) indicate that "customers turn to account the customer experience at an overall level, a dimensional level and at attribute level, and that each level drives perception on the level above".

From this point of view, customer experience quality deals with before and after service experiences, focuses on the emotional and functional aspects of quality, takes into account the social contexts of customers,

and consists of an assessment of usage value generated across multiple channels and differs from context.

## 4. CONCLUSION

Undoubtedly, the increasing competition in many sectors in recent years has made it critical for organizations to understand all cognitive, sensory, social and behavioral responses in the interaction process with their customers. As a matter of fact, we know that emotions are a factor in the decision-making process as well as rational facts as we make many decisions in our lives. For this reason, it is important to activate these senses and to make necessary stimuli through experience for re-purchase. Here too, the concept of experience is the key concept. All this highlights the importance of measuring and managing customer experience, but also draws attention to the fact that new dimensions for measurement are taken into account. The customer experience is now more than just the experience in the store or on the web site, and especially with the development of technology and the introduction of smartphones into our lives, the impact of technology on the total customer experience is worth considering.

Customer expectations information is vital for customer value anticipation and can be handled within customer retention initiatives. Customer value anticipation can be used to develop strategies for customer orientation. It must be conceptualized in broader perspectives. Moreover, anticipatory methods via data mining can be developed in this regard.

For further directions customer value should be handled considering anticipation of suppliers and their agile capabilities. It is necessary to review strategic inferences of customer value anticipation for suppliers. Foreseeing future market needs is significant input to evaluate capabilities for competitiveness. Information of Customer value anticipation can help to understand future environments of customers. In the meanwhile,

resource allocation, strategic plans can be performed according to future customers requirements.

Even more researches have done based on customer satisfaction, it is a much more dynamic process than expected. And the researches conducted are shown that social dimensions, meaning and emotion in buyer-seller relations are inseparable aspects of the customer satisfaction. It is stated that customer value anticipation has relational aspects that can support customer satisfaction and loyalty.

In future research, it can be discovered how CVA achieves the best success in buyer-seller relationships and at different times with different members of the purchasing center. Another area of study can be based on anticipateing which specific buying center members will value in the future, and the understanding how one day environmental variables will uniquely affect customers' feelings and desired value (Flint, Woodruff & Gardial, 2002). Another area of study can be based on predicting which specific purchasing center members will value in the future, and understanding how one day environmental variables will affect individuals' feelings and desired value.

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# HOW TO REDUCE EMPLOYEE TURNOVER: AI-BASED DEPARTING EMPLOYEE DETECTION AND PROFILE LIKELIHOOD ESTIMATION

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**Abstract**

One of the biggest challenges for today's research, development and engineering companies is to prevent or reduce turnover rate which roots in diverse antecedents. Changing life styles, social media, and technology trends in working environment, corporate cultures of new generation start-ups are among them. Employees switch their companies more frequently at this era than at any other time. Investment into the employee during his company career walks out the door when an employee resigns. For senior roles, it yields more complicated situations. The knowledge build-up, project management stability, relationships with customers may also get affected which may end up with inappropriate consequences. Moreover, a new employee adaptation period impact on effectiveness of the project performance and there is always the cost of time spent for job-interviews to recover the vacant position. One of the most challenging tasks of a manager as a resource allocator is to forecast the potential lifetime of an employee within the company. Although managers try to estimate this by their experience or even by intuition, an AI assisted algorithmic way of determining this parameter would be an important contributor for the manager's decision-making process. Therefore, forecasting quit tendencies even before an employee begins to work and considering this prediction as a parameter of the company's HR strategy can provide an opportunity to maintain or reduce the turn-

over rate. In this study, it is aimed to model an employee's quit inclination at specific time interval based on his/her previous work experience, education, age and gender by using machine learning techniques which can handle categorical and numerical data combinations and give categorical outputs. Results from several AI methods such as XGBoost and MLP are presented as well as the feature selection and sensitivity analysis methods at the data preparation step of CRISP-DM methodology.

**Keywords:** Employee turnover, turnover prediction, machine learning, human resource management, neural network, XGBoost

## I. Introduction

Business model of today's engineering companies is substantially based on intellectual capital, which makes qualified human resource a strategic asset (Mueller, 1996). Success of management at these companies and the overall business performance mostly rely on successful human resource management (HRM). HRM is a comprehensive set of managerial activities and tasks concerning the development and maintenance of a workforce and it aims to facilitate organizational competitiveness by managing talent, ensuring sustainability, and promoting organizational as well as individual growth and development (Denisi & Griffin, 2005). These activities have a lot of sub-dimensions involving managerial decisions, which may tackle with uncertainty because of the complicated human nature and the difficulty of modelling social mechanisms. This aspect of HRM cannot be controlled or anticipated with rules most of the time.

However, hiring process as an important part of HRM can be in companies' control, which means, they can assess the candidates during this process and it can be considered that hired employees are the most suitable or promising ones for open positions and consequently companies agree to invest on them to benefit from their talents further (Aydin, Leblebici, Arslan, Kilic, & Oktem, 2005). Related to the hiring process, what companies want to control more, is the employee turnover, specifically avoidable voluntary one, which is basically initiated by the employee and can be prevented (Heneman III, Judge, & Kammeyer-Mueller, 2003). Employee turnover is an important topic in HRM because of its negative impact on issues ranging from work place morale and productivity to disruptions in project continuity and to long term growth strategies (Punnoose & Ajit, 2016). Employee turnover can be interpreted as a leak or departure of intellectual capital from the employing organization (Stovel & Bontis, 2002). High turnover has several damaging effects on

an organization. For example, it is difficult to replace employees who have niche skill sets or are business domain experts and it affects the ongoing work and productivity of existing employees. Acquiring new employees as replacement has its own hidden costs like hiring effort, training time etc. New employees will have their learning curves towards arriving at similar levels of technical or business expertise as a seasoned internal employee. Companies may not fully control employee turnover, but they can take precautions beginning from the hiring process.

One way how companies deal with employee turnover problem can be using Artificial Intelligent (AI) techniques. A trending topic, AI is reshaping our ways of executing business and almost all aspects of modern living and HRM can also benefit from this. It is one of such technologies being developed for exploration and analysis of data to discover meaningful patterns and rules. Such techniques have already started to attract attention in approaches and in managing talent i.e. to identify existing talent by predicting their performance using the prior work experience knowledge (Ranjan, Goyal, & Ahson, 2008). Machine learning, a powerful and promising tool in HRM, can help decision makers to predict the risk of attrition of employees and more importantly to anticipate in the hiring process how long a suitable candidate for the position will work at the company if she is hired. This gives organizational leaders the opportunity to take proactive action for retention or plan for succession (Punnoose & Ajit, 2016).

Machine learning algorithms build a mathematical model using sample data, known as training data to perform a specific task without using explicit rules but patterns and inference instead (Bishop, 2006). The model may be predictive to make predictions in the future as in employee turnover case or descriptive to gain knowledge from data, or both. Parameter of the model is optimized with the training process, which involves handling and processing massive amount of sample data in gen-

eral. Once the model is built, its representation and algorithmic solution for inference needs to be efficient as well. In certain applications, the efficiency of the learning or inference algorithm, namely, its space and time complexity, may be as important as its predictive accuracy (Alpaydın, 2010). Because building a predictive model based on explicit rules in HRM is very difficult, using machine learning techniques perfectly fits in dealing with employee turnover problem. The machine learning methods can be used in employee turnover prediction are decision tree, random forest, gradient boosting trees, extreme gradient boosting, logistic regression, support vector machines, neural networks, linear discriminant analysis, Naïve Bayes and K-nearest neighbor (Punnoose & Ajit, 2016) (Zhao, Hryniewicki, Cheng, Fu, & Zhu, 2018).

In this study, we address the employee turnover in terms expected duration of stay using machine learning algorithms to predict the lifetime of employees within the organization. The output of this prediction can be an input for the improvement of the hiring process. We aim to model this as a learning problem which we infer the stability of the candidate CV, given a trained model of CV database collected from public profiles over career sites. Feature selection and analysis of attributes were executed based on raw data. This paper shows that potential lifetime of a candidate in the company can be predicted with the data in her CV even before interviewing process. Prediction is done by two different machine learning methods and their accuracies are compared.

