BMIJ
ISSN: 2148-2586

Research Article

BUSINESS & MANAGEMENT STUDIES:
AN INTERNATIONAL JOURNAL

Vol.:8 Issue:5 Year:2020, 4017-4046

Citation: Eyigün, İ., & Yaşar, O., The Impact of Organisational Learning on Demand Forecasting: Moderator Role of Chaotic Structure, BMIJ, (2020), 8(5): 4017-4046 doi: http://dx.doi.org/10.15295/bmij.v8i5.1640

THE IMPACT OF ORGANISATIONAL LEARNING ON DEMAND FORECASTING: MODERATOR ROLE OF CHAOTIC STRUCTURE[1]

İsmail EYİGÜN [2]

Okan YAŞAR [3]

Received Date (Başvuru Tarihi): 28/09/2020

Accepted Date (Kabul Tarihi): 26/11/2020

Published Date (Yayın Tarihi): 25/12/2020

In the article, the first author is in the role of the Corresponding Author.

ABSTRACT

The research aims to explain the relationship between chaotic structure, organisational learning and demand forecast, and to understand the effect of chaotic structure on the relationship between organisational learning and demand forecast. The research is based on organisational learning and chaos theory. When organisational learning theory is considered in the context of the relationship between the organisation and the environment, it is said that learning cannot be achieved in chaotic settings. Additionally, chaos theory assumes that the future is unpredictable. So, in this study, the moderator role of the chaotic structure on the organisational learning and on-demand forecasting is examined. The originality of the study lies firstly in measuring the chaotic level and using it as an organisational variable, secondly analysing the effect of organisational learning on demand forecasting. The research was designed with objectivist methodological assumptions and used relational and causal survey model. The organisational learning data were collected from individuals who are micro level, and chaotic, forecasting data were collected from organisations which is meso level. The organisational learning data were collected from 615 employees from 26 regional offices by using Organizational Learning Questionnaire developed by Watkins and Marsick (1997), and the demand forecasting and chaotic structure data were obtained from the company operating in Food Industry in Turkey. The findings of the research revealed that organisational learning level has a strong positive correlation with demand forecasting and a strong negative correlation with the chaotic environment, and the chaotic structure has a moderator effect on the relationship between organisational learning and demand forecasting. Moderator role showed that low and medium levels of chaos reduced the relationship between variables and high levels of chaos affected adversely. This study has some practical and theoretical implications. From the practical perspective, the relations between variables

Keywords:

Organisation,

Organizational Learning,

Chaos,

Chaotic Structure,

Demand Forecasting

JEL Codes:

M1, L2, D23

1 Bu çalışma Bahçeşehir Üniversitesinde Dr.Öğr.Üyesi Okan Yaşar danışmanlığında İsmail Eyigin tarafından yürütülen tezden türetilmiştir.

[2] Bahçeşehir Üniversitesi, ismail_eyigun@yahoo.com, https://orcid.org/0000-0002-4557-0467

[3] Dr. Öğr.Üyesi, Beykent Üniversitesi, okanyasar@yahoo.com, https://orcid.org/0000-0002-5455-4274

Bu makale, araştırma ve yayın etiğine uygun hazırlanmış ve iThenticate intihal taramasından geçirilmiştir.

ORGANİZASYONEL ÖĞRENMENİN TALEP TAHMİNİ ÜZERİNDEKİ ETKİSİ: KAOTİK YAPININ DÜZENLEYİCİ ROLÜ

ÖZ

Araştırmanın amacı, kaotik yapı, örgütsel öğrenme ve talep tahmini arasındaki ilişkiyi açıklamak ve kaotik yapının örgütsel öğrenme ile talep tahmini arasındaki ilişkiye etkisini anlamaktır. Araştırma, örgütsel öğrenme ve kaos teorisine dayanmaktadır. Örgütsel öğrenme teorisi, örgüt ve çevre arasındaki ilişki bağlamında ele alındığında, kaotik ortamlarda öğrenmenin sağlanamayacağı söylenmektedir. Bunula birlikte, kaos teorisi geleceğin tahmin edilemez olduğunu varsayar. Bu nedenle, kaotik yapının örgütsel öğrenme ve talep üzerine tahmin üzerindeki etkisinde düzenleyici rolü olabileceği öngörüsünden inceleme kapsamına alınmıştır. Çalışmanın özgünlüğü, öncelikle kaotik seviyenin ölçülmesinde ve onu bir organizasyonel değişken olarak kullanmasında, ikinci olarak da örgütsel öğrenmenin talep tahmini üzerindeki etkisinin analiz edilmesinde yatmaktadır. Araştırma, nesnelci metodolojik varsayımlar ile tasarlanmış ve ilişkisel ve araştırmada nedensel model kullanılmıştır. Örgütsel öğrenme verileri mikro düzeydeki bireylerden, kaotik tahmin verileri ise meso düzeydeki kuruluşlardan toplanmıştır. Örgütsel öğrenme verileri, Watkins ve Marsick (1997) tarafından geliştirilen Örgütsel Öğrenme Anketi kullanılarak 26 bölge ofisinden 615 çalışandan toplanmış, talep tahmini ve kaotik yapı verileri Türkiye'de Gıda Endüstrisinde faaliyet gösteren firmadan elde edilmiştir. Araştırmanın bulguları, örgütsel öğrenme düzeyinin talep tahmini ile güçlü-pozitif, kaotik ortamla güçlü-negatif ilişkiye sahip olduğunu ve örgütsel öğrenme ile talep tahmini arasındaki ilişkide kaotik yapının moderatör etkisi olduğunu ortaya koymuştur. Moderatör rolü, düşük ve orta düzeydeki kaosun değişkenler arasındaki ilişkiyi azalttığını ve yüksek düzeyde kaosun olumsuz etkilendiğini göstermiştir. Bu çalışmanın bazı pratik ve teorik çıkarımları vardır. Pratik açıdan, değişkenler arasındaki ilişkiler, firmalar çevrenin kaotik yapı seviyesine göre eylemlerini düzenlemelerini ortaya koymuştur. Teorik perspektiften, bulgular örgütsel öğrenme ve kaos teorisini desteklemiştir. Kaos teorisi, bir sistemin "rastlantısal" ve "deterministik" öğelerden oluştuğunu varsayar. Bulgular, kısa vadeli tahminlerin deterministik bir model, uzun vadeli tahminlerin ise rastlantısal bir model sergilediğini açıkça göstermiştir. Çalışma sonunda, uygulayıcılar ve araştırmacılar için öneriler sunulmuştur.

Anahtar Kelimeler:

Örgüt,

Örgütsel Öğrenme,

Kaos,

Kaotik Yapı,

Talep Tahmini

JEL Kodları:

M1, L2, D23

1. INTRODUCTION

The chaotic structure is one of the most prominent features of the conditions that determine the environment of organisations. Put another way; organisations strive to survive in chaotic environments. As Forrester (1987:104) states, "We live in a highly non-linear world. Social areas are not linear, appear as places with instability and unpredictability where cause and effect relationships are often unanswered." Based on this approach, chaos theory has found application in social sciences, where it has been applied to a wide variety of social phenomena, such as the traditional disciplines of economics (Grandmont, 1985; Baumol & Benhabib, 1989), political science (Saperstein & Mayer-Kress, 1989), and sociology (Young, 1991).

