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Santo Banerjee
Şefika Şule Erçetin *Editors*

Chaos, Complexity and Leadership 2012

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Chaos, Complexity and Leadership 2012

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*SB: To my sister Santa Mukherjee and my
little MAMU Sumadrish*

*SSE: In memory of my parents Mübeccel
Erçetin and Yusuf Kenan Erçetin*

Preface

Leadership in all sense has been centre of debates since humankind has its own society. From simple understanding of leadership to complex leadership theories, it is both mystical and scientific issue. Literally, leadership means that “the office or position of leader” and second explanation is “capacity to lead”. It is obvious that perception and definition of leadership have been transformed and kindly evolved.

Unfortunately, the first attempt of describing of leadership in scientific way did not go back to ancient times however, there were lots of epitaph, myths and some poets, which described “leaders of their society in different names such as king, emperor and etc.” More modern times, we have much remarkable books such as *The Prince* of Machiavelli. It was more than description of their leaders; it was also giving analysis of how good leaders (prince) should be. Even *The Prince* can be considered as a handbook of leaders.

Then, we can see books, which also criticized system and leaders especially during French revolution and its age. We can say that, scientific accumulation on leadership started from generally in the beginning of nineteenth century such as types of leadership were emerged. More alternative works have risen up in 40s and 50s. From poets on Rome’s Ceasar to twenty-first century, there are new concepts are quite popular such as global leadership reveal that an intensive and long journey of leadership.

In light of this historical picture of how sources of leadership evolved show us that term of leadership is highly complex, dependent and also interdependent scientifically. In other words, notion of leadership has mutual relationship with history, geography, culture, national identity, psychology, philosophy, politics and list goes on.

This complexity makes its’ field as a unique. Our symposium represents a new feature and dynamical perspective on leadership. We bring chaos and complexity, which are mainly notion of physics and mathematics to field of leadership. It has been studied that the nonlinear tools are very effective to investigate the modern leadership ability and to control the complex/chaotic situations. The subject is much more enhanced with the nonlinear techniques and chaos theory.

Not only physics but also, we shared many distinct, unique and fruitful ideas and workings from almost 20 different countries. That's why, we are glad to represent the book of Chaos, Complexity and Leadership symposium. Through the book, you will read numerous fantastic symposium paper which enlighten "leadership" as a phenomenon.

We are very much grateful to our invited speakers for their superlative lectures.

Finally we would like to thank all the participants, guests and members associated with ICCLS2012, to make the symposium successful.

Ankara, Turkey

Ankara, Turkey

Şefika Şule Erçetin

Santo Banerjee

Contents

1	Great Illusion in Twenty-First Century-Chaos Knocking Door	1
	Şuay Nilhan Açıkalin and Şefika Şule Erçetin	
2	Chaotic Time Delay Systems and Field Programmable Gate Array Realization	9
	D. Valli, S. Banerjee, K. Ganesan, B. Muthuswamy, and C.K. Subramaniam	
3	An Adaptive Neuro-Fuzzy Inference System-Based Approach to Forecast Time Series of Chaotic Systems	17
	Utku Köse and Ahmet Arslan	
4	Design and Development of a Chaos-Based Image Encryption System	23
	Utku Köse and Ahmet Arslan	
5	Comparison of Principal Component Analysis Biplots Based on Different Robust Covariance Matrix Estimates	29
	B. Barış Alkan and Cemal Atakan	
6	Complexity and the Relationship of the State with Islam	35
	Kamilla Sheryazdanova	
7	Anadolu Agency and the New Media Order	43
	Kemal Öztürk	
8	The Role and Place of Migration and Diaspora’s Policy in Bilateral Relations Between Kazakhstan and Germany	47
	Kamilla Sheryazdanova	
9	Complex Adaptive Leadership for Performance: A Theoretical Framework	59
	Füsün Bulutlar and Rıfat Kamaşak	

10	Chaos According to Teachers Attending PhD Programs and the Chaos Management in School	67
	Elif Gamze Özcan and Hilal Zehra Uzun	
11	Chaos Approach in Educational Administration	73
	Hilal Zehra Uzun and Elif Gamze Özcan	
12	Uncertainty, Complexity and Fuzzy Logic	79
	İbrahim Özkan and I. Burhan Türkşen	
13	Primary School Principals' Crisis Management Skills	95
	İlknur Çalıřkan Maya	
14	Evaluation of Post-Graduate Students' Perceptions of Transformational Leadership According to Some Variables	103
	Fırat Kıyas Birel and Meltem Yalın Uçar	
15	Evaluating Market Basket Data with Formal Concept Analysis	113
	Alp Üstündağ and Mert Bal	
16	Managing on the Edge of Chaos	119
	Ali Balcı	
17	Controlling Chaotic Behavior of the Stepper Motor Using Genetic Algorithms	131
	Yosra Miladi, Hanene Medhaffar, Moez Feki, and Nabil Derbel	
18	Robust Chaos Synchronization for Chua's Circuits via Active Sliding Mode Control	141
	Olfa Boubaker and Rachid Dhifaoui	
19	A Modeling Approach Based on Fuzzy Least Squares Method for Multi-Response Experiments with Replicated Measures	153
	Özlem Türkşen and Ayşen Apaydın	
20	Chaos, Complexity and Police Leadership	159
	Ramazan Terkeşli	
21	Ideas on Municipalities, Chaos Theory and Transformational Leadership	165
	Recep Bozlağın	
22	IDEAS The Modelling Technique Based on Neuro-Fuzzy Structure for Chaotic Rossler System	177
	Remzi Tuntaş	
23	Leading Diversified Workforce to Improve Organizational Network Effectiveness	183
	Pınar Büyükbalcı, Yasemin Bal, Esin Ertemsir, and Sevgin Batuk Turan	

24 Charismatic Leadership, Ethics and Effectiveness in Political Science	193
Zakir Gül	
25 GARCH Type Volatility Models Augmented with News Intensity Data	199
Sergei P. Sidorov, Paresh Date, and Vladimir Balash	
26 A General Outlook to the Transformational Leadership Practices of School Administrators in Turkey in the Light of Present Research Findings	209
Tuğba Turabik	
27 Avoidance Behaviors of School Managers in Uncertain and Chaotic Environments	219
Nilay Neyiřci and Nihan Potas	
28 New Leadership Paradigms in the Complexity Science	229
Nilay Neyiřci and Nihan Potas	
29 Chaotic Conditions That Postgraduate Students Came Across and Solution Suggestions	235
Nedim Özdemir, Selçuk Turan, and Ahmet Yirmibeř	
30 Survival of the Fittest: Intelligent Organizations as Intelligent Complex Adaptive Systems	241
Esen Arzu Kayman and řefika řule Erçetin	
31 How to Be a Quantum Leader in an Intelligent Organization?	247
řefika řule Erçetin and Esen Arzu Kayman	
32 Forming Educational Leadership Standards in Turkey and Educational Leadership Policy Standards: ISLLC 2008	253
Tuncay Akçadağ and Melek Kaymaz Mert	
33 The Importance of School Administrators' Cultural Leadership in Chaos Atmosphere	259
Mehmet Teyfur and Esin Acar	
34 Is Arab Spring a Complex Utopia?	267
K. Gediz Akdeniz	
35 Compulsory and Discontinuous Education as a New Model: 4+4+4 Is It Chaotic?	271
Kenan İli	
36 A Simulation Study Goodness-of-Fit Tests for the Skewed Normal Distribution	277
Emre E. Sarısoy, Nihan Potas, and Mahmut Kara	
37 A Chaotic Fact: 2011 Van Earthquake-Evaluation of Pedegogs	285
Mehmet Menteře	

38 Searching for New Model in Education Systems: Sample of Turkey	289
Seval Koçak	
39 Sustainability of Economic System in the Chaos	299
Anna Firsova, Olga Balash, and Vladimir Nosov	
40 Economic Systems: From Chaos to Order	305
Olga Yu. Chelnokova, Olga V. Senokosova, and Olga A. Shlyakova	
41 The Development of the Local Economic System in the Conditions of Predominant Power Economy	315
Elena Ogurtsova	
42 Would the Organizational Commitment and Occupational Burnout Perceptions of Firm Owner's with 10 –49 Employees Be High at the Same Time? Why Not? (Example of Ankara)	327
Sabri Çelik	
43 Ethics and Leadership	333
Nursel Yardibi	
44 Situational Leadership in Change Management for Different Generations	339
Buket Aksu	
45 Chaos Against Leadership in the Seljuks Era: The Case of Isfahan	355
Nurullah Yazar	
46 The Contribution of Religious Teaching to the Development of Leadership Skills	361
Tuğrul Yürük	
47 Atmospheric Tracers and the Monsoon System: Lessons Learnt from the 1991 Kuwait Oil Well Fires	371
Peter Carl	
48 Fuzzy Generalized Fractal Dimensions for Chaotic Waveforms	411
R. Uthayakumar and D. Easwaramoorthy	
49 Nonlinear Forced Convective Hydromagnetic Flow of Unsteady Biomagnetic Fluid Over a Wedge with Convective Surface Condition	423
M.M. Rahman and M.A. Sattar	
50 Advancements on Authentication Methods for Transfer of Stream Data via Chaos Synchronization Techniques	453
M.R.K. Ariffin and Z. Mahad	

51 Efficient Implementation Baptista Type Chaotic Cryptosystem with Encoding Scheme 461
 Z. Mahad, M.R.K. Ariffin, and M.A. Daud

52 Measuring Perceptual Reflections of Employees for Their Executives Intellectual Traits That Effecting Quality of Work Life of Employees and Organizational Change 471
 Seyfi Top, Ercan Öge, Serkan Dilek, and Özlem Atan

53 Relationship Between the Attitudes of Undergraduate Students Towards Complex Numbers and Misconceptions 487
 Vildan Keçeli and Necla Turanlı

54 Turkish Version of the Career Adapt-Abilities Scale (CAAS): The Validity and Reliability Study 499
 Ahmet Akın, Çınar Kaya, Serhat Arslan, Taner Demir, Hakan Sarıçam, and Recep Uysal

55 Reflections of Syrian Chaos to Turkey: A Geopolitical Analysis 507
 Nurettin Özgen

56 Leaders, Followers and Their Personalities 519
 Burcu Erentuğ and Mehmet Ali Hamedoğlu

57 Determination of Leadership Behaviors of Mayors Who Have Been Elected with Local Election According to the Opinions of Employees 533
 Fuat Uzun

58 Dystopian Future View as a Narrative of Inherent Entropy of Organizations 539
 Ulaş Çakar and Ozan Nadir Alakavuklar

59 The Turkish Version of the Career Futures Inventory-Revised: The Validity and Reliability Study 545
 Mehmet Ali Hamedoğlu, Ahmet Akin, Serhat Arslan, Çınar Kaya, Taner Demir, Recep Uysal, and Hakan Sarıçam

60 The Importance of Building Leadership Skills with the Contemporary Youth 551
 Kadisha Shalgynbayeva

61 Chaotic Politics, Chaotic Relationships 557
 Mina Abbasiyannejad and Rosli Talif

62 Dynamical Motion Capture System Involving via Neural Networks 563
 Eva Volná, Robert Jarušek, Martin Kotyrba, and Daniel Rucký

Chapter 1

Great Illusion in Twenty-First Century-Chaos Knocking Door

Şuay Nilhan Açıkalin and Şefika Şule Erçetin

1.1 The Great Illusion

Understanding the basic assumptions of Norman Angell is vital. As we mentioned above, in his time, the book became bestseller however, book became much more popular few years later because of its failed assumption and devastating WW1. In this first chapter we are going to summarize what Norman Angell's book covered assumptions and its reflections on some other theorists and scholars.

First of all, it is obvious that Great Illusion was a definitely product of liberalism and anti-war sentiments. Although, he got so much criticism after two world wars, he can be considered as a pioneer of theorists of interdependence theory. His effort on developing such an interdependency theory mostly relied on free trade. Also, he gave different perspective on free trade and its effect on society which then would be shared by modern liberalists. He can also be considered first theorists who focus on term of "change" for international systems and its consequences for societies.

Secondly, Angell analyzed interdependence theory as a historical category. He mentioned that interdependence theory like open markets occurred under specific time and conditions. According to his interdependency theory, some states would be in position of vulnerability.

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From Angell's idea, countries started to show sensitive interdependence that means possible high costs from breaking relationship. It has social, political and most importantly economic dimension. He maintained that social institutions which developed in the nineteenth century was completely different from past ones. For him, this new system is much more complex and carry its imperatives. Then he concluded that, interdependency is one of these imperatives.

Angell reveal that trade is the signifier of interdependence. Trade flows created a picture of interdependence, he mentioned some roles of country such as Indians and African colonies were the supplier of raw material. He also clarified the differences between traditional trade and modern trade with notion of "specialization". Sir Angell claim that modern trade is result of this specialization and related with this vulnerability is also product of specialization (Angell 1910).

To sum up, in *The Great Illusion* Angell try to give framework of how modern trade occurred, its reflections on system and indirectly society. Through his historical analysis, he tries to argue that in such an interdependent system, possible war and conflict would put all countries jeopardy. That's why he claims that war become obsolescence. In other words of Synopsis-a magazine in 1913, "The thesis of the book was that the integration of the economies of European countries had grown to such a degree that war between them would be entirely futile, making militarism obsolete".

1.2 Our Age- New Great Illusion?

The picture of international system drawn by Angell has some similarity today's international world. Since 45, we have been living in a kind of "Period of Pax". World history witnessed high tech revolutions, boom of free trade, mass of immigration and list goes on. Even we have much more integrated and globalized world in terms of economical, social and political. We have international organizations such as UN and even European Union which has supranational ingredients in it. In other words, we have same picture in Angell's time and it seems no place for war and conflict. "There are obvious economic parallels between the first age of globalization and the current one" (Ferguson 2005).

On the other hand, there are two sides of coin of this era. Globalization brought its challenges together. They are fostered by neoliberal economic policies. Paralleling with these challenges, states had to find how to deal with these problems and today any actors can survive by themselves. In other words, globalization made too much integrated world which cause collective action is obligatory.