## II. Methodology

In this part, the data preparation process and used machine learning models are introduced.

### A. Data Preparation

The most comprehensive part of the modeling is reverting the curric-

ulum vitae into a structured dataset. Although a curriculum vitae might include many personal or job-related details, only some sections are processed. The chosen sections are the graduation year from BSc, graduated universities, gender and working experiences. Intuitively, it has been considered that information has more influence on potential lifetime of the employee in the company. All words and information have been grouped and encoded with numbers to be able to use machine learning techniques on the data without using any NLP techniques, as text mining is out of the scope of this paper. Work experience is categorized based on the sector and size of the company and work durations in terms of months. For the dataset of this study, it turns out to be six therefore if the people have worked in different number of companies which can be more than six, only the first six companies' experiences are considered. If the company related data is used as it is, people worked less than 6 companies during their careers yields empty attributes in the dataset and to avoid this case new features are extracted. In the encoded database, we basically constitute the columns indicating the count of experience for specific sector and size combination of company and total experience duration in terms of months. It is assumed that the type of the company that candidate is working for is also another important implication on the lifetime of the candidate considering the different dynamics of each type. For the sake of simplicity, the companies are divided into three groups based on their sectors. If it is research focused, entrepreneur start-up or others. In terms of size, they are classified taking account into employee counts (Merritt, 2019). If the number of employees more than 250 then company belongs to "A" category. If it is in between 50 and 250, it belongs to "B" category else otherwise. So, there are 9 possible states for a company, which is all possible combinations of sectors and sizes. Educational data in the CV are also encoded because different ranked universities might cause more opportunities with respect to others. Uni-

versities are grouped and encrypted according to their rank order which is based on Times Higher Education Ranking 2019 (Best 25 Universities & Colleges in Turkey , 2019). The people who studied in the listed universities belong to the A category and for graduate studies, MSc or PhD, are also indicated as increasing or decreasing career path. If the person gets their MSc or PhD degree from a higher ranked university, it is encoded as increasing CV trend, otherwise it is encoded as decreasing CV trend.

Two encoding strategies are used, namely, one-hot encoding and encode with integers (Potdar, 2017). Since the one-hot encoding increases the number of features and 0 values in the dataset, of size 590, becomes insufficient and the accuracies of the models decrease considerably. That's why the results for integer-encoded and scaled according to the standard normal distribution dataset are presented. The encoding of the CVs in this way made it applicable to use Machine Learning methods which will be explained in the next section.

**B. Models**

The primary goal of the model of this study is to predict expected working duration of an employee based on the abovementioned input features in a research focused firm whose worker count is above 250. The expected duration is divided into four groups as the working duration less than 6 months, in between 6 months and 2 years, 2-5 years and more than 5 years. These intervals are chosen by trial and error to increase the accuracy of the model.

As an ensemble learning method eXtreme Gradient Boosting (XGBoost) (Tianqi & Guestrin, 2016) and as a neural network Multi-Layer Perceptron (MLP) (Rumelhart, 1986) have been applied. Ensemble learning methods use decision trees as small learning units and train them sequentially (Breiman, Friedman, Stone, & Olshen, 1984). Num-

ber of trees and max depth of a tree parameters of XGBoost have been tuned to increase accuracy. For the MLP, 4 hidden layers used since it is detected as optimum number for hidden layer counts in between 1 to 6. Maximum iteration parameter and number of layers has been tuned and confusion matrices are considered as evaluation metric.

### III. Results

Data preparation techniques are extremely important on model performance. In this research, applying standard scaler to arrange the value interval of the features in the dataset, or applying different encoding strategies have high impact on prediction accuracies, especially for the cases where we have small size of data. In the below graphic, one can observe changes in accuracies for both models with the evolving data size:

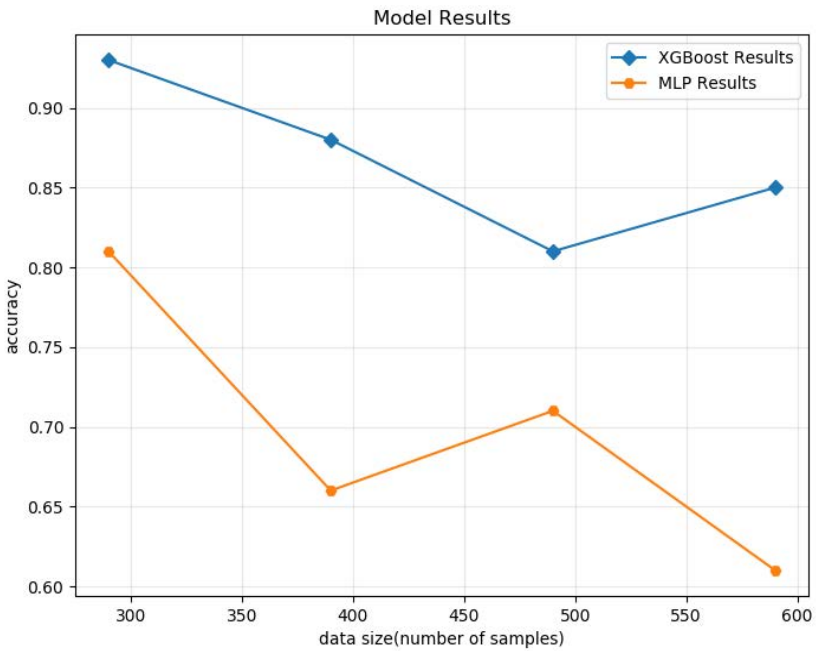


**Figure 1.** Accuracy vs. Training Dataset Size

For the above figure, accuracy metric is defined as Jaccard scores. For the given sample counts, 20% of the data used to test the model and the remaining 80% used for training. Different train-test split ratio has been tried also. Splitting 10%, 20%, 30%, 40% of the dataset as test set does not have considerable effect on the model accuracy.

After hyperparameter tuning processes, the maximum accuracy achieved by XGBoost is 0.85 for the biggest dataset and 0.61 for MLP. For the XGBoost model, the tuning process applied for the optimization of max depth for each decision tree and number of decision tree in the forests. For multilayer perceptron model, iteration count and hidden layer counts optimized by grid search methodology. As a result, by selecting the parameters providing highest accuracies the processing times are changing with data set sizes as follows:

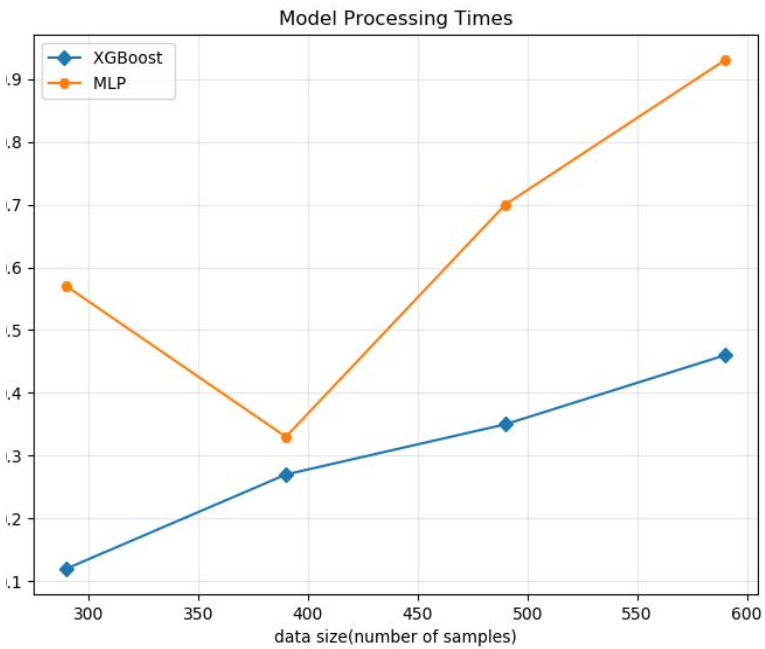


**Figure 2.** Speed Comparison of Algorithms

Unexpectedly, MLP algorithms process the data with 390 samples faster than 290 and after that point processing time decreases. In this graphics, the MLP models are chosen with different iteration counts since the model performance on different data sizes performs better with different iteration counts. So, this is the fundamental reason behind this processing time decreases.