According to the Von Foerster Theory in cybernetic theory, the closer the connections of a system's elements, the less impact they have on the system as a whole. The tighter the connections, the more alienation in the system appears. As a reflection of the theory on social sciences, the role of organisations is to shape and create the contexts in which self-organisation can be realised. The manager in such a context will not be in a position to control the change (Morgan, 2007:299). Organisational learning is a critical competency in organisations that struggle in chaotic environments, making the concepts of self-organisation and learning organisations, also known as organisational learning, ones that provide superiority to organisations in chaotic environments.

Due to changes and developments in the economic and technological fields, organisational activities take place at the centre of organisational learning, which is based on access to and effective use of information by all the individuals in the organisation. Because learning is the driving force in providing access to organisations information and improving business performance with the help of information, in this context, organisational learning has a significant impact on the success and performance of businesses. In this study, both organisational learning and chaotic structure are considered as independent variables.

The dependent variable discussed in the research is demand forecasting. While businesses continue to operate in highly competitive settings, managers face

uncertainty and other associated risks in the decision-making process (Yaşar,.2016). While making decisions for the future, the forecasting method is employed to reduce the risks in the decision process. The decisions made as a result of the forecasts have positive or negative effects on the businesses' rate of return on investments, their success in supply chain management, customer satisfaction, competitiveness in the existing market.

Determining the relationship of the forecasting variable with organisational learning and chaotic structure, on the other hand, determining the effect of chaotic structure and organisational learning on forecasting is extremely important for both organisations and the literature. When the literature is examined, it is seen that many studies are examining the relationship between organisational learning and business performance and organisational learning and innovation. (Biçkes, 2011:203). However, studies investigating the effect of the chaotic environment are insufficient. This study aims to explain the relationship between chaotic structure, organisational learning and demand forecast, and to understand the effect of chaotic structure on the relationship between organisational learning and demand forecast. On the other hand, the measurement studies of the abstract variable that is a chaotic structure, are very few. The most crucial distinctiveness of this study is to measure the chaotic structure and to calculate its relation with organisational learning and the forecast variables.

2. LITERATURE REVIEW

2.1. Organizational Learning

Psychologists first studied organisational learning as a field of academic inquiry. Later, other disciplines, such as economics and business management, took an interest. Learning is defined as the process of acquiring the knowledge, experience, skills, and behaviours necessary for a person to maintain his/her life in an environment where he/she interacts (Selçuk, 1999:95), and learning individuals are needed in the organisation for organisation learning to be understood as taking place. There is a need for teams or groups where learning individuals have uninterrupted communication with each other and share what they have learned with each other. Therefore, the various facets at play in the broader concept of organisational learning

can be characterised as individual learning, group learning, and, ultimately, organisational learning (Mulholland, Zdrahal, Domingue, Hatala & Bernardi, 2001:338).

Organisational learning is based on three fundamental theories of behavioural organisation studies. The first theory suggests that the sources of an organisation's behaviours are routines. (Cyert & March, 1963). In theory, organisations take into account legitimacy rather than outputs while taking action. The second theory suggests that organisational actions depend on history, and routines are based more on the interpretations of the past than on expectations about the future (Lindblom 1959; Steinbruner, 1974). The third theory suggests that organisations are target-oriented (Simon, 1955). Behaviours depend on the relationship between the results they observe and the interpretations they have of such results.

Four contextual factors identify organisational learning: "structure, culture, strategy and environment". The environment is the only factor considered in the study. If organisations' internal or external environment is too complicated and dynamic, overloading will occur, and learning will not take place (Lawrence & Dyer, 1983). Hedberg (1981:5) suggests that learning requires both 'change' and 'stability' within the context of the relationship between learners and their environment. Too much stability within an organisation does not create incentives for change, instead of making organisations dysfunctional, and too much change and turbulence in the environment makes it difficult for learners to define their environment (March & Olsen, 1975). In conclusion, a certain amount of stress is essential for learning to take place (Cangelosi & Dill, 1965). Level of stress and degree of uncertainty determine the effectiveness of learning conditions.

In recent years, organisations have been willing to cooperate both within the organisational structure and with other organisations in order to adapt to environmental changes. In order to keep up with the changes, the most essential element is to create systems that will enable organisations' learning abilities to reach from individuals to the organisational level (Özgen, Kılıç & Karademir 2013:176; Klimecki & Lassleben, 1999:2).

Various definitions of organisational learning reveal the various features of the concept, including the process of correcting errors by detecting them (Argris, 1977:116), a learning process where organisations make inferences from past experiences (Levitt & March, 1988:319), increasing the capacity and limits of the activities required to achieve a certain level of understanding across the organisation (Amy, 2008:212), the adaptation of people in the organisation to changes and developments within and outside the organisation in order to detect and correct errors (Koçoğlu, İmamoğlu & İnce, 2011: 74).

Organisational learning can be defined as a process starting from individual learning, continuing with group learning by transferring their experience and knowledge through their interaction with the other people in the group, and proceeding with the propagation of the new knowledge and methods on to the entire organisation through the interaction of groups with one another. At the same time, organisational learning is influenced by hierarchical organisational structure and the power relations, formal systems, and processes in the organisation (Easterby, 1990:25).

According to Argyris (1999:68), single-loop learning takes place in the organisations or the people in the organisation when a problem that occurs in the organisation is desired to be solved with the existing policies and past experiences without getting to the root of the problem. Double-loop learning suggests identifying emerging mistakes and coming up with creative and novel ideas by going beyond single-loop learning (Morgan, 2007:87). It is of strategic importance for the organisation as this learning is long term (Argyris, 1999:68). Similarly, this learning leads to evolutionary changes in the operational behaviour patterns that constitute organisational actions (Malay, 2000:205).

Life-wide learning reflects how the organisation learns, the determination to continue the learning process and the learning capacity. Individuals at this level of learning develop new learning methods by learning the factors that make learning more comfortable and more complicated (Kutaniş, 2002:269). The objective is to understand the learning process, which is essential in addition to learning certain things.

2.2. Chaos Theory

Chaos in everyday language is often used to describe turmoil and disorder. In the oxford dictionary, it is defined as a state of complete confusion and lack of order. In scientific terms, it is referred to as the structure of order within disorder. It states that a complex, variable, and non-linear structure occurs within chaos and disorder.

Chaos was first used scientifically by the French philosopher Henry Poincare in a study of the stability of a complex system during his studies of astronomy (Pamuk, 2013:78). In his study "Science and Methods", Poincare states that highly varying structures do not have permanent solution methods and their solutions will turn a dynamic situation that can last infinitely, so forecasting becomes impossible in systems (Latif, 2002:126). Another reason why chaos is so essential is that it allows us to improve our ability to understand and forecast inconsistent balances and thereby cope with the same (Smith, 2014:16).