As we mentioned in the introduction part, we agree with Warner's article and comments on Angell's book. I am going to explain why we agree with him. We will try to analyze its different dimensions respectively global financial crisis, unequal growth, scarcity of natural resources and climate change.

1.3 Global Financial Crisis- Collapse Neoliberalism?

Globalization and neoliberal economic policies are kind of complimentary each other. They are triggering and feeding each other. In other words, if we are talking about end of globalization, in my opinion, we should say about collapsing of neoliberalism and capitalism too. Especially, economic crises and their effect show that neoliberalism is suffering.

Under global financial crisis, first we can talk about Asian Financial Crisis, 2009 global crisis and trade policies of states as a motivation of conflict within states. Firstly, some of scholars like Bello considered Asian Financial Crisis as one of the three moments of global crisis. “This event, which laid low the proud “tigers” of East Asia, revealed that one of the key tenets of the globalization – the liberalization of the capital account to promote freer flows of capital, especially finance or speculative capital – could be profoundly destabilizing” (Bello 2002).

Then in 2009 world has been experienced the biggest and effective crisis. Same year, Joseph Nye wrote that “the world economy will shrink this year for the first time since 1945 and some economists worry that the current crisis could spell the beginning of the end of globalization” (Nye 2009). Here we want to more focus on these crisis divide countries into two categories; core and peripheries. Unfortunately, this division makes states more fragile in terms of economically and politically especially in peripheral countries. “Inability of governments to provide basic services and goods coupled with increased unemployment, rising costs of living and increased poverty is likely to further aggravate pre-existing levels of violence, conflict, criminality” (Bakrania and Lucas 2009).

According to Angell, free trade can be considered as a guarantee of peace, from this perspective in twenty-first century we should expect much more stability and prosperous from free trade because of non-barrier between countries, interdependency and their non-political “MNCs” unfortunately as same as his time, free trade and their benefits are not guarantee of peace anymore. Secondly, how suprisingly as same as Angell’s age our current age protectionist policies would increase in hard economic times- especially after economic crisis. Not only protectionism but also beggar-thy-neighbor policies are rising. As all we can imagine, whole high interdependency is affected with these policies. Protectionism can be done in different ways such as export subsidies, discriminatory legal requirements and VAT rebates in some sectors which China prefer to do against Japan. Warner focused on same challenge and irony of free trade “Free trade, it seems, is no guarantor of worldly peace. Nonetheless, it plainly helps which is one of the reasons why there present outbreak of protectionist posturing and backdoor trade restrictions so desperately needs to be countered” (2012). Warner maintained his criticism on beggar-thy-neighbour because of its results which are “lost commercial opportunity, economic blight and impaired employment- they can be precursor of much more serious international conflict” (Warner 2012).

Not only Warner, but also Arrighi and some other scholars point out that free trade and neoliberal economic policies create its hegemonic relations. It will sooner or later will economic collapses of some peripheral and even hegemonic states and intense conflict. “Furthermore, these expansions that they observed did eventually lead to the intensification of the economic contractions and economic collapses, paralleled with the decline of the hegemonic centres” (Yıldızoğlu 2009). Ironically, in the 1970s, neoliberalism policies were the medicine of economic crisis, however only in 40 years neoliberalism-1970s medicine turn into our age nightmare with the unexpected development of technology and financilization. In 2008, Paul Krugman concluded that in his article “. . . the belief that economic rationality always prevents war is an equally great illusion. And today’s high degree of global economic interdependence, which can be sustained only if all major governments act sensibly, is more fragile than we imagine” (Krugman 2008).

1.4 Unequal Growth

Twenty-first century can be considered glamorous times for globalization in terms of accumulation of wealth, technological development and mobility of people. Its obvious that there is growth. The main question is “Growth for whom? Actually, we can talk about two dimension of unequal growth. First one is unequal growth between states and secondly much more domestic and also depended on first one which is unequal growth in social class. In the first dimension, as we mentioned above, Arrighi in his work compare global market under British hegemony and US hegemony, he note that global market under British hegemony depend on British empire however, today’s global market under US hegemony is result of consciousness decision of international organization (Arrighi 1999). It make division of countries as all know such as G-20 or E-7, some states would get more than others.

In Wallerstein’s world system theory, today countries would be grouped into three; core, peripheral and semi-peripheral countries. According to him, core countries kindly exploit other in terms of economically. Peripheral countries were mostly responsible for supplier of raw material and sources and core countries are adverse. Whole division between countries had clear distinction of inequality. OECD prepared a report in 2008 called “Unequal Growth?” show how world face economic inequality with different facts. For example, the concentration of wealth was mostly in developed countries such as US, EU countries and partially Japan however, especially after 2000s concentration of wealth move to developing countries such as China, Mexico, India and Brazil. This diffusion of power is also mentioned in report of National Intelligence Council (2012) which is “Global Trends 2030: Alternative Worlds”. 2009 Global Financial Crisis made disparities

more sharp. Greece can be considered in core countries category however, there is a doubtless shifting of their category. Unfortunately, solution of IMF and EU resulted in much more radical social movements. Thousands of Greek protested Germany's creditor role. It seems free trade and even such integrated union would not be guarantee of peace. On the other hand, rising of right wing and ghost of fascism seems still hunt Europeans.

Second dimension of unequal growth, is related with first one, class inequality within state. Despite Arrighi's and Wallerstein assumption, emerging economies show that inequality change its place which means it is not only global anymore, it became domestic issues of countries itself. The new wealth concentration countries such as China, India, Brazil and some new emerging markets and their economic growth shouldn't be understood as glamorous for everyone in this country. Inequality between social classes in countries become more visible, most of them have huge disparities between rich class and low class- actually no more middle classes. "Global inequality rose in the 19th and 20th centuries because richer economies, on average, grew faster than poorer ones. Recently that pattern has reversed and global inequality has started to fall even as inequality within many countries has risen. By that measure, the planet as a whole is becoming a fairer place. But in a world of nation states it is inequality within countries" (Economist 2012).

When we compare to Angell's assumption and Warner comments, Angell, in his book never mention possible negative effects of free trade and globalization on the society. As most of scholar at his time, probably he considered free trade as a positive sum game and ignored "relative gains". However, free trade and related with capitalism again once more show that system is so fragile and it became much in our age – financilization made more fragile fastly. Maybe inequality between social classes would not result in any big wars between states but we should note that, in twenty-first century there is no conventional war anymore. Nevertheless, a new war threats have revealed itself in the form of civil war as we saw in Arab Spring. In other words, with all other notion, war and peace perception have been also changed with the effect of globalization.

To sum up, unequal growth is a result of free trade by boosting of globalization. It made system more fragile but ironically kind of same with just before WW1 which can be considered a war because of industrialization race. Once more, Angell's core assumption war is very costly that's why they would abstain to engage war seems not so much realistic. Interestingly, developing countries or emerging countries military expenses are really high and have been increasing. According to The New York Times, in 2012 China announced its increasing of military spending by 11.2 % which equal to \$106 billion, not only China but also such as Saudi Arabia increase their military spending in last 3 years. I gave two different country as an example because their geopolitic positions, economics and society are very different however both of them has same policy on military spending. This increasing in military spending implies how states perceive "peace" in their region and the world.

1.5 Climate Change

Climate change is undeniable and inevitable problem of humanity in last decade, climate change is basically changing of weather conditions in specific times very radically. Climate change has many different reasons which are both human-made and natural. Global warming is one of the result of climate change and maybe even more. The known effects of this continued warming are deeply troubling: rising sea levels, a thinning Arctic icecap, extreme weather events, ocean acidification, loss of natural habitats, and many others (Victor et al. 2012). Climate scientists agree that the world's glaciers and northern ice cap are melting at increasing rates and that sea-level rise will threaten many coastal and low-lying areas. We are not going to go to detail of effect of global warming. In addition to natural effect of climate change, it has security dimension also. Security dimension of climate change is hidden in effect of global warming. It is actually not new, throughout history radical climate change shaped societies and history. For example, Muslim expansion into the Mediterranean and southern Europe in the eighth century was to some extent driven by persistent drought in the Middle East (Dupont 2008). Some analysts estimate that climate change will cause 250 million people to lose their homelands by 2050 is given in "Migration and Climate Change" research report. So, climate change and global warming directly affect scarcity of natural resources especially water and food which will analyzed in next point. They have link to security concern of states. Possible immigration, risks of civil wars are only some of them. Much more bigger and extensive effect can be happened.

1.6 Chaos as a New Order

In his book, Angell simply claim that thanks to free trade, world system became more interdependent and depend on this any possible engage in a war will be costly for both winners and losers that's why militarism and war would become obsolete. Theoretically, he was completely right however probably he missed the long-term negative effect of free trade and system of capitalism. Anyway, today world system shared common values with Angell's age. Even today we are living in much more integrated world, peak of capitalism and information age, however globalization accelerated development in all sense which resulted in new concepts, new threats and new perceptions. Yes, we can accept that we have been living in peace but on the other side of coin, we have suffered climate change problem, regional conflict, financial crisis, food shortage and list can goes on.

Despite of this, in order to pursuit their interests state they should keep pace with effect of globalization and system. We tried to find an answer to my question in introduction "are we coming to the end of globalization-great illusion for our age?" we analyze three production of globalization which can trigger possible war

or conflict in near future; global financial crisis, unequal growth and climate change with effects. Unfortunately in my opinion, contrary to general belief of period of pax is not valid anymore. Long-term civil wars in Africa, water sources agreement, Bosnian war, food crisis in Africa, 9/11, global warming and now Arab Spring. All of these simply say there has been no peace for a long time and we can say that we are kind of ending of our globalization age however, right now there is no new alternative as a system. It seems that we are ending our globalization, but also it will be starting of new age for humanity.

Chaos theory is considered as part of physic and mathematic. It was completely new when it was used as term. Application of chaos theory into social sciences is still skeptic and new for everyone. First of all, as people know the word of "chaos" mean turbulence and disorder. It would be found in nonlinear and dynamic systems. Because of its dynamic structure it has its own to power generate a change. Founding of chaos can go back to eighteenth century however, using its application is completely new as we mentioned above. Lorenz who was meteorologist noticed sensitiveness to initiate point. In his experiment, when we changed the starting point, he reached different weather condition in future. So, according to the chaos theory, chaos has sensitive to initial point. Here is important point for my analyzing because in that paper, we got limited and basic part of chaos theory to apply our argument. The sensitive dependence on initial conditions shows how a small change at one place or moment in a nonlinear system can result in large differences to a later state in the system. It is also well known with "butterfly effect".

Through my analyzing, we were discussing ending of globalization with the paralleling of Angell's book suppose that free trade became guarantee of peace, any country would not take a risk to engage a war. The rising question is "will ending of globalization led to chaos?"

Ending of globalization started in uncertain time and place. Some of them considered Asian Financial Crisis as a starting point of collapsing. Then it has butterfly effect until 2009 global financial crisis. Actually, 2009 global financial crisis turned economy into chaos. As all remembered in 1970s neoliberal economic policies came up as a solution of economic chaos however, it seems collapsing slowly.

On the other hand, related with economic chaos social and environmental chaos come together. As we discussed in the above, all of them triggered each other and unfortunately it triggered instability and chaos in the region and then world. Also, possible conflict in any region which have already experienced as a civil war has a butterfly effect in long term. Especially Arab Spring showed us that any sparkle can turn into regional instability and regime change. There is no metaphor in it, burning himself of Muhammed Bauzazi resulted in Arab Spring completely new order in the region or chaos.

Future predictions of world system seem negative at first sight. There is no doubt a new system will emerge and replace the old one however uncertainty on when and how happen.

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Chapter 2

Chaotic Time Delay Systems and Field Programmable Gate Array Realization

D. Valli, S. Banerjee, K. Ganesan, B. Muthuswamy, and C.K. Subramaniam

2.1 Introduction

In this paper, we show how chaotic time delay systems can be realized physically using a Field Programmable Gate Array (FPGA) platform.

There are various analog realizations of chaotic delay differential equations (DDEs) [Namajunas et al. \(1995\)](#), [Busarino et al. \(2011\)](#), and [Srinivasan et al. \(2010\)](#). The disadvantage with the analog realization is the number of components required for realizing the delay (example: n operational amplifiers for an n -stage delay in [Busarino et al. \(2011\)](#)) and the inability to synthesize some nonlinear functions using analog electronics. For example, the Ikeda chaotic DDE ([Ikeda and Matsumoto 1987](#)) involves a sine nonlinearity and this is difficult to synthesize using analog electronics. In fact, we are not aware of any electronic realization of the Ikeda DDE.

In this work, we report on a physical realization of the Ikeda (and also Polynomial, Sigmoidal, Asymmetric Logistic ([Spratt 2010](#))) DDEs using FPGAs. The advantage of our approach is a direct physical realization of a chaotic DDE from a MATLAB block diagram. The disadvantage of our approach is the extremely low frequency behaviour in the physical realization due to the use of a processor based FPGA. An approach to resolve this issue is discussed in the conclusion.

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This paper is organized as follows: we first give an overview of DDEs by utilizing a simple example. Next we illustrate simulation results from a variety of chaotic DDEs. This is followed by a discussion of the hardware platform. The penultimate section shows results from the physical realization followed by conclusions and future work. Note that all code for this paper can be downloaded from: <http://www.harpgroup.org/muthuswamy/pubs/code/2013/iccls>. You of course need the appropriate hardware and software for using the code.

2.2 A Brief Introduction to Delay Differential Equations

Differential equations of the form

$$\dot{x} = f(x, x_\tau) \quad (2.1)$$

are called DDEs because of the time dependence of the independent variable $x_\tau \equiv x(t - \tau)$. The dot notation in Eq. (2.1) is the customary definition of derivative with respect to time.

In order to understand why delay differential equations have a variety of unique properties, let us consider the following example.

$$\dot{x} = x, \quad x(0) = 1 \quad (2.2)$$

We can easily find the solution to Eq. (2.2) for $t \geq 0$ as the exponential function.

$$x(t) = e^t, \quad t \geq 0 \quad (2.3)$$

Suppose we modify Eq. (2.2) as shown in Eq. (2.4) (Shampine and Thompson 2000).

$$\dot{x} = x(t - 1), \quad h(t) = 1 \quad \forall t \leq 0 \quad (2.4)$$

We would like to solve Eq. (2.4) for $x(t)$, $t \geq 0$. Note how in Eq. (2.4) we have a continuous set of initial conditions given by a history function h . In this regard, Eq. (2.4) is said to be “infinite dimensional” although it is first-order. This property of DDEs having infinite dimensions is particularly attractive for chaotic behaviour in terms of complexity of the underlying dynamics (Spratt 2010).