In terms of the computational complexity, both algorithms are similar. XGBoost and MLP process the all test data almost at the same time, ~0.44 seconds and ~0.92 seconds. Processing time covers both training and testing phases. The processing times are obtained by using a machine with intel Core i5-6300U CPU and 8 GB RAM.

One of the evaluation metrics for multiclassification problem is F1 score which is described as the harmonic mean of the recall and precision. Recall value is representing the answer of "What is the average ratio of true predicted classes in between all samples belonging actually to predicted classes?". In similar manner, precision value is representing the answer for "What is the average ratio of true predicted classes in between all samples which are predicted in same classes?". In the below table, one can check the data size, F1 score, recall and precision values based on the confusion matrices evaluation metric for both models:

**Table 1.** Performance Evaluation of Algorithms

| | Model Name | Data Size | Recall | Precision | F1 Score |
|---|---|---|---|---|---|
| 1 | XGBoost | 290 | 0.97 | 0.9 | 0.96 |
| 2 | XGBoost | 390 | 0.94 | 0.93 | 0.94 |
| 3 | XGBoost | 490 | 0.88 | 0.87 | 0.88 |
| 4 | XGBoost | 590 | 0.85 | 0.72 | 0.84 |
| 5 | MLP | 290 | 0.90 | 0.86 | 0.59 |
| 6 | MLP | 390 | 0.51 | 0.41 | 0.56 |
| 7 | MLP | 490 | 0.49 | 0.62 | 0.43 |
| 8 | MLP | 590 | 0.57 | 0.49 | 0.55 |

In some cases, predicting one specific class truly is of utmost importance and vice versa. In our classification problem similarly, predicting lifetime of an employee is less than 6 months is not critical since it is extremely rare case. So, its effect on accuracy can be decreased by using precision and recall methodology instead of Jaccard accuracy metric or true positive ratio in the all sample set. F1 score which is closer to the 1 means better model performance in terms of accuracy. So, XGBoost performs better than MLP among all data sizes. In addition, XGBoost classifier is also optimized for fast, parallel tree construction, and designed to be fault-tolerant under the distributed setting (Chen & Guestrin, C., 2015).

**IV. Discussion & Conclusion**

In today's business environment, companies face the challenge of keeping their employees to preserve their company culture and to accumulate know-how, however, the competitive workforce market makes it even harder as years goes by. Although there might be many different reasons that make people resign, such as pure management, a better job opportunity, private life related issues, as seen in the results, the CV of candidates can be optimal data to estimate their lifetime in a company.

In this study, the prediction of employee turnover in organizations via application of machine learning in building turnover models was presented. Main contributions of our approach are the use of machine learning methods and exploitation of employee job transitions for the solution of the problem.

Training data with balanced class distributions were used for generating models. Regarding the features of the dataset, results indicate that employee's age is more important in predicting turnovers than other features in their CVs. Even without using tremendous amount of data, our ML models can predict the duration with an accuracy ~80%. Consider-

ing the interviews, the same value can be estimated with similar accuracy with much more information that is not included in a regular CV. This is a promising result which can be used to filter candidates before an interview, or as a suggestion score for the interviewer.

The results of this research also demonstrate that the XGBoost classifier is a superior algorithm in terms of significantly higher accuracy for predicting turnover. Because of these reasons it is recommended to use XGBoost for accurately predicting employee turnover, thus enabling organizations to take actions for retention or succession of employees.

In future studies, the accuracy can be improved even further. By applying online learning methodology, the models may be retrained by real-time data and results with much higher accuracy can be obtained. The accuracy of the method can be tested further by comparing the estimation of the method with the estimation of the interviewer after an interview. As this study has started with the question of "Is it possible to forecast any candidate's resigning time, even if they are not aware of the case?" the results show that there is a pattern in CVs to predict duration of stay of an employee. It is also recommended to study the application of deep learning models for predicting duration of stay. A well-designed network with enough hidden layers might improve the accuracy, however the scalability and practical implementation aspect has to be studied as well.

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# UNDERSTANDING THE IMPACT OF ECONOMIC CRISIS ON THE DISTRIBUTION OF ORGANIZATIONAL DECISION-MAKING AUTHORITY

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**Abstract**

Understanding the dynamics of decision-making in the right way is an important problem for the management of organizations. In today's business life organizations are becoming more complex, and the environments they are operating in, are becoming increasingly uncertain.

The aim of this paper is to contribute to the understanding of the dynamics of managerial decision-making process in complex internal and external environments by sharing the results of an empirical study (Onuk, 2009). While taking the levels of the organizational structure as one of the important dimensions of complex internal environment, complex external environment is reflected within the study as economic crisis.

Using the survey tool developed by Onuk (2009), the empirical study realized in the Turkish organization of a large global company investigated decision-making process to understand how decision-making authority for different types of decisions, identified as strategic, tactical, and operational level decisions, was distributed throughout the organization levels, and how this distribution was impacted by economic crisis.

The results of the study confirmed the following common expecta-

tions: (1) Strategic decisions are mostly taken at upper hierarchical levels of the organizational structure; (2) during times of economic crisis strategic decision-making is centralized, and (3) during times of economic crisis distribution of decision-making authority is concentrated at upper management levels.

Keywords: Decision, decision-making, decision-making authority, management levels, organizational structure, complexity, economic crisis.

## 1. INTRODUCTION

Organizations can be thought of as examples of a general class of complex systems usually referred to as "complex adaptive systems" (Dooley, 2004: 354). Organizations need to be smart, agile, and responsive to fast-changing environments. They need to respond and make smart decisions at ever-increasing speed, even as the unintended consequences of speedy decisions flare up in a nanosecond and keep leaders focused only on fire-fighting (Wheatley, 2001). Making smart decisions is especially important during the times of global economic crisis like the one which became apparent with the bankruptcy of Lehman Brothers in 2008 in U.S. financial sector and then affected all national economies around the globe.

### 1.1. Problem Statement

Understanding the dynamics of decision-making in the right way is an important problem for the management of organizations. Some of the reasons for its importance are stated as follows:

1. The decision-making processes are of central importance to business administration and organization theory (Cyert et al., 1956).
2. The decisions of a firm's management have at least as great an impact on the firm's performance as overall industry factors (Wheelen and Hunger, 2006).

3. As organizations grow larger and more complex, with increasingly uncertain environments, decisions become more complicated and difficult to make (Wheelen and Hunger, 2006).
4. Effective decision-making and learning in a world of growing 'dynamic complexity' requires system thinking to expand the boundaries of existing mental models and develop tools to understand how the structure of complex systems creates their behavior (Sterman, 2001).

Regarding the relation of the problem of understanding the dynamics of decision-making to the complexity science theories, it is necessary to note a number of contemporary trends that seem to be contributing to the growth of interest in complex system theories (Cohen, 1999):

1. There are dramatic changes occurring in the structure and operational scope of business, governmental, and nonprofit organizations. The list of challenges for contemporary organizations is long; globalization, process reengineering, workforce diversity, quality improvement, and public service privatization are some of the challenges. Such transitions, in turn, apply pressure on organizations to put a premium on responsiveness to change.
2. It is common-knowledge that there is an information revolution unfolding. The prices of sensing, processing, transmission, storage, and retrieval of information decline each year at exhilarating rates. With those changes, it is possible to exploit technology to couple activities that have formerly been separated in space and/or time. There seems to be boundless opportunities to use the technology to increase the responsiveness of one process to another.
3. Organizational entities are being created and dissolved at increasing rates. Contemporary developments like macro-level political

> events influencing work, virtual organizations, increasing use of consultants, ad hoc teams, temporary employees, outsourcing agencies, corporate mergers and divestitures all push the focus on dynamics of organizations. It is necessary to consider how organizational capabilities, boundaries, and process couplings arise and change. With that focus on dynamics, it has become apparent that there are numerous points of resonance with complex systems research.

Lewin (1999) states that the implications of complexity for informing research in organization science are immediate and reveal pressing conceptual and methodological challenges. One of the most fundamental implications emerging from the science of complexity is that order naturally emerges in systems, no matter how simple, complex, non-linear, or chaotic the system is. Natural order evolves through self-organization. As summarized by Anderson (1999), when a system is open to receiving energy from the outside, it will tend to create order; when a system becomes closed, it will decay into maximum disorder and chaos.