Although J. Henri Poincare was accepted as the creator of the concept and theory of chaos, Edward Lorenz, professor of meteorology at the Massachusetts Institute of Technology, made the most critical contribution to chaos theory in 1960. Lorenz found that a reliable and accurate weather forecast cannot exceed a particular time due to its chaotic actions and therefore it is not possible to forecast in systems with dynamic movements (Öge, 2005:287).

Evidence of chaos in the social sciences emerged at the end of the 1980s and has survived to the present day. Mathematical models that produce chaotic behaviours in physics and biology and some of the models used in social behaviour research have strong similarities (Gregersen & Sailer, 1993:779). Chaos stands out from other theories by providing an essential theoretical basis for the social sciences. As a result, chaos provides significant support to social sciences, as it deals with a complex system entirely not only by looking at its structures but also by considering its relations with other structures (Yeşilorman, 2006:81).

This study reviewed the organisations in their chaotic environment and evaluated them according to chaos theory. They exist in a chaotic structure among the forces that push organisations to determination and instability (Thietart & Forgues,

1995:19-31). As such, they reveal the characteristics of the chaotic systems of organisations. The interaction of the components of the system creates chaos (Cilliers, 1998:139-142).

2.3. Demand/Forecast Management

All technologies, strategies, and processes that shape working with internal and external resources are within the scope of supply chain management. Demand management is the ability of businesses to accurately and realistically forecast customer demands (Bıçakçı & Üreten 2017:368). The ability of enterprises that understand customer demand to balance this demand with supply chain capacity forms demand management (Lambert and Cooper 2000:73). Businesses that makes over production may have overstocked. As a result they may be forced to sell under market prices. Well-implemented demand management is a critical factor in providing customer satisfaction and increasing customer satisfaction rates (Rexhausen, Pibernik and Kaiser, 2012:271).

Forecasting methodologies are grouped quantitatively and qualitatively. Quantitative forecasting methodologies systematically draw the steps to be followed and to be applied repeatedly to obtain forecasts under several conditions. Quantitative methods are divided into the following two: time series techniques, and causal or regression techniques (Makridakis & Wheelright 1977:25).

Regression analysis is used to examine the relationship between multiple variables. If the relationship is between two variables, it is a simple regression analysis, and analysis between more than two variables is called multiple regression analysis. While the relationship between this number of variables is determined numerically, the relationship between two variables can occur linearly or non-linearly (Karabulut & Şeker 2018:1058-1059). A reliable regression coefficient with a sufficient level and thus amount of explanatory power can provide reliable forecasts. The regularity and continuity of historical data positively affect the outcome of the forecast (Ballot, 1986:165).

Qualitative methods rely heavily on intuitive feelings and do not have systematic procedures making them transferable and straightforward for others to

implement (Makridakis & Wheelright 1977:25). The three most important advantages of qualitative methods are that important people take them under consideration, they need as little formal data as possible, and they ensure that the forecasting process is created by transferring the thoughts of experienced people to the forecasting process in cases where past data is not yet available, such as new product presentations. At the same time, these experts may need to devote a considerable amount of time to the forecasting process (Mentzer & Bienstock 1997:12).

The company's sales teams are a vital part of the subjective forecasting as they are in constant and direct contact with the customer and also closely monitor the changes in the market (Wilson & Keating 2001:11). It was seen that the managers of the companies within the scope of the research performed their forecasts intuitively with qualitative methods. The salespeople need to predict what the demand will be in their region. Forecasts are generated by evaluating the conditions determined by the sales teams in their former forecasts. Then, a total forecast is created by aggregating such data (Heizer & Render 2001:124).

3. METHOD

3.1. Objective and Significance of the Study

The aim of the study is firstly to explain the relationship between chaotic structure, organisational learning and demand forecasting, secondly to understand the role of chaotic structure on the relationship between organisational learning and demand forecasting. To this end, data from an enterprise operating in the Food Industry in Turkey were analysed.

When organisational learning theory is considered in the context of the relationship between the organisation and the environment, it is said that learning cannot be done in situations where the setting is very complicated. However, chaos theory states that the future is unpredictable. The research is based on the discourse that the chaotic structure mentioned in these two theories, the relationship between organisational learning and forecasting variables, and the setting moderate the relationship between learning and forecasting variables. In this regard, this study makes both a theoretical and practical contribution to the literature. The originality

and importance of the study lie primarily in its determination of the effect of chaotic structure on organisational variables at the practical level, and secondly to explain the relationship between the forecasting variable and the learning variable.

3.2. Hypotheses of Study

When the findings of the concepts in the literature are reviewed, it can be summarised that organisational learning and prediction forecasting are determinant variables for sustaining organisations' lives, and organisations need to survive in a chaotic structure. The following hypotheses were developed according to the theoretical discourses of organisational learning, demand forecast and chaotic structure variables.

The literature review indicates that the existence of organisational learning enables organisations and employees to perceive the environment better, to understand environmental changes more efficiently, and to correct mistakes in a shorter time. One of the research variables, the demand forecast quality is a forecast about a future that includes routine and non-routine behaviours against changes in the environment. Forecasting is also closely related to environment and routine and non-routine behaviours of customers. So, concluding a positive relationship between organisational learning and forecasting, hypothes1 is derived.

H_1: *There is a significant positive relationship between organisational learning and demand forecasting.*

It has been emphasised that the prediction is almost impossible in highly variable systems. The most distinctive feature of chaotic structures is that, as can be seen from the theory, small changes will have significant consequences, making predictions impossible. The unpredictability of the chaotic environment led us to produce the second hypothesis.

H_2: *There is a significant negative relationship between chaotic structure and demand forecasting.*

Four criteria affecting organisational learning are specified in the literature. In this study, only environmental factors were considered by them. Uncertainty, stress,

complexity and dynamism levels are determined as environmental factors affecting learning. The change in environmental conditions will affect the relationship between the learning and forecasting variables. The chaotic structure that determines the environment has enabled us to deduce the third hypothesis that it may have a regulatory effect between organisational learning and the forecasting variable.

H_3: *Chaotic structure has a moderator effect on the relationship between organisational learning and demand forecasting.*

3.3. Model

The study model is given in Figure 1. In the model, the dependent variable is the demand forecasting variable, the independent variable is organisational learning, and the moderator variable is a chaotic structure.

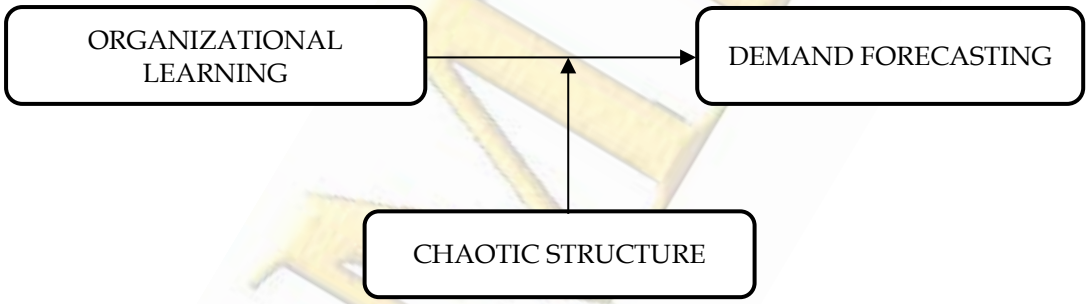

Figure 1. Study Model

3.4. Population and Sampling

The population of the study consists of the regional directorates of an enterprise operating in the food industry in Turkey with a total of 26 regional offices. Organisational learning data were obtained from 615 employees who participated in the demand forecasting process in the regions, and chaotic structure and demand forecasting data were obtained from the 2017 data of the 26 regions.