In order to solve Eq. (2.4), we can rewrite the R.H.S as follows.

$$\begin{aligned} \dot{x} &= x(t - 1) \quad 0 \leq t \leq 1 \\ &= h(t) \quad 0 \leq t \leq 1 \\ &= 1 \quad 0 \leq t \leq 1 \end{aligned} \quad (2.5)$$

Hence

$$x(t) = t + c_0 \quad 0 \leq t \leq 1 \quad (2.6)$$

Using the given history function we can find c_0 in Eq. (2.6) and hence obtain the solution for $t \in [0, 1]$, shown in Eq. (2.7)

$$x(t) = t + 1, \quad 0 \leq t \leq 1 \quad (2.7)$$

In a similar manner, we can find that for $t \in [1, 2]$

$$x(t) = \frac{t^2 + 1}{2}, \quad 0 \leq t \leq 1 \quad (2.8)$$

In general, the solution on interval $[k, k + 1]$ is a polynomial of degree $k + 1$ (and there is a discontinuity of order $k + 1$ at $t = k$) (Shampine and Thompson 2000). Notice the marked difference in solutions between Eq. (2.2) with $\tau = 0$ and Eq. (2.4) with $\tau = 1$.

DDEs that have a chaotic solution for a range of parameters are called chaotic DDEs. In the next section, we will only give examples of chaotic DDEs via numerical simulations. An excellent reference for further detailed study is Lakshmanan and Senthilkumar (2010).

2.3 Numerical Simulation Examples of Chaotic DDEs

Figures 2.1–2.4 show results of simulating various chaotic DDEs in Mathematica 8. The initial history is given by x_0 . Mathematica's built-in NDSolve function was used to simulate the system.

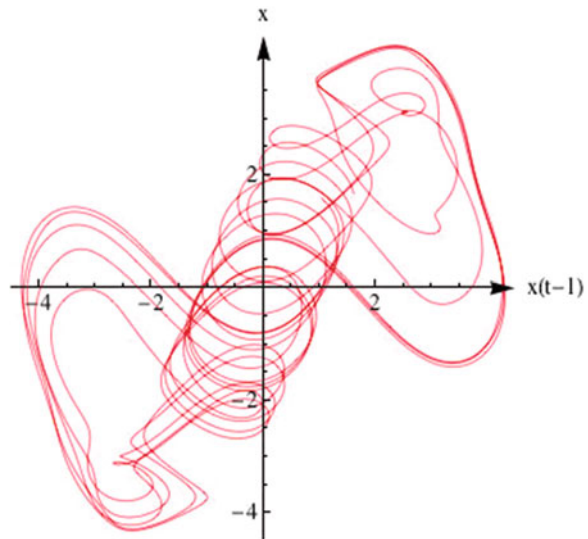


Fig. 2.1 The Ikeda DDE
 $\dot{x} = \mu \sin(x_\tau - c) - x$.
 Parameters are: $\mu = 6$,
 $\tau = 1, c = 0, x_0 = 0.1$

Fig. 2.2 The polynomial DDE $\dot{x} = x - x_t^3$. Parameters are: $\tau = 1.7, x_0 = 0.1$

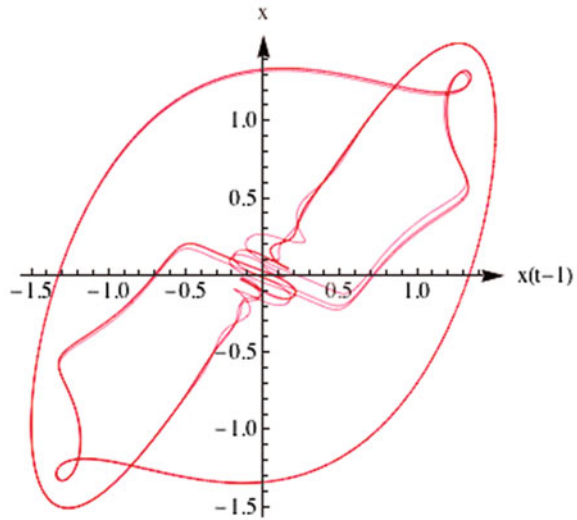
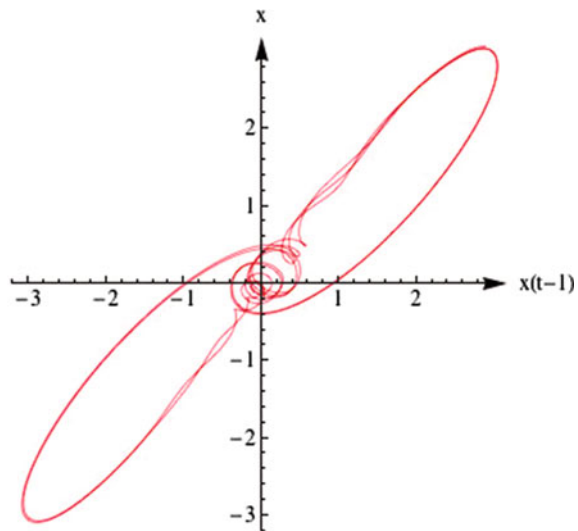


Fig. 2.3 The sigmoidal DDE $\dot{x} = 2 \tanh(x_t) - x_t$. Parameters are: $\tau = 3, x_0 = 1$



2.4 Physical Realization Results on FPGA Platform

The physical platform utilized is dSPACE DS1104. The DDE was simply realized onto the PowerPC 603e core on the FPGA from a Simulink block diagram (Fig. 2.5). Figures 2.6–2.9 show the physical realization results. It can be inferred that they match well.

Fig. 2.4 The asymmetric logistic DDE
 $\dot{x} = x_t(1 - |x_t|)$. Parameters
 are: $\tau = 3, x_0 = 0.9$

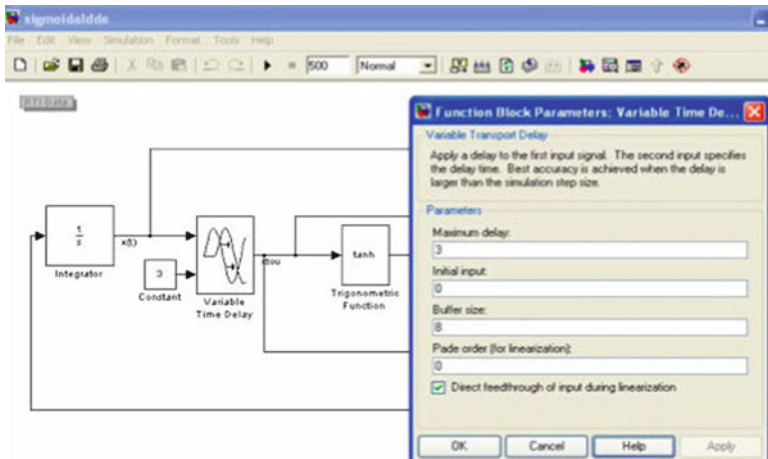
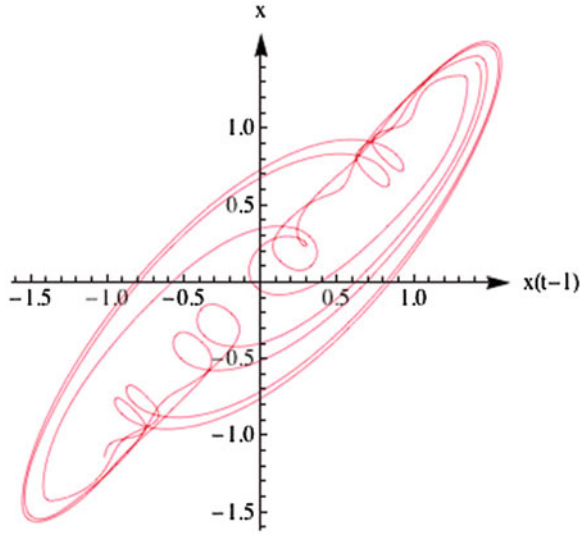


Fig. 2.5 Simulink block diagram for dSPACE realization

2.5 Conclusions and Future Work

In this work, we illustrated physical realization of DDEs using an FPGA platform. The advantage is a direct realization of a Simulink block diagram onto a physical device.

The disadvantage is that the resulting system runs sequentially on a processor. Future work is to use the inherent parallelism of an FPGA to directly realize the DDE and run synchronization experiments.



Fig. 2.6 The Ikeda DDE $\dot{x} = \mu \sin(x_\tau - c) - x$ realization. Parameters are: $\mu = 6$, $\tau = 1$, $c = 0$, $x_0 = 0.1$

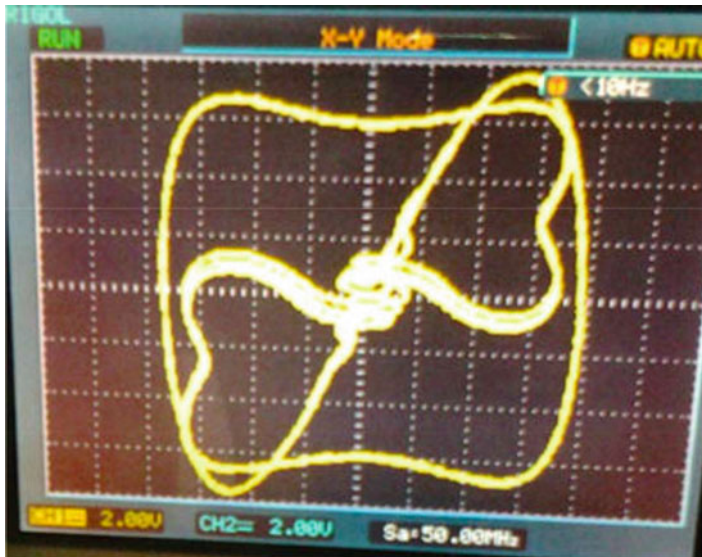


Fig. 2.7 The polynomial DDE $\dot{x} = x - x_\tau^3$ realization. Parameters are: $\tau = 1.7$, $x_0 = 0.1$

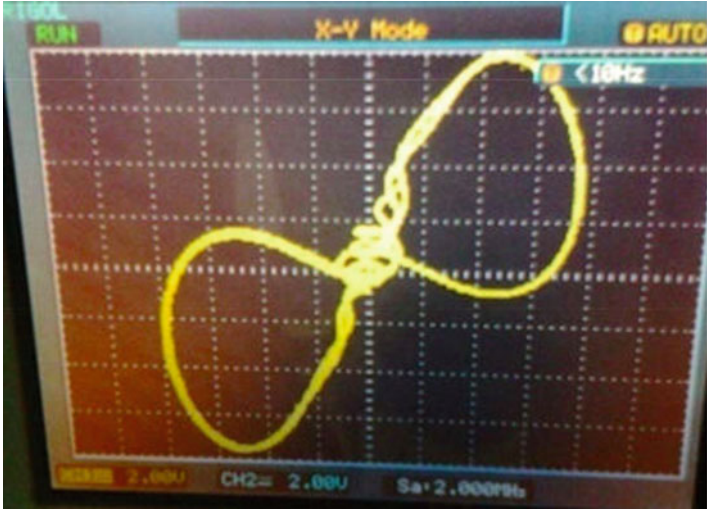


Fig. 2.8 The sigmoidal DDE $\dot{x} = 2 \tanh(x_\tau) - x_\tau$ realization. Parameters are: $\tau = 3, x_0 = 1$



Fig. 2.9 The Asymmetric Logistic DDE $\dot{x} = x_\tau(1 - |x_\tau|)$ realization. Parameters are: $\tau = 3, x_0 = 0.9$

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Chapter 3

An Adaptive Neuro-Fuzzy Inference System-Based Approach to Forecast Time Series of Chaotic Systems

Utku Köse and Ahmet Arslan

3.1 Introduction

In Mathematics, the Chaos Theory is a remarkable and important research field employing many applications in different disciplines like Physics, Engineering, Economics, Biology . . . etc. The scope of this field is based on scientific studies associated with the search on behavior of nonlinear dynamical systems, which are highly sensitive to their initial conditions. These systems are also called as chaotic systems. In time several kinds of sub-working fields have also been introduced within the context of research studies on the Chaos Theory. Control of Chaos, Chaos Synchronization and Chaotification (Anti-control of Chaos) are some sub-working fields that can be examined within the mentioned content. Additionally, there are also some other research orientations supporting these fields. In this sense, the approach of forecasting (prediction – estimation of) time series of chaotic systems is also an attractive work area for the related literature.

For the problem on forecasting time series of chaotic systems, many different approaches have been introduced to provide effective solutions. When the background of the issue is analyzed; it can be seen that this problem on forecasting time series of chaotic systems comes from the failure of forecasting methods, which are used on stationary time series before (Gromov and Shulga 2012). At this point, the related – introduced methods were unable to provide effective solutions to forecast time series of chaotic systems and because of this, a remarkable effort on searching

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for a solution for this problem has been shown by researchers. Regards to the introduced approaches – methods, Artificial Intelligence (AI) based ones have an important role on providing solutions for the ‘forecasting problem’.

This study introduces a system designed on an Adaptive Neuro-Fuzzy Inference System (ANFIS) approach, in order to forecast chaotic systems. The ANFIS is a typical hybrid AI approach which employs both Artificial Neural Networks and Fuzzy Logic techniques in order to design and develop different types of intelligent, problem-solving structures – systems. As a result of learning – reasoning infrastructure ensured by the combination of Artificial Neural Networks and Fuzzy Logic techniques, an alternative solution-based study on forecasting chaotic time series is provided for the literature, within this research work.