In addition to this, according to Lewin (1999), this rediscovery of the characteristics of open systems needs a reexamination of the underlying management logic that dominates the view of the role of managers. The idea that organizations can naturally evolve effective strategies, structures, and processes; and self-adjust to new strategies and environmental changes, implies that managers should facilitate, guide, and set the boundary conditions within which successful self-organization can take place. In the language of open systems and complexity, the new management logic requires managing all the organizational levers of dissipative energy. The new management logic also requires internal processes that facilitate all kinds of emergent processes as self-generated sources of dissipative energy, such as improvisation, product champions, and emergent strategies. In addition, the new management logic requires

openness to bottom-up processes and acceptance of effective equifinal outcome. Finally, the new management logic also requires leadership styles that moderate dysfunctional tension and forestall the emergence of chaos.

### 1.2. The Aim

The aim of this paper is to share the findings of an empirical study (Onuk, 2009) realized to contribute to our understanding of the dynamics of managerial decision-making process in complex internal and external environments by analyzing the effect of crisis on the distribution of decision-making authority, to confirm the common expectation that during the times of crises decisions are centralized, and shifted towards upper management levels.

### 1.3. The Importance of The Study

According the Cyert and his colleagues (1956), decision-making which is defined as choosing one course of action rather than another, or finding an appropriate solution to a new problem posed by a changing world, is commonly asserted to be the heart of executive activity in business. If this is so, a realistic description and theory of the decision-making process are of central importance to business administration and organization theory (Cyert et al., 1956).

In addition to operating in a complex world, within the organization, decision-making is a part of a complex integration. That is, in an organization, decisions of individual managers must be integrated with decisions of others to form a mosaic of corporate policy. This integration of individual decisions has become the major concern of organization theory (Lindblom, 1959).

Decision makers play a critical role in decision-making process. Decision makers have a strong influence on a firm's evolution. Expansion,

contraction or stagnation of a firm is the result not only of exogenous forces, but also of the activities of the management (Krystek, 1987; cited in Feichtinger and Kopel, 1993). One reason for the relatively under-developed behavioral basis of decision-making is the nature of the decision maker. The basic decision-making unit in the business context is the business organization or firm and this is a far more complex structure than, say, the consumer making a shopping decision. Any attempt to understand decision-making within a business context, therefore, must take into account the structure of business organizations (Dicken, 1971).

As a result, the study is important firstly because of the importance of decision-making as explained above. Secondly, the applications of complexity theory to organization science are limited and by taking the complex structure of business organization and the effects of complex environment into consideration, and by analyzing the dynamics of decision-making, the study provides such an application.

### 1.4. Management Questions Addressed

The study addressed the following management questions:

- What is decision?
- What are the different types of decisions?
- Who are the decision-makers?
- How are the decisions made?
- What does "decision-making authority" mean?
- How are the different types of decisions distributed throughout the different levels of organization?
- How is the decision-making authority distributed throughout the different levels of organization?
- What is crisis? What are the types of crises? What is economic crisis?
- How is the distribution of decision-making authority affected by economic crisis?

### 1.5. Methodology

The design of the research satisfies the requirements stated by Dooley and Van de Ven (1999) by providing means of observation and classification for the dynamics of decision-making process. The design of the research is also able to formulate interdependencies mentioned by Levinthal and Warglien (1999), in such a way that the emergent behavior is analyzed.

As a general rule in social research, different research problems require different research approaches (Singleton and Straits, 1999). The present research design is based both on exploratory and conclusive research. It is exploratory, because the research aims to provide significant insight to our understanding of the dynamics of decision-making in organizations. It is conclusive, because it is meant to provide information that is useful in reaching conclusions.

Although most researchers do either quantitative or qualitative research work, some researchers have suggested combining one or more research methods in one study (Gable, 1994; Kaplan and Duchon, 1988; Lee, 1991; Mingers, 2001; Ragin, 1987; Myers, 1997). Triangular approach which is the combination of qualitative and quantitative methods is used in this research for the collection of data. Besides the questionnaire, different forms of data collection, such as interviews, use of expert knowledge, analysis of formal and informal procedures, interviews, and observation for obtaining necessary information for the understanding of decision-making process in target organization are also conducted in the study.

## 2. RESEARCH FINDINGS

The study is realized with the use of the research tool developed by Onuk (2009).

### 2.1. Sampling

The study is applied in Siemens Sanayi ve Ticaret A.S., the general representative of Siemens AG in Turkey (www.siemens.com.tr). Total number of employees of Siemens Turkey during the time frame of the survey which was July 2009, was 2306. Table 1 provides the details of employee profile of Siemens Turkey:

**Table 1.** Employee Profile of Siemens Turkey as of July 2009.

| **Total Number of Employees (July 2009)** | **2306** |
|---|---|
| White-collar employees | 1601 |
| Blue-collar employees | 705 |
| **Gender** | |
| Women | 556 |
| Men | 1750 |
| **Employee with access to a computer** | **1650** |
| **Education Level** | |
| Primary School Graduate | 48 |
| Secondary School Graduate | 58 |
| High School Graduate | 842 |
| Vocational School Graduate | 133 |
| University Pre-Graduate | 10 |
| University Undergraduate | 945 |
| Master's Degree | 258 |
| PhD | 12 |
| **Position Level** | |
| Top Management, CEO and CFO | 2 |
| Upper-level Manager | 25 |
| Middle-level Manager | 96 |
| Manager | 114 |
| Employee | 2069 |

92 participants responded to the survey. After careful evaluation 7 responses were eliminated because the related respondents didn't fill in the demographic questions necessary for the analysis. As a result, 85 responses were used for the analysis.

Size of the target population, which is the total number of employees of Siemens Turkey when the survey was applied, is 2306. As a result, the representation level of the sample is 3.69%.

The survey was designed in Internet and was not accessible by the employees who do not have access to a computer. Because of this limitation, the actual size of the target population could be maximum 1650, and the representation level of the sample increases up to %5.15.

**2.2. Demographics**

The characteristics of demographic variables of the sample and their level of representation within the target population are analyzed. Correlations of demographic variables between decision-making authority of different decision types both during normal and economic crisis conditions or eras, and results of the analysis of variances are also included (Onuk, 2009).

Instead of analyzing all components of each instrument separately, the analysis is done by using their average values represented by the following variables:

STRNAVR: Average value of decision-making authority for strategic decisions related questions during normal economic conditions

STRCAVR: Average value of decision-making authority for strategic decisions related questions during economic crisis conditions

TACNAVR: Average value of decision-making authority for tactical decisions related questions during normal economic conditions

TACCAVR: Average value of decision-making authority for tactical decisions related questions during economic crisis conditions

OPENAVR: Average value of decision-making authority for operational decisions related questions during normal economic conditions

OPECAVR: Average value of decision-making authority for operational decisions related questions during economic crisis conditions

### 2.3. Distribution of Decision-Making Authority

#### 2.3.1. Analysis Based on Averages

The results of the analysis realized based on average values of responses depending on gender, age, education level, position level and distance to CEO during the times of normal economic conditions are given in Table 2, Table 3, Table 4, Table 5 and Table 6 respectively.

**Table 2.** Distribution of Decision-Making Authority based on Gender during Normal Period

| | | | Averages of Decision-Making Authority (Values between 1 to 7) | | |
|---|---|---|---|---|---|
| **Gender** | **Nr of Cases** | **% of Cases** | **Strategical (STRNAVR)** | **Tactical (TACNAVR)** | **Operational (OPENAVR)** |
| Female | 12 | 14% | 2.22 | 2.24 | 2.36 |
| Male | 73 | 86% | 3.06 | 3.28 | 3.21 |
| **Total** | **85** | **100%** | **2.94** | **3.13** | **3.09** |

Table 2 indicates that the impact level of males in the sample organization is higher than females for all decision types during normal economic conditions.