3.5. Methodology and Data Collection Tools

The study was designed with objectivist methodological assumptions and used relational and causal screening methods, in an attempt to reveal the relationships between organisational learning and chaotic structure variables and the demand

forecasting variable of the organisation. Besides, the moderator role of the chaotic structure between the other two variables was examined. In this context, the research can be considered causal research.

The analysis level of the research is the multiple analysis levels. The data used in the research were collected from individuals at the micro-level, and chaotic level and forecasting data from organisations at the meso analysis level. The data of demand forecasting and chaotic structure were obtained from business resources, and organisational learning data were obtained through questionnaires. Since all data about the individuals and the organization were collected in 2019, the ethics committee permission was not obtained.

The Dimensions of the Learning Organization Questionnaire (DLOQ) developed by Watkins and Marsick (1997:4) and adapted to Turkish by Basım, Korkmazyürek and Şeşen (2007:369) was used as an organisational learning scale and consisted of 60 statements. In this study, only 43 statements of dimensions of the learning organisation questionnaire aiming to measure individual, group, and organisational learning were used.

Chaotic Structure is composed of the following sub-parts.

i. Number of active customers is the part where the number of customers actively worked in the areas of responsibility served by the regional directorates.

ii. Number of passive customers is the number of customers that are in the area of responsibility of the regional directorates, but not served by such directorates, which means the competitors serve the customers.

iii. Number of rainy days: Includes the number of rainy days in the regions.

iv. Population covers the total population density in the areas served by the regional directorates. The chaotic structure level of the regions defined is presented in Figure 2.

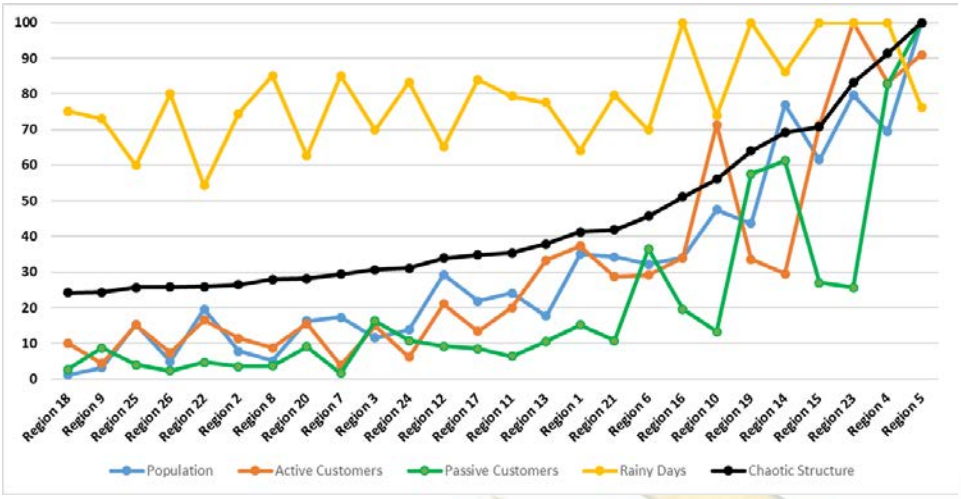

Figure 2. Population Forming Chaotic Structure, Number of Active and Passive Customers, and Rainy Days Based on Regions

4. FINDINGS

The demographics of the 26 participants from regional directorates are given in Table 1.

Table 1. Demographics of Respondents

Demographics of Respondents	Categories of Variables	Distribution of Frequency	Distribution of Percentage (%)
Gender	Male	554	90,38
	Female	59	9,62
Age	0-25 years	17	2,77
	Over 25 years-30 years	103	16,80
	Over 30 years-35 years	154	25,12
	Over 35 years-40 years	143	23,33
	Over 40 years-45 years	134	21,86
	Over 45 years	62	10,11
Educational Background	High School Graduate	420	68,52
	Two-year degree	64	10,44
	Bachelor's degree	126	20,55
	Master's Degree	3	0,49
Department Studied	Sales	576	93,96
	Sales Finance	37	6,04
Experience in the Industry	0-5 years	84	13,70
	Over 5 years-10 years	194	31,65
	Over 10 years-15 years	185	30,18
	Over 15 years-20 years	106	17,29
	Over 20 years	44	7,18
Term of Employment in the Business	0-5 years	270	44,05
	Over 5 years-10 years	213	34,75
	Over 10 years-15 years	93	15,17
	Over 15 years	37	6,04

4.1. Relation of Organizational Learning with Demographic Variables

4.1.1. Gender

The normality test was used to determine whether the data on organisational learning level met the assumption of normal distribution in gender subgroups. The

Kolmogorov-Smirnov normality test showed that the data were not normally distributed (p <.05). Non-parametric tests analysed the differences in subgroups.

According to the findings obtained, there is no significant difference in the sub-dimensions of Supportive Systems (Z=-1,441, p<,05), Supportive Leadership (Z=-,096 p<,05), Learning as a Team (Z=-1,441, p<,05), Research (Z= -,863), p<.05), and Dialogue (Z=-1,349, p<.05). Continuous Learning (Z = -1,441, p <, 05), Empowered Employees (Z = -2,385, p <, 05), and Organizational Learning (Z = -1,971, p <, 05) dimensions showed significant differences between men and women. Average mean values indicate that men have relatively higher learning levels than women.

4.1.2. Department

The normality test was used to determine whether the data on organisational learning level met the assumption of normal distribution in the employed department subgroups. The results of the Kolmogorov-Smirnov normality test given in Table 7.7 showed that the data were not normally distributed (p <.05). Non-parametric tests analysed differences in subgroups.

According to the results of Mann-Whitney U Test applied to discover whether the learning levels of the employees differ according to the department, there is no significant difference in the sub-dimensions of Supportive Systems (Z=-,821, p<,05), Supportive Leadership (Z=-,124 p<,05), Continuous Learning (Z=0,28, p<, 05), Team Learning (Z=-, 923, p<,05), Research (Z=-, 843, p<,05), Dialogue (Z=-,414, p<,05), Empowered Employees (Z=-1,116, p<,05)), and Organizational Learning (Z= -,714, p<,05). Additionally, it can be seen that the sales department has relatively higher learning levels than the finance department in terms of sequential average values.