3.2 Adaptive Neuro-Fuzzy Inference System

Adaptive Neuro-Fuzzy Inference System (ANFIS) is some kind of ‘hybrid’ approach combining both Artificial Neural Networks and Fuzzy Logic techniques in a single structure. At this point, ANFIS is evaluated as a type of Neuro-Fuzzy systems within the related literature. Generally, the ‘hybrid approach’ of a typical Neuro-Fuzzy system ensures an intelligent system structure that combines the human oriented thinking and reasoning behavior (with the Fuzzy Logic) and the intelligent learning method – behavior (with the Artificial Neural Networks). In the literature, this structure is also defined – called as mostly ‘Neuro-Fuzzy system’ or ‘Fuzzy Neural Network’.

Related to the expressed literature and the subject, fundamentals of the ANFIS have been first proposed by Jang (1992, 1993). As different from other approaches, ANFIS provides a hybrid structure employing the Fuzzy Logic approach and a typical Radial Basis Function Neural Network (RBFNN), in which each node has radial basis function such as Gaussian and Ellipsoidal (Güner 2003). Within this structure, a typical ANFIS also employs a Takagi-Sugeno model-based Fuzzy inference approach in order to form the related hybrid system. In this sense, the rule base of a ‘basic ANFIS’ is formed via two ‘fuzzy’ IF... THEN rules-based on a first order Takagi-Sugeno model.

The basic ANFIS structure comes with some parameters called as ‘premise’ and ‘consequent’ parameters (Jang 1992, 1993; Güler and Übeyli 2005). At this point, the general objective is to use learning algorithms for tuning the related parameters, to make the ANFIS output match the training data (Güler and Übeyli 2005). In other words, a typical optimization approach could be applied in order to adjust the related parameters as well as reduce the error measure – value (called as the ‘square error sum’ related to the difference between the input value and the output value) – (Pedraza et al. 2010). At this sense, there are some learning algorithm approaches like ‘Gradient Decent Backpropagation’, ‘Gradient Decent and One Pass of Least

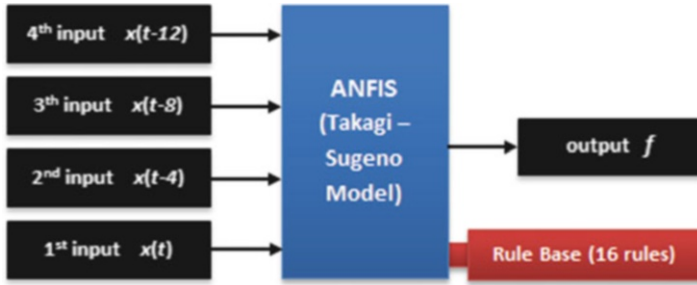


Fig. 3.1 A brief schema of the designed and developed ANFIS

Square Estimates (LSE)' and 'Gradient Decent and LSE' for performing the related training processes (Güner 2003).

In order not to affect the flow of the paper and ensure better readability related to the main subject of the work, readers are referred to (Jang 1992, 1993; Güler and Übeyli 2005) in order to learn more about mathematical details – working mechanism (calculations, learning process . . . etc.) of the ANFIS approach.

3.3 Designed and Developed Anfis Structure

A general ANFIS structure aiming to forecast time series of chaotic systems has been designed and developed in the context of the explained approaches. At this point, it is also possible to express features of the structure, as follows:

- In the context of the introduced structure, four inputs (including two Gaussian sets separately) have been used for ensuring an ANFIS approach. In this sense, ANFIS structure also employs a total of 16 rules.
- Generally, the ANFIS system aims to forecast a chaotic time series according to its four past values. In more detail, it can be said that the system structure aims to forecast $x(t+4)$, according to the four past values, which are $x(t)$, $x(t-4)$, $x(t-8)$ and $x(t-12)$ respectively.

According to the expressed points, a brief schema of the designed and developed system structure can be represented as in Fig. 3.1.

3.4 Evaluation

In order to test its effectiveness, the ANFIS structure has been used for forecasting time series of three different chaotic systems: Lorenz, Rössler, and Chen System (Table 3.1). During tests, error values between the original time series and the

Table 3.1 Chaotic systems considered within the evaluation process

System	Mathematical expression	Std. values
Lorenz (1963)	$dx/dt = \sigma \cdot (y - x)$	$\sigma = 10$
	$dy/dt = r \cdot x - y - x \cdot z$	$r = 28$
	$dz/dt = x \cdot y - b \cdot z$	$b = 8/3$
Rössler (1976)	$dx/dt = -z - y$	$a = 0.50$
	$dy/dt = x + a \cdot y$	$b = 0.20$
	$dz/dt = b + z \cdot (x - c)$	$c = 10$
Chen and Ueta (1999)	$dx/dt = a \cdot (y - x)$	$a = 35$
	$dy/dt = d \cdot x - x \cdot z + c \cdot y$	$b = 3$
	$dz/dt = x \cdot y - b \cdot z$	$c = 28$
		$d = -7$

forecasted ones have also been calculated for validating the introduced approach. In this sense, the used equation: ‘square error sum’ is expressed as follows:

$$\sum_0^k e^2(k) = \sum_0^k (fs(k) - os(k))^2 \tag{3.1}$$

where $fs(k)$ is forecasted time series for the original time series: $os(k)$.

For each chaotic system, data files containing 30,000 rows in the form of “ $x(t + 4): x(t), x(t-4), x(t-8), x(t-12)$ ” values have been created via MATLAB solution – tool provided by Petras in the a book study (2011). At this point, 15,000 data rows were used for training the ANFIS whereas other 15,000 ones were employed for testing.

For the Lorenz System, the square error sum value was obtained as 3,642,677 whereas it was 3,136,143 for the Rössler System and also (it) was 4,468,721 for the Chen System. In this sense, graphs for the forecasted time series and the original time series for each chaotic system considered are also represented under Fig. 3.2.

3.5 Conclusions and Future Work

The approach introduced in this paper, provides an effective system structure to forecast time series of different chaotic systems. Generally, the system provides a simple AI-based, hybrid approach for solving the related problem of the forecasting. In this sense, the introduced ANFIS structure has four inputs enabling the system to be capable of forecasting a specific time series – value according to its four – previous samples. At this point, the ANFIS also employs a total of 16 rules.

In order to test the designed and developed approach, it has been used for performing forecasting operations on three different chaotic systems and according to the obtained results, it can be expressed that the related ANFIS is effective enough to forecast chaotic systems as being appropriate to objectives of this study.

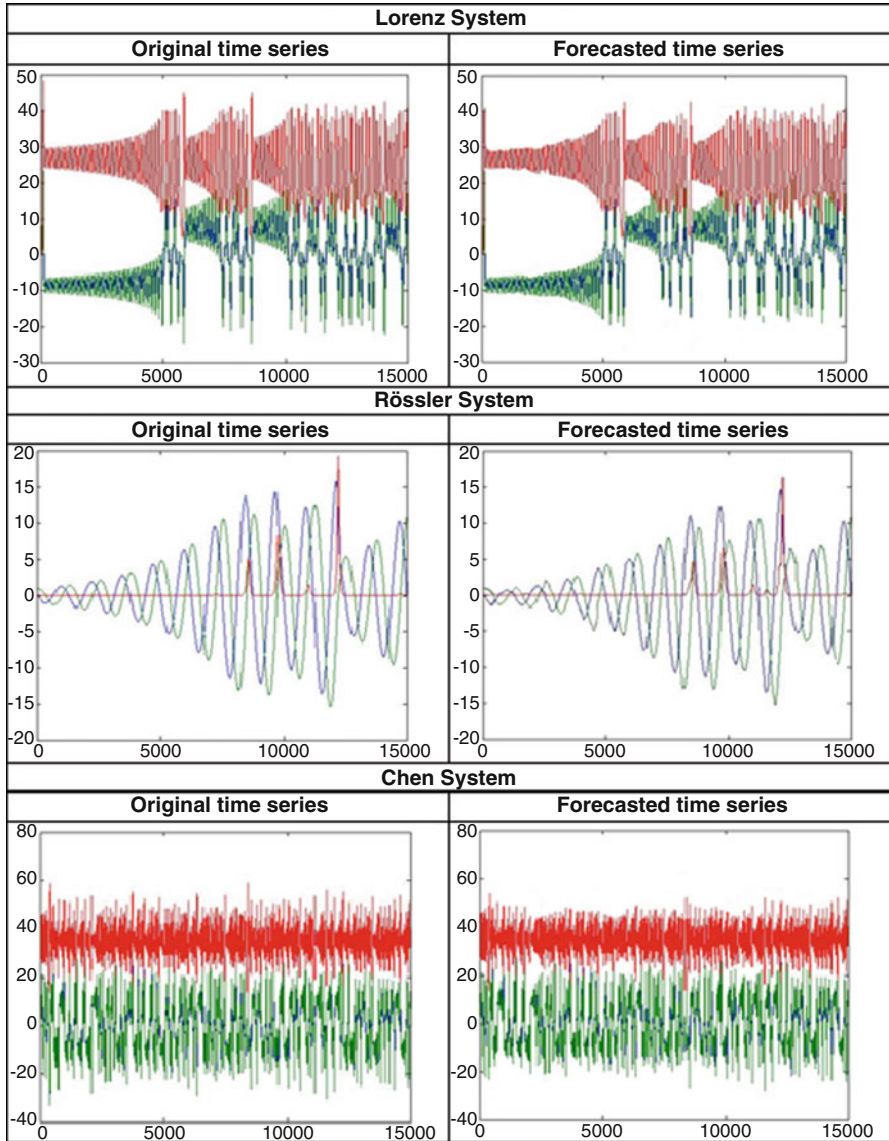


Fig. 3.2 Graphs for the forecasted time series and the original time series

In addition to the introduced work, authors also think on some future works for improving the introduced ANFIS. In this sense, there will be some works on using new AI-based systems – techniques for adjusting the accuracy and the speed. On the other hand, new research works are also organized for testing forecasting abilities of the ANFIS on different chaotic systems in the current literature.

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Chapter 4

Design and Development of a Chaos-Based Image Encryption System

Utku Köse and Ahmet Arslan

4.1 Introduction

Nowadays, approaches for keeping digital data secure or more generally, ensuring the security for information has become more important and remarkable subject as a result of rapid developments and improvements in especially information and communication technologies. In this sense, innovative trends on digital data sharing or faster and more effective communication techniques for reaching to specific digital data have also given a rise to enable researchers to think again on the security concept in the context of current technology structures. Furthermore, providing the digital data within many different data form like text, image, video . . . etc. has also caused designing and developing different kinds of security solutions related to the data form. At this point, the cryptography field has been continued to be popular working area for performing encryption related research works to provide approaches for making the digital data more secure. However, rapid developments and improvements within the related technologies have also caused to appear more effective methods and techniques for ‘breaking’ the related security structures – systems. Because of this, researchers and scientists have been also encouraged to search for more effective and efficient approaches, methods or techniques to provide better encryption-based ways and improve the related literature.

As being parallel with the related research efforts, especially designing and developing ‘hybrid’ system structures to create more effective and efficient security solutions has been very popular approach among the related researchers and

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scientists within the associated literature. Additionally, improving already introduced security solutions via different kinds of mathematical structures has also been another way to provide alternative works for the related objective. In this context, Artificial Intelligence-based techniques have enabled providing more innovative, effective and efficient security solutions in the context of encryption approaches. On the other hand, another remarkable field, which is widely used within encryption – decryption approaches, is the ‘Chaos Theory’.

The Chaos Theory is a remarkable and important research field for employing many applications in different disciplines like Physics, Engineering, Economics, Biology . . . etc. As general, scope of the Chaos Theory is based on scientific works related to searches on behaviors of nonlinear dynamical systems (which are highly sensitive to their initial conditions). The related systems are named as ‘chaotic systems’ and unpredictable, sensitive mathematical structures of these systems have enabled them to be used effectively for providing alternative solutions for the problem of ensuring security for the information (which is especially digital).

As being related to the explained aspects, objective of this study is to introduce a basic, simple Chaos-based image encryption system, which can employ chaotic systems to form a mathematical and algorithmic infrastructure for ensuring data security. In the related sense, a specific encryption approach designed for making image data more secure has been provided as a way to provide an example for the usage of the Chaos Theory within the cryptography field.

4.2 Image Encryption

In the context of ensuring security for the digital data and protecting the content in this way, image encryption is an approach, which is related to performing crypto(logy) – coding approaches for making the original image content inaccessible. At this point, the approach of image encryption has become very important as a result of improvements on sharing or storing image-based data via information and communication technologies. Generally, the image encryption is also known one of two approaches for protecting the image-based data. The other approach is called as ‘information hiding’ and it employs ‘watermarking’, ‘anonymity’, ‘steganography’ and ‘cover channel’ methods to protect the data (Zhang et al. 2005).

When the current literature related to using Chaos for image encryption is examined, it can be seen that there are many different ways to design and develop alternative solutions for encryption processes. At this point, it is important that different kinds of data structures, models and mathematical calculations are employed for making encryption approaches more effective, robust and faster. Generally, the related research efforts can be categorized under the following titles:

- Using alternative and/or newer chaotic systems and chaotic maps for designing and developing new image encryption approaches.
- Adding chaotic systems and maps-based approaches to already introduced image encryption approaches.

- Combining both chaos-based approaches and some other approaches (for example Artificial Intelligence-based) to form hybrid image encryption systems.
- Making different kinds of modifications to improve some features or functions of already introduced chaos-based image encryption approaches.

At this point, the expressed categories can also be increased or decreased by taking into account more general or specific research directions in each category. It is also important to have more idea about the foremost methods or techniques related to the image encryption works within literature and also examine the latest research works associated with chaos-based image encryption approaches. In this sense, in order not to affect flow of the paper and give brief enough information about the foundation of this work, readers are referred to examine (Zhang et al. 2005; Pareek et al. 2012; Krikor et al. 2009; Chattopadhyay et al. 2012; Soni and Acharya 2012; Wang and Liao 2012) to obtain information about research directions and introduced works within the current literature.