**Table 3.** Distribution of Decision-Making Authority based on Age during Normal Period

| | | | Averages of Decision-Making Authority (Values between 1 to 7) | | |
|---|---|---|---|---|---|
| **Age** | **Nr of Cases** | **% of Cases** | **Strategical (STRNAVR)** | **Tactical (TACNAVR)** | **Operational (OPENAVR)** |
| 21-30 | 10 | 12% | 2.45 | 2.22 | 2.28 |
| 31-40 | 32 | 38% | 3.14 | 3.14 | 3.18 |
| 41-50 | 30 | 35% | 3.64 | 3.23 | 3.04 |
| 51-60 | 12 | 14% | 3.57 | 3.67 | 3.65 |
| 60+ | 1 | 1% | 2.67 | 2.50 | 2.67 |
| **Total** | **85** | **100%** | **2.94** | **3.13** | **3.09** |

Looking at the results in Table 3 it is not possible to reach a conclusion regarding the effect of age on the distribution of decision-making authority during normal economic conditions.

**Table 4.** Distribution of Decision-Making Authority based on Education Level during Normal Period

| | | | Averages of Decision-Making Authority (Values between 1 to 7) | | |
|---|---|---|---|---|---|
| **Education Level** | **Nr of Cases** | **% of Cases** | **Strategical (STRNAVR)** | **Tactical (TACNAVR)** | **Operational (OPENAVR)** |
| Vocational School | 5 | 6% | 1.57 | 1.70 | 2.00 |
| University | 41 | 48% | 2.68 | 2.81 | 2.78 |
| Master's Degree | 37 | 44% | 3.33 | 3.64 | 3.52 |
| PhD | 2 | 2% | 4.42 | 3.92 | 4.00 |
| **Total** | **85** | **100%** | **2.94** | **3.13** | **3.09** |

Results of Table 4 indicate an effect of education level on the distribution of decision-making authority. The higher the level of education

the higher the level of impact on decision-making for all decision types during normal economic conditions.

**Table 5.** Distribution of Decision-Making Authority based on Position Level during Normal Period

| | | | Averages of Decision-Making Authority (Values between 1 to 7) | | |
|---|---|---|---|---|---|
| **Position** | **Nr of Cases** | **% of Cases** | **Strategical (STRNAVR)** | **Tactical (TACNAVR)** | **Operational (OPENAVR)** |
| Upper-Level Manager | 10 | 12% | 3.88 | 4.48 | 3.97 |
| Middle-Level Manager | 28 | 33% | 3.33 | 3.79 | 3.65 |
| Manager | 16 | 19% | 3.00 | 3.11 | 3.38 |
| Employee | 31 | 36% | 2.25 | 2.10 | 2.15 |
| **Total** | **85** | **100%** | **2.94** | **3.13** | **3.09** |

**Table 6.** Distribution of Decision-Making Authority based on Distance to CEO during Normal Period

| | | | Averages of Decision-Making Authority (Values between 1 to 7) | | |
|---|---|---|---|---|---|
| **Distance to CEO** | **Nr of Cases** | **% of Cases** | **Strategical (STRNAVR)** | **Tactical (TACNAVR)** | **Operational (OPENAVR)** |
| LEVEL 1 | 11 | 13% | 3.45 | 3.83 | 3.26 |
| LEVEL 2 | 22 | 26% | 3.69 | 3.74 | 3.76 |
| LEVEL 3 | 17 | 20% | 3.25 | 3.29 | 3.49 |
| LEVEL 4 | 24 | 28% | 2.24 | 2.51 | 2.38 |
| LEVEL 5 | 11 | 13% | 1.97 | 2.30 | 2.48 |
| **Total** | **85** | **100%** | **2.94** | **3.13** | **3.09** |

Table 5 indicates that with respect to position, the decision-making authority is higher at higher managerial levels. This finding is in line

with the definition of legitimate power (French, Raven, 1959). Similar finding is also generally valid with respect to distance to CEO except for Level 1 and Level 2 for strategic and operational level decisions as indicated in Table 6.

It is assumed that strategic level decisions are taken at strategic apex, tactical level decisions are taken in middle line, techno structure, and support staff, and finally operational level decisions are taken in operating core, being the organizational parts defined by Mintzberg (1979). Satisfying one of the aims of the research, the findings of the empirical study identify this distribution. However, different than the hypothesis, the findings indicate that although the strategic level decisions are more concentrated in upper level of management, tactical level decisions and operational level decisions are also concentrated in upper level of management instead of being concentrated in middle-level management, and lower-level management and employee level respectively. This may indicate an empowerment related issue within the target organization. In addition, the findings also indicate that some non-managers believe that they are taking part in making some of the strategic level decisions and some tactical level decisions. These findings can also be partially related to the divisional organizational form (Mintzberg, 1979) of the target organization.

### 2.3.2. Correlations

The correlations between six instruments are listed in Table 7. Instead of analyzing all components of each instrument separately, their average values are used for the calculations.

As listed in Table 7, there are significant correlations between all instruments. In other words, the authorities of decision-making at different hierarchical levels at different economic eras are correlated. As expected, there are high correlations between normal and crisis eras at each decision level with Pearson Correlation measures 0.969, 0.972, and 0.962 for

strategic, tactical, and organizational decision levels respectively, all being at significance level 0.01. It is also worth noting that the correlation between strategic level decisions and tactical level decisions (0.724 up to 0.770) is higher than the correlation between strategic level decisions and operational level decisions (0.696 up to 0.740). The correlations between tactical level decisions and operational level decisions (0.844 up to 0.888), on the other hand is higher than the correlation between strategical level decisions and operational level decisions. These correlation values indicate a hierarchy among different levels of decisions.

**Table 7.** Correlations between Six Instruments

**Correlations**

| | | STRNAVR | STRCAVR | TACNAVR | TACCAVR | OPENAVR | OPECAVR |
|---|---|---|---|---|---|---|---|
| STRNAVR | Pearson Correlation | 1 | .969** | .760** | .724** | .735** | .696** |
| | Sig. (2-tailed) | . | .000 | .000 | .000 | .000 | .000 |
| | N | 85 | 85 | 85 | 85 | 85 | 85 |
| STRCAVR | Pearson Correlation | .969** | 1 | .769** | .770** | .739** | .740** |
| | Sig. (2-tailed) | .000 | . | .000 | .000 | .000 | .000 |
| | N | 85 | 85 | 85 | 85 | 85 | 85 |
| TACNAVR | Pearson Correlation | .760** | .769** | 1 | .972** | .867** | .865** |
| | Sig. (2-tailed) | .000 | .000 | . | .000 | .000 | .000 |
| | N | 85 | 85 | 85 | 85 | 85 | 85 |
| TACCAVR | Pearson Correlation | .724** | .770** | .972** | 1 | .844** | .888** |
| | Sig. (2-tailed) | .000 | .000 | .000 | . | .000 | .000 |
| | N | 85 | 85 | 85 | 85 | 85 | 85 |
| OPENAVR | Pearson Correlation | .735** | .739** | .867** | .844** | 1 | .962** |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | . | .000 |
| | N | 85 | 85 | 85 | 85 | 85 | 85 |
| OPECAVR | Pearson Correlation | .696** | .740** | .865** | .888** | .962** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | . |
| | N | 85 | 85 | 85 | 85 | 85 | 85 |

**. Correlation is significant at the 0.01 level (2-tailed).

### 2.3.3. Effect of Economic Crisis on Distribution of Decision-Making Authority

In order to understand whether there is a statistically meaningful difference between the responses collected for the distribution of decision-making of different decision types during normal and economic cri-

sis conditions a Paired Sample T-test is realized. In order to realize the test, averages of decision-making authority levels for each different decision types for normal and economic crisis conditions are paired together. As an example, variable STRNAVR which represents the averages of decision-making authority of strategic type decisions during normal period is paired with the variable STRCAVR which represents the same during economic crisis period. Similarly, TACNAVR is paired with TACCAVR for tactical decisions, and finally OPENAVR is paired with OPECAVR for operational decisions. The statistics, correlations and the result of the Paired Sample T-test are given in Table 8, Table 9, and Table 10.