4.1.3. Educational Background

The normality test was used to determine whether the data on organisational learning level met the assumption of normal distribution in the educational level subgroups. The results of the Kolmogorov-Smirnov normality test showed that the data were not normally distributed (p <.05). According to the results of the Mann-Whitney U Test applied to find out whether the learning levels of the employees differ according to the educational background, there is a significant difference among high

school, bachelor's degree and master's degree graduates in the sub-dimensions of Supportive Systems (Z=-,-4.955, p<,05), Supportive Leadership (Z=-,-3.418 p<,05), Continuous Learning (Z=-4,047, p<, 05), Team Learning (Z=-, -3.130, p<,05), Research (Z=-, -3.177, p<,05), Dialogue (Z=-,-2.884, p<,05), Empowered Employees (Z=-3,689, p<,05)), and Organizational Learning (Z= -,-3.101, p<,05). When the sequential average values are examined, it is seen that high school graduates have relatively higher learning levels compared to a bachelor's degree and master's degree graduates.

4.1.4. Status

The normality test was used to determine whether the data on organisational learning level provided the assumption of normal distribution in employee subgroups. The results of the Kolmogorov-Smirnov normality test given in Table 7.11 showed that the data were not normally distributed (p <.05). Non-parametric tests analysed differences in subgroups.

According to the results of the Mann-Whitney U test applied to determine whether the learning levels of the employees differ according to the employee status, there is a significant difference between the employees and the managers in the sub-dimensions of Supportive Systems (Z=-,-3.457, p<,05), Supportive Leadership (Z=-,-3.170 p<,05), Continuous Learning (Z=-3,647, p<, 05), Team Learning (Z=-, -2.308, p<,05), Research (Z=-, -2.927, p<,05), Dialogue (Z=-,-2.563, p<,05), Empowered Employees (Z=-3,695, p<,05), and Organizational Learning (Z= -,-3.466, p<,05). Average mean values indicates that the employees have relatively higher learning levels than the managers.

4.2. Reliability Analysis of Organizational Learning

Cronbach's alpha coefficient was used to measure reliability in the study. In Table 3, it can be seen that the coefficients were high and satisfactory (Cronbach Alpha> 0.70).

Table 3. Reliability Analysis of Organizational Learning

Scale	Correlation
Continuous Learning	,672
Learning as a Team	,906
Dialogue	,729
Research	,725
Empowered Employees	,837
Supportive Systems	,800
Supportive Leadership	,841
Organizational Learning	,990

4.3. Relationship between Organizational Learning, Forecasting, and Chaotic Structure

The results of the correlation analysis conducted to determine the relationships between the variables in the model are given in Table 4.

Table 4. Correlation Analysis Table for the Relationship between Organizational Learning Sub-Levels, Forecasting, and Chaotic Structure

			Demand Forecasting	Continuous Learning	Learning As a Team	Research	Dialogue	Empowered Employees	Supportive Systems	Supportive Leadership	Organizational Learning	Chaotic Structure
Spearman's rho	Demand Forecasting	Correlation Coefficient	1									
		Sig. (2-tailed)	.									
	Continuous Learning	Correlation Coefficient	,654**	1								
		Sig. (2-tailed)	0	.								
	Learning As a Team	Correlation Coefficient	,419*	,737**	1							
		Sig. (2-tailed)	0,033	0	.							
	Research	Correlation Coefficient	,412*	,803**	,901**	1						
		Sig. (2-tailed)	0,037	0	0	.						
	Dialogue	Correlation Coefficient	,578**	,850**	,832**	,903**	1					
		Sig. (2-tailed)	0,002	0	0	0	.					
	Empowered Employees	Correlation Coefficient	,536**	,699**	,787**	,735**	,753**	1				
		Sig. (2-tailed)	0,005	0	0	0	0	.				
	Supportive Systems	Correlation Coefficient	,450*	,778**	,946**	,878**	,860**	,766**	1			
		Sig. (2-tailed)	0,021	0	0	0	0	0	.			
	Supportive Leadership	Correlation Coefficient	,534**	,802**	,853**	,788**	,756**	,822**	,883**	1		
		Sig. (2-tailed)	0,005	0	0	0	0	0	0	.		
	Organizational Learning	Correlation Coefficient	,489*	,828**	,951**	,912**	,887**	,794**	,952**	,857**	1	
		Sig. (2-tailed)	0,011	0	0	0	0	0	0	0	.	
	Chaotic Structure	Correlation Coefficient	-,826**	-,722**	-,476*	-,451*	-,570**	-,515**	-,552**	-,645**	-,521**	1
		Sig. (2-tailed)	0	0	0,014	0,021	0,002	0,007	0,003	0	0,006	.

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

*. Correlation is significant at the 0.05 level (2-tailed).

According to the results of the correlation analysis, demand forecasting has a significant and positive relation with the following sub-dimensions of organizational learning: learning as a team (r=,419; p<0.05), supportive leadership (r=,450; p<0.05), continuous learning (r=,654); p<0.05), empowered employees (r=,536; p<0.05), research (r=,412; p<0.05), dialogue (r=,578; p<0.05), and supportive systems (r=,450; p<0.05). Demand forecasting has a significant and inverse relation with chaotic structure. Demand forecasting has a significant and inverse relation with the following sub-dimensions of organizational learning: learning as a team (r=,476; p<0.05), supportive leadership (r=,645; p<0.05), continuous learning (r=,722; p<0.05), empowered employees (r=,515; p<0.05), research (r=,451; p<0.05), dialogue (r=,570;

p<0.05) and supportive systems (r=,552; p<0.05).

4.4. The Effect of Organizational Learning and Chaotic Structure on Forecasting

Hierarchical regression analysis was performed to see how much of the observed change in the dependent variable of demand forecasting is explained by the independent variables of organisational learning and the chaotic structure and to identify whether such an explanation is significant and what the level of significance is.

Table 5. Hierarchical Regression Analysis Results

Model		B	Standard Error	Beta	t	Significance	Collinearity		R	R^2
							Tolerance	VIF		
1	(Constant)	32,346	3,272		9,886	,000				
	Zscore (Learning)	11,025	3,337	,559	3,304	,003	1,000	1,000	,559	,313
2	(Constant)	32,346	2,503		12,923	,000				
	Zscore (Learning)	,203	3,608	,010	,056	,956	,500	1,998	,784	,615
	Zscore (Chaotic Structure) Interactional	-15,312	3,608	-,777	-4,244	,000	,500	1,998		

a. Dependent variable: Forecast

Table 5 There is a summary of the two models that make up the hierarchical regression model. Model-1 covers the organisational learning variable, and Model-2 covers the interactional chaotic structure variable, which was regressed with the first group. The organisational learning variable entered in the first model explains 31.3% of the change in the forecasting variable. However, it explains 61.5% of the change by including the interactive chaotic structure variable in the second model. Accordingly, the chaotic interactive structure explains the variance in the forecasting variable by 30.2%. It is observed that the effect of the organisational learning variable entered in the first group has a significant impact on forecasting (β =, 559; p =, 003) and the impact

of the interactive chaotic structure variable entered in the second group is significant (β= -,777 p < ,001).

VIF and tolerance values were compared with the critical values to determine whether collinearity existed between organisational learning and chaotic structure. Critical value is 1-R2 = 1- ,313 = 0,687. Tolerance value (1,00) is higher than the critical value. When the same process is applied to the second model, the critical value is 1-R2 = 1- ,615 = 0,385. Tolerance value (1,00) is higher than the critical value. No collinearity problem was observed in either the first or second model.