4.3 A Chaos-Based Image Encryption System

The designed and developed chaos-based image encryption system employs a basic, simple algorithmic flow for ensuring the related encryption process. In this context, the main objective of the system is coding R (Red), G (Green) and B (Blue) values for each pixel included within the image data. According to the objective, steps of the approach can be expressed briefly as follows and in Fig. 4.1:

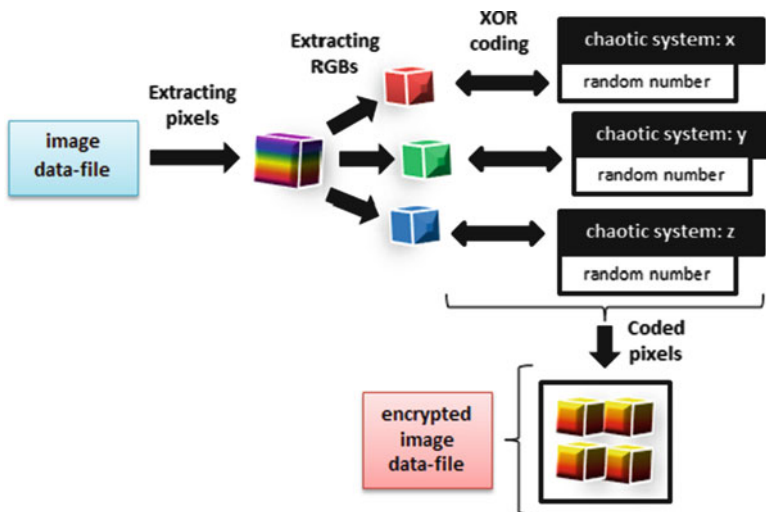


Fig. 4.1 A brief schema of the chaos-based image encryption approach

Step 1: Read the related image file in the context of RGB values of each pixel. In this sense, a matrix structure keeping the related values is obtained.

Step 2: For each color value of a pixel, use a (three-dimensional) chaotic system to obtain randomly generated numbers (At this point it is also employ different dimensional chaotic systems or chaotic maps for ensuring separate coding ways).

Step 3: Perform XOR operation between an original image pixel color value and the randomly obtained number via chaotic system and replace newly obtained (coded) pixel color values with the original ones.

4.4 Evaluation

In order to be an evaluation approach, the designed and developed system has been tested with two different image files. In this sense, the Chen System, which is explained below (Chen and Ueta 1999) has been used within the encryption system.

$$\begin{aligned} dx/dt &= a.(y - x) \\ dy/dt &= d.x - x.z + c.y \\ dz/dt &= x.y - b.z \end{aligned} \quad (4.1)$$

(For Chen System, standard – default values are; $a = 35$, $b = 3$, $c = 28$, $d = -7$)

Related to the testing results, the following figure presents image and histogram views for both original and encrypted image file – data (Fig. 4.2).

4.5 Conclusions and Future Work

The chaos-based image encryption system introduced in this paper comes with a basic, simple infrastructure to provide an approach for encrypting image-related digital data. As general, the system is based on the usage of different chaotic systems to ensure an encryption technique.

Obtained evaluation – testing process results show that the approach is able to encrypt an image data and ensure a secure way for protecting the related data. At this point, it is also important that there are many different kinds of advanced chaos-based systems that have been already introduced within the current literature. However, the approach – encryption system explained within this study provides basic ways – functions to ensure a stable system structure for performing the security based operations for image-data. Furthermore, it also employs a pure but effective enough approach to provide an encryption strategy on image-based data.

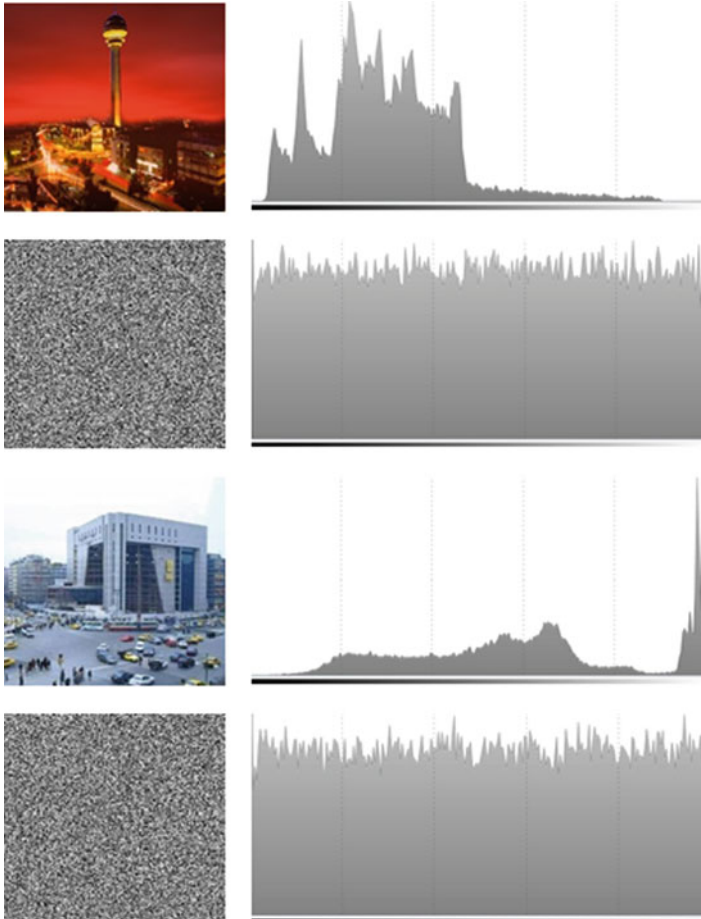


Fig. 4.2 Image and histogram views for both original and encrypted image files – data

As being additionally to the current system – approach structure, authors also think about some future works for improving many features and functions of the introduced chaos-based image encryption system. In this sense, robustness of the system will be improved more by combining the current system structure with any additional, appropriate techniques. At this point, there will be also some testing works on new system combinations with Artificial Intelligence-based techniques. But more emphasis will be given on adding simple but effective enough mathematical expressions for improving the whole system and keeping it on a single structure rather than a typical hybrid one. Finally, the speed of the encryption process provided by the current system will also be increased by using alternative, ‘speed-related’, additional methods introduced already in the related literature.

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Chapter 5

Comparison of Principal Component Analysis Biplots Based on Different Robust Covariance Matrix Estimates

B. Barış Alkan and Cemal Atakan

5.1 Introduction

The structures which includes chaos and complexity encountered in daily life depends on several variables. In order to interpret these chaotic and complex structures as closest to reality, the use of multivariate statistical methods is very important.

The commonly used method between these methods is Principal component analysis (PCA) which allows to explain variance-covariance structure of the data with the less number of components (Ma and Genton 2001). PCA is preferred for analysis of complex systems and complex data in recent years (Li et al. 2012).

Principal component analysis (PCA) aims to explain the variance-covariance structure of a multivariate data with a lower linear combinations of the variables (Hubert et al. 2005). Linear combinations of the variables is called principal components (PCs). PCA is based on variance-covariance (or correlation) matrix. It gives information about the multivariate data set in a multidimensional space. PCA is a factorization of a data matrix $\mathbf{X} : n \times p$ with n observation and p variables, is given by $\mathbf{X} = \mathbf{TP}'$, where $\mathbf{P} \in \mathbb{R}^{p \times k}$ is an orthogonal matrix and called as the matrix of loading, $\mathbf{T} \in \mathbb{R}^{n \times k}$ is called as the matrix of score. The dimension of k is the rank of \mathbf{X} . Also, k is the number of PCs. Important PCs are given by the first r columns of \mathbf{P} , where $r \leq k \leq p$. Then PCs are obtained with $\mathbf{T}^{(r)} = \mathbf{XP}^{(r)}$. The proportion of the variance explained by PCs is found by $\left(\sum_{i=1}^r \gamma_i / \sum_{i=1}^k \gamma_i \right) \times 100$, where

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γ_i is eigenvalues of variance-covariance matrix (Demsar et al. 2013). Detailed information about the PCA can be found in Jolliffe (2002), Abdi and Williams (2010), Johnson and Wischern (1998).

Graphical approaches are widely used in the examination of multivariate data. The most popular of them is called biplot. This technique provides an geometric approach that examined the relations between observations and variables in the principal components space with reduced-size. PCA biplot is used for visualization of PCA results.

Variance-covariance (or correlation) matrix is sensitive to outliers. Therefore PCA is influenced by the presence of outliers. So PCA is not a robust method. In the literature, there are different robust estimators of the variance-covariance matrix. In this study we have considered only estimators of minimum covariance determinant (MCD) and orthogonalized gnanadesikan-kettenring (OGK). According to these, robust PCA is obtained by replacing the classical variance-covariance matrix with one of the robust variance-covariance (MCD and OGK) (Todorov and Filzmoser 2009). The aim of robust PCA is to find PCs that are not affected by outlier (Hubert et al. 2005).

In this study we compare the performances of PCA biplots based on different robust covariance matrix estimates (MCD and OGK) on the one real and the artificial data sets.

5.2 PCA Biplot Based on Robust Covariance Matrix (MCD and OGK)

5.2.1 MCD and OGK Estimators

The minimum covariance determinant (MCD) estimator was proposed by Rousseeuw (1984). The properties of the MCD estimator was studied by Croux and Haesbroeck (2000). This estimator is a highly robust estimator of multivariate location and scatter (see Rousseeuw 1984; Todorov and Filzmoser 2009; Daszykowski et al. 2007 for details).

Orthogonalized gnanadesikan-kettenring (OGK) estimator was proposed by Maronna and Zamar (2002). OGK uses the orthogonalized pairwise covariance matrix estimate. The pairwise covariances are obtained the estimator which was proposed by Gnanadesikan and Kettenring (1972) (see Todorov and Filzmoser 2009; Maronna and Zamar 2002 for details).

5.2.2 Biplot Technique

The biplot was introduced by Gabriel (1971). It is considered as a generalization of the scatterplot. A biplot gives information on both samples and variables of a data

matrix to be showed graphically. Samples (scores of PCs) are represented as a point in the biplot and variables (loadings of PCs) are represented as a vector. The vectors graphically indicate the proportion of the original variance explained by the first two PCs (see Gower and Hand 1996; Gower et al. 2011 for details).

5.3 Application to Real and Artificial Data

We used data on monthly financial investment returns of deposit interest (V_1), stock exchange (V_2), US dolar (V_3), euro (V_4) and gold (V_5) from January, 2001 to October, 2008 as a real data. The data are compiled from the monthly press releases of Turkish Statistical Institute (TurkStat).

First, we determine outliers with multivariate outlier deduction test. Then we apply the classical PCA (CPCA), robust PCA (RPCA) based on MCD and robust PCA based on OGK to data of financial investment returns. Table 5.1 present results of CPCA, RPCA based on MCD and RPCA based on OGK. For CPCA, the first two PCs accounts for 79.81 % of the total variation in the data set. In RPCA based on MCD, the first two PCs account for 90.62 % of the total variation and for RPCA based on OGK, the first two PCs account for 91.72 % of the total variation. Figure 5.1 present the results of CPCA and RPCA Biplot. The points in the biplots for Fig. 5.1 correspond to the times and vectors correspond to the financial investment returns. In Fig. 5.1b, c, we can see to be very little the impact of V_1 variable in RPCA Biplots. In this case, the comments on CPCA for V_1 can be misleading. So

We used an artificial data to compare the performances of CPCA, RPCA_MCD and RPCA_OGK. One hundred samples of size were generated for $p = 5$, 90 % and 80 % of the samples were generated from $N(\mu, \Sigma)$, $\mu = [1 \ 5 \ 10 \ 7 \ 2 \ 1]'$, $\Sigma = \text{diag}[100 \ 20 \ 8 \ 4 \ 2]$ and 10 % and 20 % of the samples were generated from a multivariate t population with 5° of freedom. The results for the contamination of 10 % and 20 % are given in Table 5.2. We apply the classical PCA (CPCA), robust PCA (RPCA) based on MCD and robust PCA based on OGK to artificial data. Table 5.2 present the results of CPCA Biplot (a), CPCA Biplot (10 % t_5) (b), RPCA_MCD Biplot (10 % t_5) (c), RPCA_OGK Biplot (10 % t_5) (d), RPCA_MCD Biplot (20 % t_5) (e), RPCA_OGK Biplot (20 % t_5) (f). Figure 5.2c–f indicates a group of outliers. CPCA Biplot shows only extreme outliers. RPCA Biplot

Table 5.1 Results of classical PCA and robust PCA applied to financial investment returns

	Methods	PC1	First two PCs
Cumulative proportion	CPCA	0.5983	0.7981
	RPCA_MCD	0.7086	0.9062
	RPCA_OGK	0.7340	0.9172

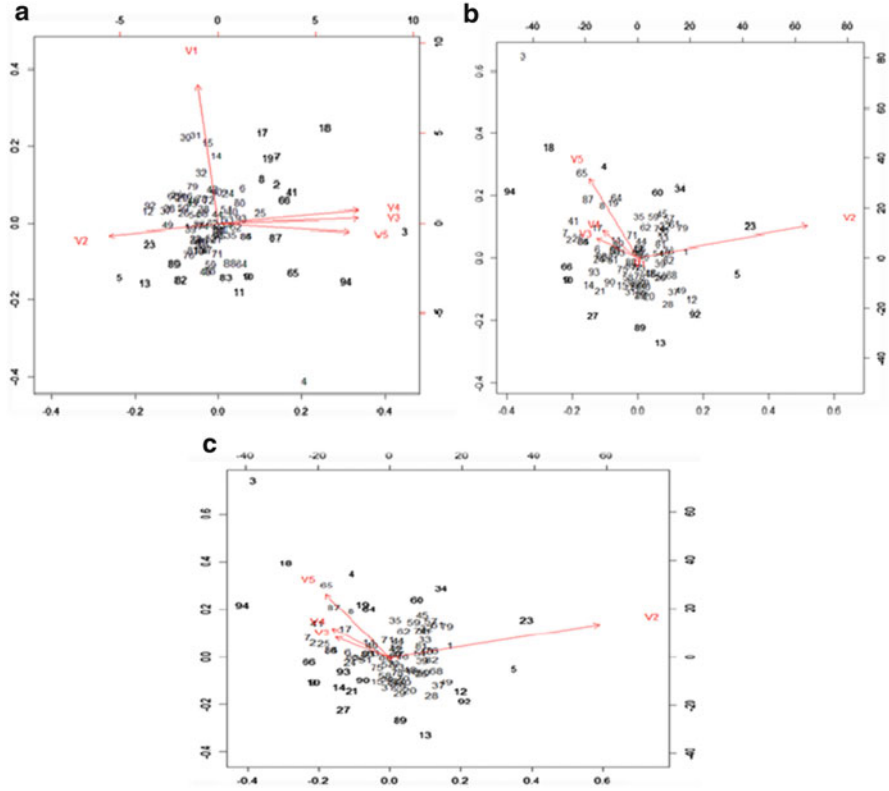


Fig. 5.1 Classic PCA biplot (a), Robust PCA biplot Based on MCD (b) and Robust PCA biplot Based on OGK (c)

Table 5.2 Results of classical PCA and robust PCA applied to artificial data

	Methods	PC1	First two PCs
Cumulative proportion	CPCA	0.8031	0.9256
	CPCA (10 % t_5)	0.7642	0.9094
	RPCA_MCD (10 % t_5)	0.7812	0.9132
	RPCA_OGK (10 % t_5)	0.7639	0.9089
	RPCA_MCD (20 % t_5)	0.7899	0.9172
	RPCA_OGK (20 % t_5)	0.7914	0.9255

based on MCD and RPCA Biplot based on OGK methods can use for the outlier identifications.