**Table 8.** Statistics of Paired Samples

**Paired Samples Statistics**

| | | Mean | N | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Pair 1 | STRNAVR | 2.9393 | 85 | 1.41058 | .15300 |
| | STRCAVR | 2.7842 | 85 | 1.37856 | .14953 |
| Pair 2 | TACNAVR | 3.1294 | 85 | 1.56829 | .17010 |
| | TACCAVR | 2.9780 | 85 | 1.57516 | .17085 |
| Pair 3 | OPENAVR | 3.0865 | 85 | 1.76666 | .19162 |
| | OPECAVR | 2.9565 | 85 | 1.77049 | .19204 |

**Table 9.** Correlations of Paired Samples

**Paired Samples Correlations**

| | | N | Correlation | Sig. |
|---|---|---|---|---|
| Pair 1 | STRNAVR & STRCAVR | 85 | .969 | .000 |
| Pair 2 | TACNAVR & TACCAVR | 85 | .972 | .000 |
| Pair 3 | OPENAVR & OPECAVR | 85 | .962 | .000 |

The results of Table 9 indicate that each pair is strongly correlated with each other.

**Table 10.** Results of Paired Samples T-test

**Paired Samples Test**

| | | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference Lower | Upper | | | |
| Pair 1 | STRNAVR - STRCAVR | .1551 | .35084 | .03805 | .0794 | .2307 | 4.075 | 84 | .000 |
| Pair 2 | TACNAVR - TACCAVR | .1514 | .37043 | .04018 | .0715 | .2313 | 3.768 | 84 | .000 |
| Pair 3 | OPENAVR - OPECAVR | .1300 | .48913 | .05305 | .0245 | .2355 | 2.450 | 84 | .016 |

Results of Table 10 confirm that the changes between each pair are not a chance variation but statistically significant with significance levels 0.000 for strategic and tactical decisions, and 0.016 for operational decisions. This finding indicates that crisis has a statistically significant effect on the distribution of decision-making for different decision types.

Analysis based on averages is repeated to compare normal and economic crisis period. The aim of the analysis is to look for changes in averages with respect to gender, age, education level, position level and distance to CEO. The results are summarized in Table 11, Table 12, Table 13, Table 14, and Table 15 which show the effect of economic crisis on the distribution of decision-making authority.

**Table 11.** Effect of Economic Crisis on the Distribution of Decision-Making Authority based on Gender

| | | | **Averages of Decision-Making Authority (Values between 1 to 7)** | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Strategical** | | **Tactical** | | **Operational** | |
| **Gender** | **Nr of Cases** | **% of Cases** | **Normal (STRNAVR)** | **Crisis (STRCAVR)** | **Normal (TACNAVR)** | **Crisis (TACCAVR)** | **Normal (OPENAVR)** | **Crisis (OPECAVR)** |
| Female | 12 | 14% | 2.22 | 2.13 | 2.24 | 2.11 | 2.36 | 2.26 |
| Male | 73 | 86% | 3.06 | 2.89 | 3.28 | 3.12 | 3.21 | 3.07 |
| **Total** | **85** | **100%** | **2.94** | **2.78** | **3.13** | **2.98** | **3.09** | **2.96** |

Results in Table 11 indicate that level of impact on decision-making decreases for all decision types during the times of economic crisis irrespective of gender.

**Table 12.** Effect of Economic Crisis on the Distribution of Decision-Making Authority based on Age

| | | | Averages of Decision-Making Authority (Values between 1 to 7) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Strategical | | Tactical | | Operational | |
| Age | Nr of Cases | % of Cases | Normal (STRNAVR) | Crisis (STRCAVR) | Normal (TACNAVR) | Crisis (TACCAVR) | Normal (OPENAVR) | Crisis (OPECAVR) |
| 21-30 | 10 | 12% | 2.45 | 2.40 | 2.22 | 2.22 | 2.28 | 2.27 |
| 31-40 | 32 | 38% | 3.14 | 2.98 | 3.14 | 3.03 | 3.18 | 3.11 |
| 41-50 | 30 | 35% | 2.64 | 2.48 | 3.23 | 3.03 | 3.04 | 2.93 |
| 51-60 | 12 | 14% | 3.57 | 3.39 | 3.67 | 3.42 | 3.65 | 3.24 |
| 60+ | 1 | 1% | 2.67 | 2.00 | 2.50 | 2.33 | 2.67 | 2.33 |
| **Total** | **85** | **100%** | **2.94** | **2.78** | **3.13** | **2.98** | **3.09** | **2.96** |

Results in Table 12 indicate that during the times of economic crisis level of impact on decision-making decreases for all decision types irrespective of age.

**Table 13.** Effect of Economic Crisis on the Distribution of Decision-Making Authority based on Education Level

| | | | Averages of Decision-Making Authority (Values between 1 to 7) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Strategical | | Tactical | | Operational | |
| Education | Nr of Cases | % of Cases | Normal (STRNAVR) | Crisis (STRCAVR) | Normal (TACNAVR) | Crisis (TACCAVR) | Normal (OPENAVR) | Crisis (OPECAVR) |
| Vocational | 5 | 6% | 1.57 | 1.53 | 1.70 | 1.67 | 2.00 | 2.00 |
| University | 41 | 48% | 2.68 | 2.54 | 2.81 | 2.70 | 2.78 | 2.67 |
| Master's | 37 | 44% | 3.33 | 3.15 | 3.64 | 3.43 | 3.52 | 3.35 |
| PhD | 2 | 2% | 4.42 | 4.08 | 3.92 | 3.75 | 4.00 | 4.00 |
| **Total** | **85** | **100%** | **2.94** | **2.78** | **3.13** | **2.98** | **3.09** | **2.96** |

Results in Table 13 indicate that during the times of economic crisis level of impact on decision-making decreases for all decision types irrespective of education level.

**Table 14.** Effect of Economic Crisis on the Distribution of Decision-Making Authority based on Position Level

| | | | Averages of Decision-Making Authority (Values between 1 to 7) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Strategical | | Tactical | | Operational | |
| Position | Nr of Cases | % of Cases | Normal (STRNAVR) | Crisis (STRCAVR) | Normal (TACNAVR) | Crisis (TACCAVR) | Normal (OPENAVR) | Crisis (OPECAVR) |
| Upper-Level Manager | 10 | 12% | 3.88 | 3.90 | 4.48 | 4.33 | 3.97 | 3.85 |
| Middle-Level Manager | 28 | 33% | 3.33 | 3.11 | 3.79 | 3.62 | 3.65 | 3.49 |
| Manager | 16 | 19% | 3.00 | 2.92 | 3.11 | 3.08 | 3.38 | 3.31 |
| Employee | 31 | 36% | 2.25 | 2.06 | 2.10 | 1.91 | 2.15 | 2.01 |
| **Total** | **85** | **100%** | **2.94** | **2.78** | **3.13** | **2.98** | **3.13** | **2.98** |

**Table 15.** Effect of Economic Crisis on the Distribution of Decision-Making Authority based on Distance to CEO

| | | | Averages of Decision-Making Authority (Values between 1 to 7) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Strategical | | Tactical | | Operational | |
| Distance to CEO | Nr of Cases | % of Cases | Normal (STRNAVR) | Crisis (STRCAVR) | Normal (TACNAVR) | Crisis (TACCAVR) | Normal (OPENAVR) | Crisis (OPECAVR) |
| LEVEL 1 | 11 | 13% | 3.45 | 3.52 | 3.83 | 3.79 | 3.26 | 3.33 |
| LEVEL 2 | 22 | 26% | 3.69 | 3.42 | 3.74 | 3.48 | 3.76 | 3.65 |
| LEVEL 3 | 17 | 20% | 3.25 | 3.05 | 3.29 | 3.12 | 3.49 | 3.16 |
| LEVEL 4 | 24 | 28% | 2.24 | 2.09 | 2.51 | 2.42 | 2.38 | 2.29 |
| LEVEL 5 | 11 | 13% | 1.97 | 1.88 | 2.30 | 2.18 | 2.48 | 2.33 |
| **Total** | **85** | **100%** | **2.94** | **2.78** | **3.13** | **2.98** | **3.09** | **2.96** |

One of the main aims of this study is to check the general expectation of the centralization of decision-making during the times of crisis in terms of the distribution of decisions shifting towards upper management levels. The findings of the empirical study given in Table 14 and Table 15 confirm

the general expectation for strategic level decisions. All decision-making authority levels with respect to different position and different decision levels are decreased during the time of crisis, except the decision-making authority level of the upper-level management for strategic level decisions. Similar findings are also valid with respect to the distance to CEO, with the exception that operational level decision-making authority of upper-level management is also increased during the time of crisis.