These results indicate that the chaotic structure variable has a possible moderator effect on the relationship between organisational learning and forecasting variables. IBM SPSS Process was used to visualise the moderator effect. The moderator role of the chaos variable is shown graphically in Figure 3.

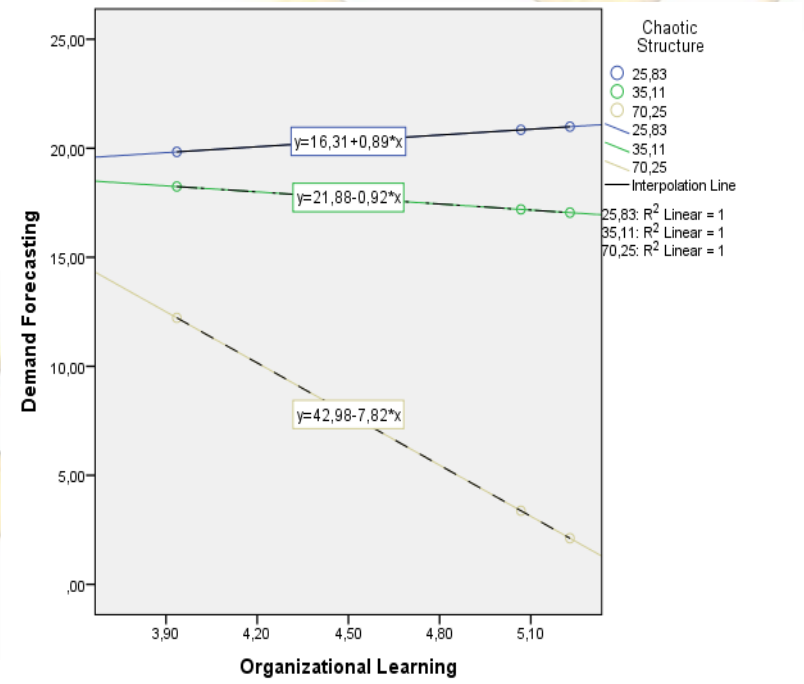

Figure 3. Scatter Diagram of the Model of Moderator Effect of Chaotic Structure on the Relationship between Forecasting and Organizational Learning

Incremental chaotic structure with three levels is defined in the model. As the chaos level increases, the forecasting variable decreases at the same learning level. The moderator variable can affect the relationship at the dependent and independent level in two directions, 'decreasing' and 'opposite direction'. As seen in Figure 3, it is seen

that the moderator effect of the chaos variable occurs in the opposite direction at high values. In other words, as the moderator variable takes increasing values, it has reversed the effect of organisational learning on demand forecasting.

5. CONCLUSION, DISCUSSION, AND SUGGESTIONS

The study aims to explain the relationship between chaotic structure, organisational learning, and demand forecasting, and to understand the impact of chaotic structure on the relationship between organisational learning and demand forecasting. The study also investigates the moderator impact of the chaotic structure on the impact of organisational learning on demand forecasting.

It was examined whether the variables considered in the study differed from the demographic variables. In this context, a significant difference was found between gender and organisational learning. According to the results of the analysis, it is seen that the men in the study have higher levels of learning in terms of learning as a team, supportive leadership, continuous learning, empowered employees, research, dialogue, supportive systems, and organisational learning level when compared to the women. Similarly, organisational learning was found to be associated with variables at the individual and organisational level in the literature. Uru (2009:244-260) found that women's expectations of research and transfer-effort performance and the performance self-efficacy levels of organisational learning were higher than that of men and supportive of leadership, continuous learning, research levels, and intrinsic motivation of the employees (compelling and enjoyment of work, self-expression, and satisfaction) increased with organisational learning. The finding that males have more organisational learning levels than females were found to be opposite to the findings of Ürü (2009) in terms of the direction of the relationship. Besides, there was no significant difference between men and women in terms of organisational learning capacity. Its sub-dimensions, however, of experience, interaction with the external environment, dialogue, participatory decision-making averages, and the differences in organisational learning capacity between men and women were significant based on the educational level.

A significant difference was found between the educational level of the participants and organisational learning. When the results are examined, it is seen that high school graduates have relatively higher learning levels compared to a bachelor's degree and master's degree graduates. Keçeli (2018) states that there is a significant difference in organisational learning capacity between master's degree graduates and PhD graduates, and as the level of education increases, organisational learning capacity increases. However, the learning level of high school graduates was higher than the undergraduate and master's degree graduates in this research. Therefore, it was evaluated that contextual factors should be investigated about education and organisational learning level.

A significant difference was found between the status of the participants and organisational learning. It seems that the employees have relatively higher learning levels than the managers. A significant difference was not found between the departments of the participants and organisational learning. The sales department has relatively higher learning levels than the finance department. From the definitions of learning, it can be said that people learn new skills and knowledge as a result of the interactions they have with their environment, so individuals who interact more frequently with the environment will more often acquire new skills and knowledge from their environment. It is suggested that this could be explained by the fact that employees have more interaction with their environment compared to their managers and the associates in the sales department have more interaction with their environment compared to the associates in the finance department.

When the research hypotheses are examined, the findings show that all three hypotheses are supported. Findings indicates that organisations should attach importance to organisational learning processes in order to improve their performances and stay in constant interaction with the environment while doing so. Also, organisational learning is the state of adapting to changes and developments occurring in and around the organisation.

Regarding the first hypothesis, it is observed that an accurate and realistic demand forecasting can only be achieved by reaching the level of a learning

organisation and there is a strong positive relationship between organisational learning level and demand forecasting since demand forecasting is a dynamic process affected by changes and developments in the business environment. Biçkes (2011) examined the effect of organisational learning and innovation on business performance and found a significant and positive relationship between organisational learning and innovation types. According to these findings, he stated that as the organisational learning levels of the companies increased, the performance of the companies would increase (Biçkes, 2011:267-273).

Keçeli (2018:208-224) examined the effect of organisational learning on work performance. He found that organisational learning is a factor that positively affects many performance types in general and that it affects innovative performance, organisational performance, adaptive performance, and business performance positively. Mert (2017:180-202) concluded that there is a positive relationship between variables in the study of the relationship between organisational emotional memory and organisational learning and business innovation, and these results increase business performance. This finding shows similarity with many empirical study findings such as Di Milia and Birdi (2010), Jimenez-Jimenez and Cegarra-Navarro (2007), Garcia-Morales, Llorens-Montes and Verdú-Jover (2006) and Khandekar and Sharma (2006), Therin (2002), and Yeo (2003). Based on these findings, it can be stated that businesses can reach their targets more easily as their organisational learning levels increase.