In this study, Classical PCA biplot and Robust PCA biplot based on MCD and OGK were obtained with the libraries of the robustbase, rrcov and stats in statistical software package R (R Development Core Team 2011).

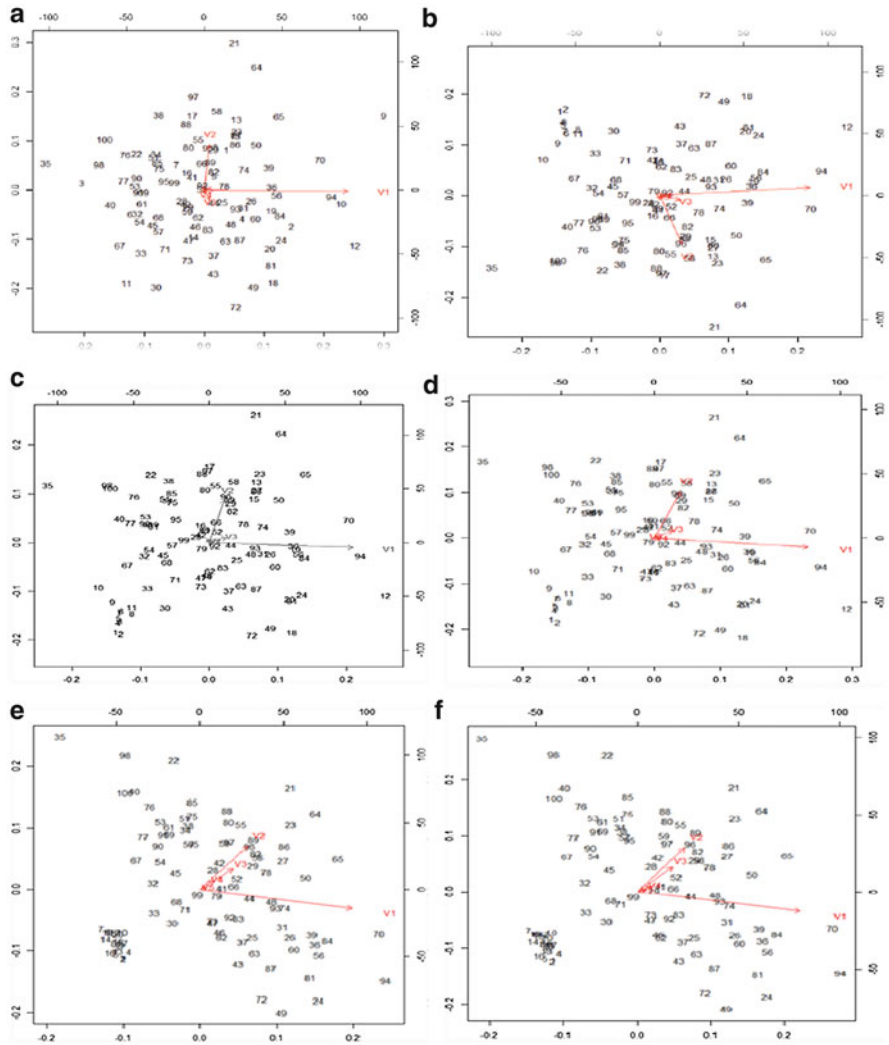


Fig. 5.2 CPCA Biplot (a), CPCA Biplot (10 % t_5) (b), RPCA_MCD Biplot (10 % t_5) (c), RPCA_OGK Biplot (10 % t_5) (d), RPCA_MCD Biplot (20 % t_5) (e), RPCA_OGK Biplot (20 % t_5) (f)

5.4 Conclusion

Classic PCA biplot, Robust PCA biplot based on MCD and Robust PCA biplot based on OGK techniques were applied to financial investment returns data and artificial data. The results indicate that the robust PCA biplots generally leads to more suitable than its non robust in the presence of outlier. Also, we saw that outliers can influence results of biplots.

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Chapter 6

Complexity and the Relationship of the State with Islam

Kamilla Sheryazdanova

The Central Asia which includes Kazakhstan is a unique region, in which the western and eastern civilizations cross. Many residents of our countries are carriers of knowledge and achievements of modern civilization. Our population is well educated and literate, and our countries could hardly be attributed to the stereotypical approach of the West against Muslim countries. That is to say, we are the peoples of the region that is radically different on all parameters from the Arab countries on the level of world view, education, development of political processes.

The Central Asia is a boundary of the Eurasian cultural, humanitarian and political space. The West and the world should be aware the importance of social and cultural role of the Central Asia, without considering its member countries only as a territory, which are rich in hydrocarbon and energy resources.

After Kazakhstan became independence in 1991, the matters of spiritual renewal, counteraction to the political extremism on a national and religious ground, establishing the tolerant relations between believers of different confessions and denominations became topical. In addressing these crucial issues the interests of Kazakhstan as a secular state coincide with the interests of the Spiritual Board of Muslims of Kazakhstan (SBM), particularly in strengthening the national unity, establishment of piece and spiritual consolidation of society.

The development of humanistic principles of Islam in the country meets the strategic orientation of country's development to build a democratic society, in which the individual rights and personal liberty, including freedom of conscience are freely approved. In our country, as well as worldwide, the largest direction of Islam is Sunnism. His confession is almost 90 % of Muslim (Амреев 2001).

In Kazakhstan, in a multiple ethnic and multi-confessional society relations between the state, society and religious groups are formed and processed for

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about 20 years-. Kazakhstan has succeeded in building an optimal model of state-confessional and inter-confessional relations, bearing in mind those realities in which we live.

The experience of inter-confessional stability of the Kazakhstan society built by the joint efforts of state and society is of great interest from other countries with multiethnic populations. Kazakhstan is an organic combination of traditions and values of the eastern and western cultures.

Kazakhstan society managed to avoid open armed confrontations and maintain inter-confessional and inter-ethnic harmony in the country due to the goals-oriented and flexible policy of our Head of the state, correctly determined the primary objectives and selection of appropriate strategies, including national security, internal political stability and consolidation of the society are highlighted in the Strategy “Kazakhstan – 2030” as the long-term priorities of development of sovereign Kazakhstan.

During the years of our independence, we could see that the development of democratic processes in the Republic of Kazakhstan and modernization of Kazakhstan’s society in up-to-date conditions have been achieved owing to the formation and development a culture of tolerance in the public mind, which is designated to retain civil peace, to harmonize the interethnic and inter-confessional relations, to facilitate in strengthening the social and political stability.

The religious tolerance becomes a great importance in Kazakhstan. Thus the feature of recent decades has been quite dynamic structural transformation of the confessional space in Kazakhstan. Currently, the total number makes up over 4,000 religious organizations represented over 40 confessions, from them 2,736 Islamic, 303 Orthodox, 1,301 Protestant, 87 Roman Catholic, 27 the Jewish community and more than 300 foreign missionaries (Закржевская 2002).

In general, the state of the religious situation in Kazakhstan is characterized as stable. Since independence the country has established the appropriate legal framework which ensures equality of rights and freedoms of all citizens regardless of their religious affiliation. Kazakhstan has managed to build an optimal model of state-religious and inter-confessional relations.

The policy of our country comes from the deep understanding that further development of the country requires not only financial investments but human factors and intellectual contributions to an even greater degree. The purpose of social development is a man and its interests. Therefore, the systemic multi-vector work on attitude development of tolerance, religious tolerance and high culture in Kazakhstan is conducted and this work is unique in the region. Systematic work for bringing the ideas of tolerance to each person is conducted.

This was a task of statesmen and scientists, clergy and mass media. At the same time it is explained that there is no place for violence in any religion. The ideas of enlightened Islam in Kazakhstan are reflected in the writings of the well-known Kazakh enlighteners Zhussup Balasuguni, Hoja Ahmet Yassavi, Chokan Valikhanov and Abai Kunanbayev. Today Kazakhstan is a leader of the social and cultural changes in Central Asia. The successful solution of problems of society

modernization, set by the President of the Republic of Kazakhstan N.A. Nazarbayev became possible due to inter-confessional and inter-religious harmony in our multi-ethnic society.

The important geopolitical location of Kazakhstan imposes a great responsibility for maintaining the peace not only inland, but also promoting its preservation outland. In order to prevent possible threats and challenges to security and stability Kazakhstan is actively developing such direction of foreign policy strategy, as the development of civilizations dialogue. The aim of Kazakhstan's peacekeeping mission is to improve the inter-civilizational situation.

Kazakhstan, in its foreign policy, considers an objective need for understanding the trends of the Islamic political movement in global environment. Any event associated with political activity of Muslims in any part of the world, the experience of confrontation and, the use of leverage to achieve the goals, almost instantly become known among the Muslims.

The events and revolutions in Libya, Egypt, Tunisia, outbursts in Yemen have convincingly shown powerful political disturbances of political movement under Islam motto, which gave legitimacy of its actions in the eyes of the society. Launched with the support of the revolution of the West for the alleged human rights and democracy against the dictatorship led to different results: instead of the existing secular states of Libya, Egypt, Tunisia, movement of the Islamic persuasion came in, sometimes radical, which has announced the creation of Islamic states where Sharia law will be enforced. Islamic remonstrative ideology serves to global calls for all Muslims, including those in the United States, Russia, Central Asia and it is impossible not to take into account these factors.

Kazakhstan's foreign policy does not cast such a well-known factor, as an appeal to Islamic unity, as the most important instrument of foreign policy of many Islamic states, especially Saudi Arabia and Iran. In this context it is important to investigate not only the level of development of Islamic ideology, but also the degree of its involvement in the worldwide process. Kazakhstan opposes any penetration of ideas of radical Islam into its territory, including the "Wahhabi jamaat", the movement of Al Qaeda and other radical movements (Мохаммад 2001).

Diplomacy of Kazakhstan takes into account the "Islamic factor", the current risk of radical Islam focuses, and all its practical actions promote actively the dialogue widespread with the Islamic world in order to reduce the risk of tension in the relationship, if any, to prevent the possible manifestations of religious and cultural intolerance. "State – Islam" dialogue can be expressed by the following formula: cooperation based on a wide range of issues for which there exist mutual understanding and peaceful coexistence of emerging contradictions.

Islam in Kazakhstan has a clear humanistic potential. The tolerance is enriched with "national" character of the confession of Islam in Kazakhstan. Whereas a number of countries of "classic" Islam are influenced by a huge temptation with their extreme forms of fundamentalism, Islam in Kazakhstan is a good example of the peaceful development of this religion and its cooperation with the secular state.

The secular states, which constitute the vast majority in today's world, have developed various forms of interaction with religious associations. Kazakhstan has chosen a common space for dialogue, neither a purely religious, nor purely secular relationships of Central Asia and Islam – that are balanced and focused on peaceful cooperation. State of Kazakhstan based on the fact that Islam of the region must be connected to global processes of intercultural, inter-civilization, and inter-religious dialogue, which allows you to unlock the humanistic potential of the religion from the other side, and does not allow to develop negative trends.

In our opinion, the interaction of state and Islam – is the best way to preserve Central Asian Islam as a stabilizing factor in regional and international security systems.

Consolidation of Kazakhstan contacts with Islamic states has contributed to further development of international relations, and the peace process, initiated by N.A. Nazarbayev, the President of Kazakhstan, becomes the foundation of the Kazakh policy to approve inter-religious harmony in the country, to promote inter-civilization norms of tolerance, which varies greatly from the policy pursued by other states. The peacekeeping mission has become unique characteristic of our sovereign state. Each country has the peculiarities, defined by the country image. And the image of Kazakhstan is peacekeeping that reflects the state's original nature associated with bright ideals. There is a match of positions of the country and the Islamic religion in this area.

In our opinion, the conditions for “invitation” of religion to modern politics have become quite mature in the modern process of world development of international relationships. That's how Congresses of World Religions, held in 2003, 2006, 2009, 2012 in Astana, the Kazakh capital, should be considered. Seventy delegations from different countries, representing Islam, Christianity, Buddhism, Judaism, Taoism, Shintoism, and Hinduism met in the dialogue area. The main theme of the IV-th Congress of world and traditional religions, which was held on 30–31 May, 2012, was: “Peace and harmony as the choice of mankind”. It was a dialogue of issues on sustainable development, multiculturalism, women in religion and related spiritual values, problems of the younger generation. The main ideas of all the congresses, held in Kazakhstan, are not only the holding of representative meetings, but a resolute opposition to religious fundamentalism as a political ideology. After all, Islam does not tolerate violence, extremism and the “plague of the XXI Century” – terrorism. Grand purpose of these congresses was not just a meeting of religious leaders, but the search for the positive influence of religion on the difficult political situation in the modern world, the humanization of international relations, and elimination of the negative effects of globalization.