**2.4. Results of the Qualitative Analysis**

In order to understand respondents and the social and cultural contexts within which they live, as proposed by Myers (1997), four qualitative instruments are included within the survey. The instruments are designed as open-ended questions asking the personal opinions and feelings of the participants on how decision-making authority is affected from crisis. Translations of the instruments are given below.

1. How your decision-making authority is affected from times of crisis? Please share your opinions.
2. Is your decision-making authority decreased during the times of crisis? How do you feel about this? Please share your opinions.
3. What type of relationship exists between the strength of the crisis and the distribution of decision-making authority? Please share your opinions.
4. What type of relationship exists between the duration of the crisis and the distribution of decision-making authority? Please share your opinions.

Summary analyses of the collected responses to the qualitative instruments are provided in Table 16, Table 17, Table 18, and Table 19.

As shown in Table 16, at least 62 of the respondents (73%) think that economic crisis has an effect on the distribution of decision-making au-

thority. 51.8% of the respondents confirm the common expectation that during the time of crisis decision-making authority is decreased and shifted towards upper management levels.

**Table 16.** Summary Result of First Qualitative Question

| **1. How your decision-making authority is affected from times of crisis? Please share your opinions.** | | |
|---|---|---|
| **Comment** | **Nr. of Cases** | **% of Cases** |
| No change | 7 | 8.2% |
| Little impact | 3 | 3.5% |
| Becomes worse | 1 | 1.2% |
| It decreases | 8 | 9.4% |
| It decreases, Germany becomes more active | 4 | 4.7% |
| It decreases, shifts to upper management levels | 44 | 51.8% |
| Depends on position and/or target | 2 | 2.4% |
| Careful decision-making necessary, risk appetite reduced | 1 | 1.2% |
| Different management styles and planning necessary | 1 | 1.2% |
| Leads to limitation of spending | 1 | 1.2% |
| More rules of control, reduced flexibility, new procedures, loss of opportunities | 1 | 1.2% |
| I have no decision-making authority | 1 | 1.2% |
| General remarks | 3 | 3.5% |
| No Comment | 8 | 9.4% |
| **TOTAL** | **85** | **100%** |

As shown in Table 17, when asked directly, 57.6% of the respondents confirm the common expectation that during the time of crisis level of decision-making authority is decreased. 29.4% of the respondents feel bad about this decrease. Among the respondents who commented on their feelings this ratio increases up to 57%, while 36% is neutral.

**Table 17.** Summary Result of Second Qualitative Question

| **2. Is your decision-making authority decreased during the times of crisis? How do you feel about this? Please share your opinions.** | | |
|---|---|---|
| **Comment** | **Nr. of Cases** | **% of Cases** |
| Yes | 49 | 57.6% |
| No | 19 | 22.4% |
| In opposite, it increases | 2 | 2.4% |
| Partially decreases, partially increases in specialty area | 2 | 2.4% |
| General remarks | 1 | 1.2% |
| No comment | 12 | 14.1% |
| **TOTAL** | **85** | **100%** |
| Feeling positive | 3 | 3.5% |
| Feeling negative | 25 | 29.4% |
| Feeling as a normal situation | 16 | 18.8% |
| No Comment on feelings | 41 | 48.3% |
| **TOTAL** | **85** | **100%** |

As shown in Table 18, 78.8% of the respondents think that as strength of the crisis increase, decision-making authority will decrease.

**Table 18.** Summary Result of Third Qualitative Question

| **3. What type of relationship exists between the strength of the crisis and the distribution of decision-making authority? Please share your opinions.** | | |
|---|---|---|
| **Comment** | **Nr. of Cases** | **% of Cases** |
| As strength increases, decision-making authority decreases | 67 | 78.8% |
| It doesn't change | 4 | 4.7% |
| Participative decision-making will be helpful | 2 | 2.4% |
| There will be little impact on institutional corporation | 1 | 1.2% |
| No Comment | 11 | 12.9% |
| **TOTAL** | **85** | **100%** |

As shown in Table 19, at least 60% of the respondents think that as the duration of the crisis extends, decision-making authority will be decreased.

**Table 19.** Summary Result of Fourth Qualitative Question

| **4. What type of relationship exists between the duration of the crisis and the distribution of decision-making authority? Please share your opinions.** | | |
|---|---|---|
| **Comment** | **Nr. of Cases** | **% of Cases** |
| As crisis extends, decision-making authority decreases | 43 | 50.6% |
| It doesn't change | 10 | 11.8% |
| As crisis extends, decision-making authority decreases, after the end of the crisis it normalizes after some time | 6 | 7.0% |
| As crisis extends normalization starts | 5 | 5.9% |
| As crisis extends radical changes appear | 2 | 2.4% |
| Participative decision-making will be helpful | 2 | 2.4% |
| Different type of reactions will occur based on duration | 1 | 1.2% |
| As crisis extends decision-making authority decreases, fear and loss of opportunities will occur | 1 | 1.2% |
| As crisis extends decision-making authority decreases, even crisis ends decrease in authority will remain | 1 | 1.2% |
| As crisis extends change will be permanent | 1 | 1.2% |
| As crisis extends there will be more demand for normalization and receiving the authority back | 1 | 1.2% |
| No Comment | 12 | 14.1% |
| **TOTAL** | **85** | **100%** |

### 2.5. Hypothesis Testing

Based on the findings given in previous sections the hypotheses are tested as follows:

H1. Distribution of decision-making authority in organizations is significantly affected during crises

Research findings confirm that within the framework of the empirical study realized, crisis has an impact on the distribution of decision-making authority.

Results of Paired Samples T-test given in Table 10 confirm that the changes on distribution of decision-making for each decision type due to economic crisis are not chance variations but statistically significant. This finding indicates that economic crisis has a statistically significant effect on the distribution of decision-making for different decision types.

Results of the analysis based on averages summarized in Table 14 and Table 15 also show that economic crisis has an effect on the distribution of decision-making authority.

Results of the qualitative analysis also confirm that economic crisis has an effect on the distribution of decision-making authority. As shown in Table 16, at least 73% of the respondents think that economic crisis has an effect on the distribution of decision-making authority.

In summary the results of the empirical study confirm that hypothesis H1 is valid.

This finding is in line with the research (see Faulkner, 2001; Ritchie, 2004; Avena, 2005; and Harrington and Ottenbacher, 2009) stating that crisis has an effect of the managerial decision-making.

H1a. Crises cause an increase of the impact of top-level executives in strategic decisions

Analysis confirms the fact that position level has a statistically significant effect on the distribution of decision-making authority for strategic decisions during both normal and economic crisis period. Analysis confirms similar result for distance to CEO. However, because of limited number of cases it is not possible to differentiate among the effects of

different position levels or different levels of distance to CEO. Analysis of averages is used to make this differentiation.

According to Table 14, for strategic decisions, level of decision-making authority of upper-line managers which is 3.88 during normal conditions increased to 3.90 during economic crisis conditions. This is also valid with respect to distance to CEO. According to Table 15, for strategic decisions, level of decision-making authority of managers closest to the CEO which is 3.45 during normal conditions increased to 3.52 during economic crisis conditions. Based on the analysis of averages, the findings of the empirical study given in Table 14 and Table 15 confirm the hypothesis H1a.

This finding is also in line with the theoretical background provided in previous research Harrison and Pelletier (2000), Avena (2005), and Harrington and Ottenbacher (2009) confirm that level of decision-maker within the organization has an effect on decision-making. Regarding strategic decisions, Alkaraan and Northcott (2007) state that most strategic decisions are authorized by senior executives at the top level of the organization. As a result, an increasing impact of top management on decision-making during times of crisis can be expected.

H1b. Crises cause a decrease of the impact of middle level managers in tactical decisions

The statistical analyses for position level, and for distance to CEO indicate that these variables have a statistically significant impact on the decision-making authority for tactical decisions only during normal period. Therefore, based on the results of the existing empirical study it is not possible to comment on the effect of crises on the impact of middle level managers in tactical decisions and the null hypothesis should be rejected.