For the second hypothesis of the research, it was determined that there is a significant and inverse relationship between chaotic structure and demand forecasting. An excess of the number of elements constituting the structure, meaning the size of the chaotic structure, decreased the forecasting level. Alpar (2012:151-152) observed chaos in the Istanbul Stock Exchange index change data. He found that only three days ahead could be forecast with time series analysis methods. In other words, fourth closure data cannot be forecast consecutively with the known analysis methods. In light of this information, the research findings are supported by the fact that chaos exists in forecasting, which is a business practice. It has been observed that the forecasting performance of the business is negatively affected by the presence of

chaotic structure. Therefore the capability of forecasting decreases with increasing chaotic conditions.

Findings of the third hypothesis increase the originality value of the research.As a result of this analysis, the moderator effect of organisational learning on the relationship between chaotic structure and demand forecasting was observed. Considering the moderator role analysis, the increase in the chaos level first decreases the relationship between these two variables, and the higher chaotic structure reverses the relationship. In other words, the increase in the level of learning in highly chaotic conditions does not improve the level of the forecasting, and the relationship turns negative. The finding that prediction does not occur in chaotic environments coincides with the claims of the new science: Future is unpredictable. Because, the new science considers chaotic systems as non-linear systems (Yaşar & Sundu, 2017). Actions have only one outcome in linear systems, whereas there are many outcomes in non-linear systems and linear systems can be seen as the sum of their parts, whereas non-linear systems envisaged by chaotic environments are greater than the sum of their parts. Therefore, it is not possible to describe a non-linear system by dividing it into its parts with a reductive method. As stated in the properties of chaos theory, non-linear feedback is sensitive to initial conditions, and the causal relationship disappears within the complexity of the interaction. Therefore, chaotic environments are considered unpredictable structures (Yaşar & Sundu, 2017:5-6). He argues that short-term (deterministic) future forecasts can be made since a system consists of random and deterministic elements, but long-term (random) forecasts should be avoided (Mutlu & Sakınç, 2006:12-13). As pointed out by Zohar (2018:92), quantum and chaotic systems are advanced in uncertainty and variability compared to classical Newtonian systems. If we consider that today's business environment is dominated by chaos, constant change and uncertainty, we see the need for cultures and companies that develop on these concepts. The finding of the third hypothesis also empirically supports the primary discourse of organisational learning theory. According to the theory, overloading will occur, and learning will not take place if organisations' internal or external environment is too complicated and dynamic. In light of these findings, the following recommendations are made for organisations and researchers.

6. RECOMMENDATIONS

6.1. Recommendations for Organisations

Organisations have to create an organisational model that is consistent with chaos theory in order to forecast and manage customer demands.

To build a learning organisation, managers need to support learning and establish an environment that can make it permanent. For this, there is a need for empowered employees who perform research and who are in dialogue with one another. It can be said that organisations have to allow self-complex structures to use human capital more effectively.

In order to increase creativity in chaotic environments, the ability to cope with uncertainty needs to be improved (Zohar, 2018). Therefore, it is clear that the infrastructures and strategies of the organisations should be designed in such a way as to allow ambiguity and uncertainty.

It is assumed that the critical part of the components that make up systems is firstly quantity and secondly quality. In the new science, the critical thing is connective integrity (Kılıç 2019). All of the current management thinking is directed towards network or data-based organisations. Knowledge is always contextual, and the larger the context in which information is used, the more significant it becomes (Zohar 2018, p. 100-101). Therefore, only free communication between organisations with their broader political, economic, and social environments will improve their learning levels.

6.2. Recommendations for Researchers

It can provide researchers with some guiding findings for studies to be carried out in other sectors and on different samples. Findings to be obtained as a result of the studies to be conducted in the said sectors and samples, and the knowledge accumulation that will be formed can contribute to the conclusions that can be generalised. Recommendations made for the researchers during and as a result of the study are presented below.

Various studies can be conducted on the premises and results of organisational learning, chaotic structure and firm prediction performance, which are not addressed in this study, and the relationships between these variables.

Four factors affecting organisational learning have been identified in the literature. Of these, only the environmental factor is considered as a variable. Studies dealing with the other three factors, organisational structure, culture and strategy, can provide a holistic structure for literature.

Besides, the size of the organisation is considered as a variable that can affect this research model. Similar studies may be repeated on different size of organisations.

Within the framework of the chaotic structure, similar studies can be conducted as different performance indicators of companies such as financial and customer satisfaction as prediction variables.

BMIJ

REFERENCES

Alpar, O., (2012). Kaos teorisi ve kaotik işletme uygulamaları Doktora Tezi. İstanbul: İstanbul Üniversitesi SBE.

Amy, A. H., (2008). Leaders as facilitators of individual and organisational learning. *Leadership & Organization Development Journal,* 29(3), pand 212-234.

Argyris, C., (1977). Double loop learning in organisations. *Harvard Business Review*, 55(5), pp. 115-125.

Ballot, M., (1986). Decision making model in production & operations. Florida: Robert E. Krieger Publishing Company.

Basım, H. N., Sesen, H. & Korkmazyürek, H., (2007). A turkish translation, validity and reliability study of the dimensions of the learning organisation questionnaire. *World Applied Sciences Journal*, 2(4), pp. 368-374.

Baumol, W. J., & Benhabib, J. (1989). Chaos: significance, mechanism, and economic applications. *Journal of economic perspectives*, 3(1), 77-105.

Bıçakçı, P. S. & Üreten, S., (2017). Tedarik zinciri yönetimi uygulamalarının zincir performansı üzerindeki etkileri: bir uygulama. *Gazi Universitesi Iktisadi ve Idari Bilimler Fakultesi Dergisi,* 19(1), pp. 367-386.

Biçkes, D. M., (2011). Örgütsel öğrenme, inovasyon ve firma performansı arasındaki ilişkiler: inovasyonun aracılık etkisine yönelik büyük ölçekli işletmelerde bir araştırma Doktora Tezi. Kayseri: Erciyes Üniversitesi SBE.

Cangelosi. V. E., & Dill, W. R. (1965) Organisational learning: Observations toward a theory. *Administrative Science Quarterly*, 10, 175-203

Cilliers, P., (1998). Complexity and Postmodernism. 1 dü. London: Routledge.

Cyert, R. M., ft March, J. G. (1963) A behavioral theory of the firm. Englewood Cliffs, NJ: Prentice-Hall.

Di Milia, L., & Birdi, K. (2010). The relationship between multiple levels of learning practices and objective and subjective organisational financial performance. *Journal of Organizational Behavior*, 31(4), 481-498.

Easterby-Smith, M., (1990). Creating a learning organisation. *Personnel Review*, 19(5), pp. 24-28.

Forrester, J. W. (1987). Lessons from system dynamics modeling. *System Dynamics Review*, 3(2), 136-149.

Garcia-Morales, V. J., Llorens-Montes, F. J., & Verdú-Jover, A. J. (2006). Antecedents and consequences of organisational innovation and organisational learning in entrepreneurship. *Industrial Management & Data Systems,* 106(1), 21-42.

Grandmont, J. M. (1985). On endogenous competitive business cycles. E*conometrica: Journal of the Econometric Society,* 995-1045.

Gregersen, H. & Sailer, L., (1993). Chaos theory and ıts ımplications for social science research. *Human Relations,* 46(7), pp. 777-802.