Of course the held congresses of representatives of world and traditional religions, including those from the majority of Islamic countries, were effective and focused on the implementation of inter-religious dialogue. Spiritual leaders adopted joint declarations calling on all believers, regardless of their religious affiliation, to develop peace, harmony, friendship and tolerance. The Holy Qur'an says: “lead each other in good deeds” (Qur'an Koran. “Al-Baqara”, verse 143). The words “peace,” “benevolence,” “tolerance” are the key concepts of the spheres of both

international contacts and the Islamic religion. It should be noted that the formation of domestic and foreign policies of states, the work of international associations and organizations is not the main objective of religion, including Islam, however, the interaction of state with religious institutions in the formulation of a tolerant environment in the state itself and on the international arena is quite acceptable. This makes it possible for religion to have a “platform” to clarify its peacekeeping role and it works for the state’s image to a certain extent. The congresses have raised the international prestige of Kazakhstan in the Muslim world as the state that is capable of pursuing peacekeeping initiatives effectively and strengthening the overall stability in the world. These initiatives have become a real breakthrough in the promotion of human values. After all, those, who had previously attempted to gather the clerics together, did not achieve the desired results. For example, the call of Vatican II, the efforts of the King of Jordan, President of Iran Mohammad Hatami, etc.

It should be noted that Kazakhstan is developing international relations with Islamic states not only through the held congresses of representatives of world religions and non-conventional religions. One of the creative actions of the state of Kazakhstan became the initiative, put forward by the head of state, to convene the Conference on interaction and confidence-building measures in Asia, uniting in its ranks many Islamic countries of Asia. CICMA has achieved certain progress in strengthening stability in the continent for 20 years of existence.

The authorities of Kazakhstan are carrying out the policy, which is fully justified and takes into account all the realities of today’s reality, towards the Islamic Muslim organizations, such as the Organization of Islamic Cooperation where Kazakhstan was the chairman from 2011 to 2012. Countries that are part of OIC recognize the coordinating role of Kazakhstan in promoting inter-civilization and inter-religious dialogue. Kazakhstan has become a kind of international “East–west” bridge. This policy is based on an objective assessment of Islam, takes into account the cultural, educational interests and sentiments of the Muslims, establishes inter-ethnic, inter-religious peace and harmony in the society and the region. It is the correct ratio of secular state and the major religions existing in Kazakhstan that strengthen the basis of the Kazakh democratic state.

Counteraction to extremism is one of the global problems of Mankind. The extremism based on religion in the modern world escalates in connection with the globalization of economic, legal and cultural environment. This objective process inevitably generates collisions and conflict of group and human values, causes aggression among people of different cultures and religions. Traditional religious beliefs came into conflict with modern civilization (Яблокова 1998).

In the West, together with the blurring of state boundaries in the way of foundation of the United Europe, a gradual softening of the traditions is going on that causes a violent negative reaction from the confessions, defending their religious exclusiveness. In the East, the collision of tradition and modern civilization are often translated into massive bloodsheds of particular relevance in which these circumstances is the problem of overcoming mutual hostility and hatred of people, dictated by religious discord. The balance in the world, which continues

to evolve extremism and terrorism, disguised by religious shell, depends largely on the dialogue and reconciliation in the sphere of the state-confessional relations. Currently, extremism has become one of the potentially and really destabilizing factors relating to domestic policy development of the CIS countries. Suffice it to mention the existing contradictions and conflicts on religious grounds in the former Soviet Union.

The problem of extremism in Kazakhstan is linked primarily with an external factor. The evidence of law enforcement agencies testifies this, according to which foreign religious extremist organizations continue to implement and carry out its ideological influence in respect of Kazakhstan. They believe our country to be a sort of pristine virgin, therefore they seek to impose their ideas, often of radical nature, on Kazakhstan.

Of course, the world is changing rapidly, there are new geopolitical challenges, and the former ones are being reshaped. Central Asia is a complex region in respect of the religious situation. Kazakhstan is experiencing significant pressure from our neighbors on several fronts, and religion is one of these directions. In addition, religion remains the most important factor in geopolitics, which also complicates the whole situation around religion. In recent years, religious issues have been actualized in Kazakhstan. It became obvious that the country's Muslim community is not consolidated: it is undoubtedly dominated by Sunni Hanafi school of thought, but there are different others, including the radical movements. Kazakhstan is faced with the task – to preserve and strengthen the religious peace and harmony that exist in the country. We have a solid foundation; it must be maintained and developed. The state supports not only the religious harmony, but also provides the legal regulation of activities of religious associations. One important task is that of countering the penetration in our country of alien ideologies and pseudo-religious teachings. That is why the Agency for Religious Affairs has been founded in Kazakhstan. The law of the country “On the religious activities and religious organizations” has been developed and adopted. The work of the Council for Relations with Religious Associations has been intensified.

The world experience shows that the improvement of legislation on freedom of religion and state-confessional relations is also necessary for the preservation of religious peace and interfaith harmony in the country.

Vectors of foreign policy aimed at the development and expansion of friendly relations with the countries of the world, including Islamic states, Kazakhstan is building the national interests of the country on the basis of international practice, the accumulated experience of building relations between the state and religious associations of over 20 years of independence.

Secularism does not imply exclusion of religion from public life of the country. Firstly, religious groups are separated from the state, and not the religion. Secondly, the religion cannot be separated from society on principle that almost the entire population of Kazakhstan, according to official statistics is faithful, and thus society is religious.

Secularism of the state must be understood properly: religion does not interfere in the affairs of the state and the state – in the affairs of religious organizations.

But the state cannot withdraw from the regulation of state-confessional relations, this sphere is very important for the stability of the state and society. There are nuances, and they must be borne in mind, but conceptually the relationship of state and religion is as stated above. These relations cannot stay undeveloped as the life poses new problems and their solution requires the improvement of approaches in state-religious sector. Further improvement of these relations, both domestically and in international relations of Kazakhstan with Islamic states, will be implemented for the state's good and for the needs of religions, and Kazakhstan will continue to preserve religious peace and harmony.

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Chapter 7

Anadolu Agency and the New Media Order

Kemal Öztürk

7.1 Introduction

Anadolu Agency (AA) is an agency that was born after discussions of Yunus Nadi, Halide Edip Adıvar and people who set their heart on the War of Independence, in a train that was heading to Ankara from İstanbul. When the train stopped over in Geyve station, the whole team had agreed on the establishment of this Agency and had decided its name over there. When the train arrived at Ankara, Mustafa Kemal Atatürk, İsmet Pasha, Halide Edip Adıvar and a group of War of Independence volunteer discussed the issue again and the establishment of the Anadolu Agency was decided.

This decision was declared on April 6, 1920 to all over of Turkey with a telegram. In other words, Anadolu Agency was established 17 days earlier than the declaration of Grand National Assembly and 3 years earlier than the declaration of our Republic. In his telegram, Mustafa Kemal Atatürk was summarizing the duty of the agency with a single sentence: “To make Anatolia’s voice be heard all over the world”. Because there was a need for an instrument to make the War of Independence heard all over the world. The Agency took on this significant and crucial duty as a task.

On those hard times, Anadolu Agency was broadcasting English and French bulletins to tell the War of Independence to the world but unfortunately after the passing years Anadolu Agency has come to a point where it cannot broadcast English and French bulletins anymore. As of yet, AA broadcasts 1,200 photos, 1,000 news and 150 images daily. This is the strongest agency publication in Middle East, Caucasus and Balkans region.

This institution who was established 92 years ago to make Anatolia’s voice be heard over the world was only broadcasting in Turkish. After we took office,

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publications in five different languages was executed within a year. Between 150 and 200 news are broadcasted in these languages daily. AA holds the first place in Middle East in terms of broadcasting the most Arabic news in Middle East.

7.2 “Centennial Vision” of Anadolu Agency

While the studies were being made to prepare Anadolu Agency to the future, the project that we carried into effect and being discussed over for a long time, namely “The Centennial Vision” has been our road map. The Centennial Vision contains the answers for how the mission that will make Anatolia’s voice be heard over the world will be realized and what kind of an AA we will meet in the year 2020.

Our goal is to be one of the top 5 agencies in the world. A year ago, Anadolu Agency could only broadcast in two languages in terms of broadcasting languages. A few number of English news were being broadcasted. However, along with broadcasting 1,000 news and 1,200 photos in five languages, AA has achieved to enter the top 10 agencies in the world. Predicting that we will move one step each year, we are aiming to enter top 5 among international agencies in the year 2020.

7.3 We Aim to Broadcast in 11 Languages

We aim to establish a structure that is becoming widespread around the world. Within this scope, we have opened the New York and Sarajevo Offices of Anadolu Agency. We have launched Cairo and Baku Regional Directorates. We will open offices in Nairobi, New Delhi and Jakarta. We have launched Shanghai Regional Directorate.

In this context, we aim to open 9 regional directorates around the world and broadcast in 11 languages. We are going to be one of top 5 news agencies in the world when we broadcast in 11 languages, some of are French, German, Persian, Chinese and already broadcasting Russian, Bosnian, Turkish and English and publish 3,501 photos every day. Naturally, Anadolu Agency’s main setup is in Turkey. Right now Anadolu Agency is the greatest news, photo and image producer in Turkey. Seventy percent of the news in Turkey is produced by our agency.

7.4 Crisis Reporting

As the Anadolu Agency and as a result of the studies that we conducted within ourselves, we have designated several standards by identifying what kind of a method will be followed in case of great events which are called as crisis. In other words; “How should a reporter act in case of a crisis?” – this subject was turned into an intraagency directive.

War in particular, reporting in crisis environment is something else. Therefore AA's News Academy provides training for war reporting by conducting a joint project with the Police Academy and Turkish Armed Forces.

Like a soldier has to be trained before going to war, a journalist also has to be trained before going to war as well. We have to consider this situation as a job safety.

Anadolu Agency War Journalism Training Program is the third largest war training center in the world. The perception and the definition of the news is primarily important.

The second important issue on the crisis areas and periods is the security of the news. It is not possible to provide the security of the news with armed forces. We cannot also provide the security of the news with onesided broadcasts as it was done like radios broadcasting mono in 1970s and 1980s. We can provide the security of the news only with double channeled (stereo) broadcasts.

For example in Syria, Syrian News Agency SANA claims that in Damascus, there is a big blast, 150 dead in that big blast and it was done by the group "A". This is a mono broadcast. In the situation of this story being stereo, double sided, in other words our own sources, our journalists in the field confirms it, we can validate the story.

Propaganda is one of the most critical and risky issues for the journalists. Propaganda is a great problem during crisis periods. In 1991, when the Gulf War emerged, there was a story in Turkish Newspapers: "Americans made such a missile that it comes out of the ship, goes to Baghdad to hit its target, it even turns around a corner that comes in its way." The headline was "The missile that turns the corner." This was not a story that newspapers or journalists leaked from Pentagon or not the journalists' success of gathering information from analyzing Pentagon's war strategy. It was a story that was sent to that newspaper.

Usually, agencies really want to service that kind of stories. "The missile that turns around the corner" story is the most important part of the propaganda in crisis periods. The story was made to say that "You cannot get in the war with this country, if they made a corner turning missile". While we all are looking that monkey and thinking about how it is playing, discussing about the missile's turning around the corner, The Gulf War erupted without the discussion of the wars details, human rights, and "Why Kuwait was invaded?"

No corner turning missile was ever seen in The Gulf War. Missiles was seen, Cruise Missile, but no video footage of them turning a corner. Accordingly, the journalists have to watch out propaganda while looking at the monkey.

7.5 The Future Is in the New Media

The era that we are living in is one of the most important crossroads of the world that is digital revolution. Digital revolution is one of the biggest crises of the journalism sector. Every story that you see in Twitter, every message or photo that you see in Facebook may or can be a part of manipulative operation.

From the point of agencies and media organizations, there is a great process of change and transformation right now. This change and transformation has never been this effective throughout the 300 years of media history and 4,000 years of written history.

Mankind's relation with an object was never that quick either. 15 years ago, the number of worldwide internet user is 700 million. Although it has been only 15 years, this number went up to 2.2 billion people. Nothing has ever changed that fast in the history. It is an incredible change.

Accordingly, in this incredible change, media is affected primarily, readers are affected secondarily. Readers are facing an informatics salvo, actually a bomb like Facebook, Twitter and Youtube. The most common channel used in crisis times and chaotic environments is the social media.

Twitter is an environment that is greatly effective for journalists. Right now, for example, Lady Gaga has 33 million Twitter followers. Nobody else in the world has 33 million followers. Even a superpower like USA President Barack Obama hasn't got that much follower. This actually shows that Lady Gaga can send messages directly to your smartphones. Thirty-three million people actually buy Lady Gaga newspaper every day. This caused a major breaking point in Turkish press history and world media sector. Right now, we cannot fully understand the perception of the subject. Lots of press organizations forbid Twitter to their employees. On the contrary, Anadolu Agency is promoting social media to their employees. In order to be active in social media and promote the agency, we imposed obligation of Twitter accounts to every employee of Anadolu Agency.

Aikido, a defensive sport, has a very valuable philosophy. "If a great power is coming to you way, do not resist it. Use that power to attack and defend." We noticed this great power. In USA, 260 newspapers shut down in the last 5 years. Only in England in 2010, 63 newspapers shut down. In Turkey also, the press sector is facing a great danger.

New media is in the internet now. You can do everything with your smartphones. It is a trash effort, trying to block this trend by publishing newspapers, giving away magazines, book etc. In Turkey, total circulation is around five million today and all of them are AA subscribers. The press sector has to redetermine their places against this digital change.

Chapter 8

The Role and Place of Migration and Diaspora's Policy in Bilateral Relations Between Kazakhstan and Germany

Kamilla Sheryazdanova

Special place in bilateral relations of the Republic of Kazakhstan and the Federal Republic of Germany is taken by German diaspora in Kazakhstan and about one million of emigrants from Kazakhstan to the Federal Republic of Germany.

Today more than 130 nations and nationalities are living in Kazakhstan. This is the big wealth of our society and simultaneously the big concerns. One of the largest diasporas is German diaspora.

The German diaspora of Kazakhstan, formed for this period, has generated a variety of particularities, presented both historical and theoretical interest (Алексеевко and Алексеевко 2001).

Firstly, formation and development of the German diaspora of Kazakhstan were carried out in close dependence on politics of party and state authorities. It affected on such social and cultural indices of the German diaspora as employment of population, knowledge of their native language and level of education. The formation process of the German diaspora in Kazakhstan has been mainly connected with forced migrations to the Republic in 1930–1940s.