On the other hand, the analysis based on the average values of the decision-making authority level for tactical decisions provides consistent results in terms of the effect of crises on decision-making authority. Ac-

cording to Table 14, for tactical decisions, level of decision-making authority of middle-line managers which is 3.79 during normal conditions decreased to 3.62 during economic crisis conditions. This is also valid with respect to distance to CEO. According to Table 15, for tactical decisions, level of decision-making authority of managers close to the CEO three levels which is 3.29 during normal conditions decreased to 3.12 during economic crisis conditions. Based on the analysis of averages, the findings of the empirical study given in Table 14 and Table 15 confirm the hypothesis H1b. However, despite the analysis based on averages, since it cannot be statistically confirmed hypothesis H1b should be rejected.

H1c. Crises cause a decrease of the impact of lower level managers in operational decisions

The statistical analyses for position level and for distance to CEO indicate that these variables don't have a statistically significant impact on the decision-making authority of operational decisions. Therefore, based on the existing empirical study it is not possible to comment on the effect of crises on the impact of lower level managers in operational decisions and the null hypothesis should be rejected.

On the other hand, similar to the tactical decisions, the analysis based on the average values of the decision-making authority level for operational decisions also provides consistent results in terms of the effect of crises. According to Table 14, for operational decisions, level of decision-making authority of lower level managers which is 3.38 during normal conditions decreased to 3.31 during economic crisis conditions. This is also valid with respect to distance to CEO. According to Table 15, for operational decisions, value of decision-making authority of managers close to the CEO at Level 4 and Level 5 which are 2.38 and 2.48 respectively during normal conditions, decreased to 2.29 and 2.33 during economic crisis conditions. Based on the analysis of averages, the find-

ings of the empirical study given in Table 14 and Table 15 confirm the hypothesis H1c. However, despite the analysis based on averages, since it cannot be statistically confirmed hypothesis H1c should be rejected.

H1d. Crises cause an increase of the impact of male managers in organizational decisions

Results of the analysis on the relation of gender with decision-making authority are given in Section 4.1.1 of the research of Onuk (2009). Within the literature review realized it was not possible to identify an impact of gender on the distribution of decision-making authority. However, the parametric and non-parametric analyses realized on the results of the empirical study indicate a statistically significant impact of gender on the distribution of decision-making authority on tactical decisions during both normal and economic crisis period. Since there are only two categories, it is not statistically possible to identify whether this impact is from male or female origin. In addition, since there are only 12 cases in female category, the results of the statistical analysis cannot be generalized.

The results of the analysis based on the average values given in Table 11 also do not provide a differentiation between female and male respondents however it indicates that crisis decreases the impact level of both female and male decision makers for all type of decisions. As a result, hypothesis H1d should be rejected.

H1e. Crises cause an increase of the impact of more educated managers in organizational decisions

Based on the results of the statistical analyses reported in Section 4.1.3 of the research of Onuk (2009), it can be said that the distribution of decision-making authority is affected by education level of the employees for strategic and tactical decisions both for normal and economic crisis eras.

On the other hand, the analysis based on the average values of the

decision-making authority level in relation to educational level provides consistent results both in terms of the impact of education level and the effect of crises. According to Table 13, for all type of decisions, without any exception, the more educated the employee, the higher his/her impact on decision-making. This statement also holds during the time of crisis. However, comparing the level of decision-making authority before and during the time of crisis reveals the fact that for all education levels and decision types, crises causes a decrease in the level of decision-making authority. Therefore, hypothesis H1e should be rejected.

H1f. Crises cause an increase of the impact of managers with greater work experience in organizational decisions

Being one of the limitations of this research work experience is not directly measured within the survey. As an approximate solution age of the employee is used to analyze this hypothesis. Results of the statistical analyses indicate that age has no effect on the distribution of decision-making authority of different decision types during normal and economic crisis eras.

The analysis based on averages does not provide any results to differentiate among age categories in terms of their impact of decision-making authority either. Regarding the effect of crises, results in Table 12 only indicate that during the times of economic crisis level of impact on decision-making decreases for all decision types irrespective of age. Therefore, hypothesis H1f should be rejected.

H2. During crises, decision-making authority tends to be shifted towards and centralized in the upper management levels

As reported for hypothesis H1, within the framework of the empirical study realized within this research, crises has a statistically significant impact on the distribution of decision-making authority within the

organization. General expectation and the concept of centralization as explained by Mintzberg (1979) tell that during crises decision-making within an organization will be centralized. However as explained while testing the hypothesis H1a, the findings of this research confirms this general expectation statistically only for strategic type decisions.

The results of the qualitative analysis on the other hand provide some supporting findings for the hypothesis without making any differentiation among decision types. As shown in Table 16, 48 respondents (56.5%) clearly confirm the common expectation that during the time of crisis decision-making authority is decreased and shifted towards upper management levels. The percentage which supports the general expectation increases up to 70% when empty and unrelated respondents are taken out of the evaluation. In addition, a detailed analysis based on position levels made on the results of Table 96 provides following results: In employee level 85% of the respondents believe that their decision-making authority decrease during the crisis. This ratio is 71% for managers, 73% for middle-line managers, but only 30% for upper-line managers. 70% of the upper-line managers believe that their decision-making authority is not affected negatively from the crises.

In conclusion, despite the strongly supporting results of the qualitative analysis, it can be said that based on the results of the research H2 holds only for strategic type decisions.

H3. There is a negative relationship between the strength of crisis and decision-making authority

A quantitative analysis investigating the characteristics of the crises was not included within the survey. This created an important limitation during the statistical analysis of the findings. However, on the qualitative part one of the questions is directly related to hypothesis H3. As shown in Table 18, 78.8% of the respondents think that as strength of the

crisis increase, decision-making authority will decrease. When empty and unrelated responses are eliminated the percentage increases to 94%, confirming the negative relationship between the strength of crisis and decision-making authority strongly. Therefore, based on the result of the qualitative analysis it can be said that H3 is justified.

H4. There is a negative relationship between the duration of crisis and decision-making authority

Similar situation of hypothesis H3 is also valid for hypothesis H4. A quantitative analysis investigating the characteristics of the crisis was not included within the survey. This created an important limitation during the statistical analysis of the findings. However, one of the questions in qualitative part is directly related to hypothesis H4. As shown in Table 19, at least 60% of the respondents think that as the duration of the crisis extends, decision-making authority will be decreased. When empty and unrelated responses are eliminated the percentage increases to 84%, confirming the negative relationship between the strength of crisis and decision-making authority strongly. Therefore, based on the result of the qualitative analysis it can be said that H4 is justified.

## 3. CONCLUSION

The purpose of this study was to analyze the effect of crisis on the distribution of decision-making authority of different types of decisions throughout the organization levels.

Based on the theoretical background investigated (Onuk, 2009), several hypotheses were developed to understand the effects of crises on the distribution of decision-making authority within organization. Application of the survey tool developed by Onuk (2009) to the target organization provided following summary results regarding these hypotheses:

First of all, distribution of decision-making authority in organizations is significantly affected during crises.

Second, crises cause an increase of the impact of top-level executives

in strategic decisions. Although the findings indicate that the strategic level decisions are more concentrated in upper level of management as foreseen, tactical level decisions and operational level decisions are also concentrated in the upper level of management instead of being concentrated in the middle-level, and the lower-level management level respectively. This may indicate an empowerment related issue within the target organization. In addition, the findings also indicate that some non-managers believe that they are taking part in making some of the strategic level decisions and some tactical level decisions. These findings can also be partially related to the divisional organizational form (Mintzberg, 1979) of the target organization.

Third, during crises, for strategic type decisions, decision-making authority tends to be shifted towards and centralized in the upper management levels. This study was aiming to check the general expectation that during the times of crisis the distribution of decisions is shifted towards and is centralized in the upper management levels. The findings of the empirical study confirmed the general expectation only for strategic level decisions. All decision-making authority levels with respect to different positions and different decision levels are decreased during the time of crisis, except for the decision-making authority level of the upper-level management for strategic level decisions. Similar findings are also valid with respect to the distance to CEO, with the exception that operational level decision-making authority of upper-level management is also increased during the time of crisis. The results of the qualitative analysis also confirmed that during the times of crisis the decision-making is centralized.

Fourth, there is a negative relationship between the strength of crisis and decision-making authority.

Finally, there is a negative relationship between the duration of crisis and decision-making authority.

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