Hedberg, B. (1981) How organisations learn and unlearn? In P. C. Nystrom ft W. H. Starbuck (Eds.), Handbook of organisational design (pp. 8-27). London: Oxford University Press.

Heizer, J. & Render, B., (2001). *Operations management*. New Jersey: Prentice Hall.

Jiménez-Jiménez, D., & Cegarra-Navarro, J. G. (2007). The performance effect of organizational learning and market orientation. *Industrial Marketing Management*, 36(6), 694-708.

Karabulut, R. & Şeker, K., (2018). Belirlenmiş değişkenlerin vergi gelirleri üzerindeki etkisi: çoklu doğrusal regresyon analizi. *Suleyman Demirel University Journal of Faculty of Economics & Administrative Sciences,* 23(3), p. 1049–1070.

Keçeli, S., 2018. Çalışan perspektifinden örgütsel öğrenme yeteneğinin görev ve bağlamsal performansa etkisi: sağlık sektöründe bir uygulama Doktora Tezi. İstanbul: Haliç Üniversitesi: SBE.

Khandekar, A., & Sharma, A. (2006). Organisational learning and performance: Understanding Indian scenario in present global context. *Education+ Training*, 48(8/9), 682-692.

Kılıç T. (2019) 21.Yüzyılın Bağlantısal Bütünsellik Bilimi: https://www.youtube.com/watch?v= dXoWXzK2iec Son Erişim Tarihi:09.09.2019.

Klimecki, R. & Lassleben, H., (1999). What causes organisations to learn. Lancaster University, Lancaster, 3rd International Conference on Organizational Learning, p. Lancaster University.

Kutaniş, R. Ö. (2002). Öğrenen organizasyonlar. Stratejik Boyutuyla Modern Yönetim Yaklaşımları, 258-282.

Lawrence, P. R., ft Dyer, D. (1983) Renewing American industry. New York: Free Press.

Lambert, D. M. & Cooper, M. C., (2000). Issues in supply chain management. *Industrial Marketing Management,* 29(1), p. 65–83.

Latif, H., (2002). Kaotik ortamda yönetim, Stratrjik Boyutuyla Modern Yönetim Yaklaşımları. 1 dü. İstanbul: Beta Basım-Yayım-Dağıtım.

Levitt, B. & March, J. G., (1988). Organisational learning. A*nnual review of sociology*, Cilt 14, pp. 319-340.

Lindblom, C. E. 1959. The science of muddling through. Public Admin. Rev.,1 9:79--88

March, J. G., ft Olsen, J. P. (1975) The uncertainty of the past: Organisational learning under ambiguity. *European Journal of Political Research*. 3, 147-171.

Makridakis, S. & Wheelwright, S. C. (1977). Forecasting: ıssues & challenges for marketing management. *Journal of Marketing*, 41(4), pp. 24-38.

Mentzer, J. T. & Bienstock, C. C. (1997). Sales forecasting management. California: SAGE Publications.

Mert, G., (2017). Kurumsal duygusal hafıza ile örgütsel öğrenme, firma yenilikçiliği ve firma performansı arasındaki ilişkiler Doktora Tezi. İstanbul: Beykent Üniversitesi SBE.

Morgan, K. (2007). The learning region: institutions, innovation and regional renewal. *Regional studies,* 41(S1), S147-S159.

Mulholland, P., Zdrahal, Z., Domingue, J., Hatala, M., & Bernardi, A. (2001). A methodological approach to supporting organisational learning. *International Journal of Human-Computer Studies*, 55(3), 337-367.

Mutlu, A. & Sakınç, İ., (2006). Yönetimde kaos. *Journal of İstanbul Kültür University*, Cilt 3, pp. 1-12.

Öge, S., (2005). Düzen mi düzensizlik (kaos) mu örgütsel varlığın sürdürülebilirliği açısından bir değerlendirme. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 13(1), pp. 285-303.

Özgen, H., Kılıç, K. C. & Karademir, B., (2013). Öğrenmenin kurumsallaşmasında toplam kalite yönetimi yaklaşımı. *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 13(2), pp. 175-188.

Pamuk, N., (2013). Dinamik sistemlerde kaotik zaman dizilerinin tespiti. *BAÜ Fen Bil. Enst. Dergisi*, 15(1), pp. 77-91.

Rexhausen, D., Pibernik, R., & Kaiser, G. (2012). Customer-facing supply chain practices—The impact of demand and distribution management on supply chain success. *Journal of Operations Management*, 30(4), 269-281.

Saperstein, A. M., & Mayer-Kress, G. (1989). Chaos versus predictability in formulating national strategic security policy. *American Journal of Physics*, 57(3), 217-223.

Selçuk, Z., (1999). Gelişim ve öğrenme eğitim psikolojisi. Ankara: Nobel Yayın Dağıtım.

Simon, H. A. (1955) . A behavioral model of rational choice. Q. J. Econ. 69:99-118

Smith, L., 2014. Kaos. 1 dü. Ankara: Dost Kitabevi.

Steinbruner, J. D. (1974). The Cybernetic Theory of Decision. Princeton, NJ: Princeton Univ. Press

Therin, F. (2003, January). Organisational learning and innovation in high-tech small firms. In 36th Annual Hawaii International Conference on System Sciences, 2003. Proceedings of the (pp. 8-pp). IEEE.

Thietart, R. A. & Forgues, B., (1995). Chaos theory and organisation. *Organization Science*, 6(1), pp. 19-31

Ürü, F. O., (2009). Örgütsel öğrenmenin çalışan yaratıcılığına etkisi (iso 500'de yer alan demir-çelik, otomotiv ve tekstil sektörlerindeki işletmelerde bir araştırma) Doktora Tezi. İstanbul: Marmara Üniversitesi SBE

Watkins, K. E. & Marsick, V. J., (2013). Dimensions of the learning organisation questionnaire, self-scoring version. Warwick, RI: Partners for the Learning, pp. 1-20.

Wilson, J. & Keating, B., (2001). Business forecasting. 4 dü. Columbus: McGraw-Hill/Irwin.

Yaşar, O. (2016). Davranışsal karar verme, düşünme, problem çözme. Detay Yayıncılık, Ankara.

Yaşar, O. & Sundu, M., (2017). Kaotik ortamlar için karar verme model önerisi: doğal karar verme. Ankara, 25. Ulusal Yönetim ve Organizasyon Kongresi.

Yeşilorman, M., (2006). Kelebek kanadını kimden yana çırpıyor. Birleştirilmiş bilimin kıyısında kaos ve sosyal bilimler. *Journal of İstanbul Kültür University Science and Engineering*, 4(3), pp. 77-86.

Yeo, R. K. (2005). Revisiting the roots of learning organisation: A synthesis of the learning organisation literature. *The Learning Organization*, 12(4), 368-382.

Young, T. R. (1991). Chaos and social change: Metaphysics of the postmodern. *The Social Science Journal,* 28(3), 289-305.

Zohar, D., (2018). 21.Yüzyılda kuantum liderlik. 1 dü. İstanbul: The Kitap Yayınları.54-178.

BNMIJ