Secondly, the German diaspora in Kazakhstan combined along with German culture the elements of Russian and Kazakh cultures. It had an effect on formation of mentality, traditions and customs of the Germans in Kazakhstan.

Thirdly, migration behavior of the Germans in Kazakhstan in 1980–1990s. Analysis of reasons of emigration behavior of the Germans is very important both for common understanding of consequences of mass departure of population from the Republic, as result of it – sharp decrease of industrial active part of population, losses in skilled personnel, and for working out of appropriate measures for retention of multiethnic composition of population of the Republic (Авторитетный институт гармонизации межэтнических отношений).

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Fourthly, deepening of the democratization processes of civil society of any country, including Kazakhstan, inevitably puts on an agenda an item on further improvement of organizational and legal form of human rights protection and its fundamental freedoms. The German diaspora in Kazakhstan is an active participant of democratic transformations in the Republic. In 1997 the State program for development of the ethnic Germans, residing in the Republic of Kazakhstan has been worked out by joint efforts of the Government of RK and the Union of the Germans of Kazakhstan. In 1998 the Union of public associations of the Germans with assistance of executive secretariat of Assembly of Nations of Kazakhstan had drafted a law of the Republic of Kazakhstan on the rights of national and ethnic minorities.

Fifthly, the economic, sociocultural and socio-political potential of the German diaspora in Kazakhstan is important for establishment of foreign policy, foreign trade and cultural relations between Germany and Kazakhstan. At present time Germany is the largest economic partner of the Republic of Kazakhstan.

The importance of cooperation, developing between Kazakhstan and Germany is confirmed by the fact that 2009 was declared the Year of Kazakhstan in Germany, and 2010 – the Year of Germany in Kazakhstan.

History of the German diaspora in Kazakhstan has more than 200 years.

In general, the main stages of the German diaspora in Kazakhstan are as follows:

First stage – (Nineteenth century – 1917). The main sources of formation of the German population in Kazakhstan were peasants-settlers, state officials of tsar's administration, military servants, entrepreneurs, prisoners of the World War I, as well as the categories of people such as doctors, teachers and priests. Migration and position of some categories of people were regulated by aims and objectives of the colonial policy of tsarist Russia, while migration of others was specified by personal reasons.

Second stage – (1920–1940). At this stage we can mark out two periods. The first period during the 1920s, it was a period of original adaptation of the German population to the new socio-political and economic conditions, associated with the establishment of Soviet power. It could be described as a period of natural internal development of German villages. The second stage – 1930–1940s, it was a period of development of the German diaspora in the conditions of totalitarian system formation of the Soviet state. Population of the Germans was increased due to forced migration, deportation and labor mobilization.

Third stage – (1950–1970). The totalitarian system of the Soviet state was step-by-step reformed these years. The regime of special settlement was canceled in relation to German population and legislative acts were adopted which deemed illegal and baseless the accusations against the Germans in the 1940s of twentieth century. Since the early 1970s, the Germans were able to determine their own place of residence.

Fourth stage – (1980–1990). It is a period of mass emigration of the Germans from Kazakhstan. Against the background of difficult social – economic and political situation in the Republic the organizational structures of German

associations were gradually established. During this period, as opposed to emigration, we could observe the process of re-emigration of the Germans, the rise of national self-consciousness of the Germans in Kazakhstan, accompanying by increased interest in history and culture of its own people (Выступление Президента Республики Казахстан Н.А.Назарбаева на XII сессии Ассамблеи народов Казахстана).

Integration is a process, upon completion of which it could be a full member of other nation. The integration includes all spheres of social life and equal participation of immigrant in economic, social and cultural life of residence.

That is why it is early to make hasty conclusions about established integration based on obtaining of constant residence and workplace by the immigrant. It is possible to define a level of integration if we would know how much equitable is participation of the immigrant in using of common property resources. Essential moment of integration is temporary scales. It has been already repeatedly noticed, that integration proceeds during generations.

Nevertheless, the fact of residence in the country is neither a proof of established integration nor a guarantee of release from problems connected with integration process.

For the first time since 2003 the ethnic Germans stopped their mass departure from Kazakhstan to their historical homeland, about which they were aware of it from hearsay, and some of them came back.

In 1993 about 150 early migrated German families came back to Kazakhstan.

It was a great relief for the Government of Germany. For a long time the Government of Germany took measures with purpose to stop the mass arrival of the ethnic Germans from the Eastern Europe and the Former Soviet Union. Approximately from one million of ethnic Germans, earlier resided in Kazakhstan, about 700,000 peoples immigrated to their historical homeland. The Germans from Kazakhstan, which entered to Germany, faced the problems of adaptation in cases when they settled at new place by compact groups, communicated with each other and did not learn German language. Generally speaking it became more difficult to enter Germany. Earlier it would be enough to prove its German parentage, and now according to the new law of emigrants, currently in force in January, the emigrants should pass exam on knowledge of language. Besides there are many other restrictions.

As explained the President of Kazakhstani conflictological center Yelena Sadovskaya, the annual quota for receipt of the ethnic Germans from Eastern Europe and the former Soviet Union recently has tended to decrease.

According to the experts opinion the current policy of Germany in relation to the ethnic Germans abroad is more oriented to render assistance to the Germans over the territory of Germany. For this purpose Germany supports various cultural programs in Kazakhstan and renders assistance to small entrepreneurship.

Last years the number of emigrants is decreased: in 2007 their number amounted 38,000, in 2008 – about 30,000, that made a half of annual average for the proceeding years. In the first half of 2004, 39,159 people have applied for admission

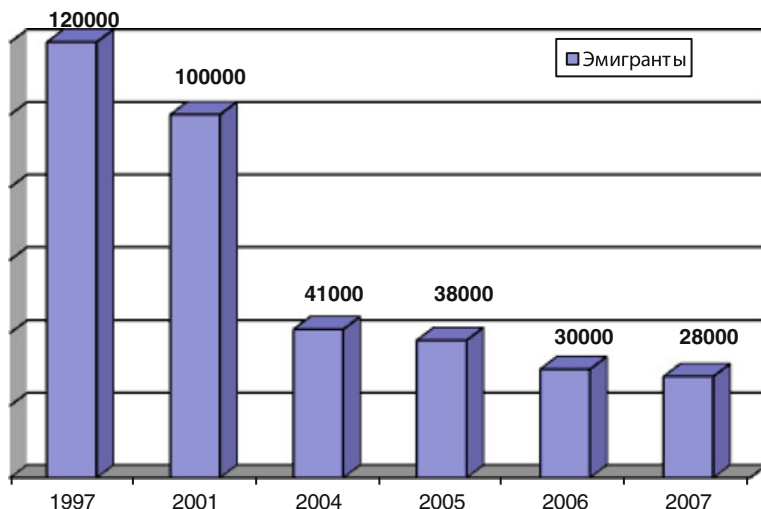


Fig. 8.1 Emigrants from Kazakhstan to the FRG, persons

as late migrants and in 2005 during the same period – 26,401 people. In 2006 about 150 of earlier emigrated German families came back to Kazakhstan (Германия – Казахстан 2007).

Today, they numbered about 300,000 people. As we know, this hard reduction was caused by both decrease of migration potential of the community and by change of the policy of Germany on this matter. Last years it was not considered as a greeting of departure, but contrariwise as some assistance to the ethnic Germans for economic and social self-realization in Kazakhstan (Fig. 8.1).

Cooperation between Kazakhstan and Germany began in 1989 from establishment of different public organizations – Union of public associations of the Germans of Kazakhstan “Wiedergeburt” and cultural centers. Over a number of further years Kazakhstan supported in full the policy of Germany in respect to the ethnic Germans.

Concerning the Kazakh diaspora in Germany it should be noted that its population is real small – more than 1,000 persons: from them about 500 persons residence in Cologne, in Munich about 400, in Berlin more than 110, in Hamburg – 34, in Mainz – 11, Frankfurt am Main – 7, Heidelberg – 7 (Дияспора казахов в Германии растет, мало кто возвращается в Казахстан). Representatives of diaspora consisted from emigrants from Turkey in 1950–1960s of twentieth century, with the exception of the late emigrants from Kazakhstan, arrived to the Federal Republic of Germany after the breakup of the Soviet Union composed of mixed families.

The principal part of diaspora is consisted from people who left the eastern regions of Kazakhstan in the late 1920s – early 1930s for reasons of forced collectivization, famine, arbitrary rule of the Soviet power.

Through Tibet and India, they moved to Pakistan, Iran, where they lived for about 10–12 years, and by reason of the war, they moved to Turkey in the early 1950s. The Turkish government has received them with understanding, providing financial and moral support and granted citizenship (Иммиграционная политика Германии: успешный – неуспешный опыт).

The next wave of the Kazakhs in Germany consisted from prisoners of the Second World War. At this time, the diaspora with support of Mustafa Shokai began to publish a journal “National Literature – World Literature” in Berlin.

One of the founders, chief editor of the journal Mazhit Aitbai under the name of Kobyzshy Korkyt, published a book “Abylai dastany”, which in 1971 was republished in Munich with a foreword by Kh. Oraltay. The newspaper “Unity of the Turks” was also published in Berlin.

The third wave was consisted from the descendants of Kazakh immigrants from Turkey who arrived in Germany as “guest workers” in the middle 1960s. Their children went to local schools; some of them gained diplomas of secondary and higher education.

Many of the older generation are yet citizens of Turkey and many young people possess the German citizenship.

In order to solve urgent problems of the diaspora at places of their compact residing in Germany the Kazakh cultural centers were formed and are operating in Germany now. In particular, in 1998 the Kazakh cultural center was organized in Munich (since October 2007 chaired by Abdurrahman Unal), then in 2001 in Cologne (from October 2007 chaired by Abdulgani Makin). On March 2, 2003 was established the “Kazakh Society in Berlin” (Chairman – Zhunusbek Toraman).

One of the most significant and important for the Kazakh diaspora's event “Year of Kazakhstan in Germany” was a registration of Federation of Association of the Kazakhs in Europe in July 2009 in Germany (Munich), consolidating under its own aegis the Kazakhs from eight European countries.

Chairman of the Federation of European Association of Kazakhs, a doctor Abdulkaiym Kesichi presented this organization on November 5, 2009 in Cologne at the Kazakh-German Forum “Intercultural dialogue in Kazakhstan – Progress through Diversity.”

With the assistance of the Kazakh society of cultural and interethnic concord in April 2009 in Munich was held the European Conference of the Kazakh diaspora on the subject “Issues on identity and integration of young people of the Kazakh diaspora in German-speaking countries” and the first meeting of the youth of the Kazakh diaspora, residing in European countries.

Thereby based on the above-mentioned, it can be concluded that the Republic of Kazakhstan and the Federal Republic of Germany are combined by common problems of repatriation and adaptation of ethnic groups at the historical homeland. The ethnic factor is one of the most actual problems in bilateral relations.

The current policy of the Government of Germany concerning ethnic Germans abroad is more oriented to render assistance to the Germans beyond the territory of Germany. For this purpose Germany supports various cultural programs in Kazakhstan and renders assistance to small entrepreneurship.

From 2004 to 2007 in the line of the Ministry of Internal Affairs of Germany about seven million Euros was allocated to support the ethnic Germans in Kazakhstan. The programs for humanitarian support of the needy, the old and sick peoples, for linguistic training of young people, for raising of occupational qualifications of the ethnic Germans were financed by means of these funds. The last direction of work in social sphere is the most effective – about 80 % of the trained persons immediately were employed (Казахская диаспора в Германии).

In order to support the interests of the German diaspora in Kazakhstan, there is German-Kazakh intergovernmental commission on problems of the ethnic Germans, living in the Republic of Kazakhstan, the sixth meeting of which took place in October 2006 in Berlin. Following the results of it, it was signed a Protocol on amendments and supplements to the Agreement on cooperation between the Government of the Republic of Kazakhstan and the Government of the Federal Republic of Germany for support of the citizens of the Republic of Kazakhstan of German nationality dated May 31, 1996. This Protocol provides for the prolongation of the long-term cooperation with the Government of Germany for rendering of assistance to the ethnic Germans living in the Republic of Kazakhstan.

We would like to mention some terms of this agreement. Kazakhstan guarantees to the Germans from Kazakhstan the equal rights with all other citizens, the right to use freely their own language and to disseminate information on it, liberty of speech, conscience and public associations, rights to free contacts, ethnic and cultural originality, to participate in the management of public affairs and equal rights before the law. The rights of the Germans for free movement and choice of residence, departure from Kazakhstan and coming back are specially stipulated in this agreement (Конституция Республики Казахстан от 30 августа 1995г). Herewith the property rights of departed and arrived persons are guaranteed. For execution of this agreement the parties agreed to establish the joint commission with the participation of the citizens of German nationality. The Government of the Republic undertook not to levy taxes and customs fees the humanitarian and charitable aid, rendering services and technical assistance, carried out through international cooperation. In return the Government of the Federal Republic of Germany promised to implement projects of the intergovernmental commission, to render assistance in the technical equipment of agricultural enterprises, in the medical and social fields and staff training, as well as to support schools in German language, to provide them with necessary literature.

International round table “Overcoming of obstacles of economic development of the German diaspora in Kazakhstan” was held in German House on March 18, 2007.

Expressing concern in relation to the mass emigration of the Germans from Kazakhstan, being aware that it causes the irreparable damage to the national, economical and demographic security of sovereign Kazakhstan, wishing to stabilize the German diaspora and to secure the foundations of its sustainable development, as well as to realize the full potential of the Kazakh-German relations in the interests of two countries, wishing to raise their relations to the proper level, the representatives of the Executive Office of the President and the Government, the various departments and ministries in the Republic of Kazakhstan, UN missions and embassies of the Federal Republic of Germany in Kazakhstan, scientists and leaders of public

organizations, which took part in the international round table, discussed a number of proposals for both Governments and international missions in Kazakhstan and abroad, which were able to assist in solving of these immediate problems.

Since the early 1990s the Government of Germany rendered assistance to the German diaspora in CIS countries, conducting of cultural, economic, humanitarian and other programs.

Thanks to the goal-oriented assistance, representatives of the German diaspora as citizens of their country had the opportunity to participate actively in processes taking place in those countries. The rendered assistance based on the principle "help to self-help" and took into account social environment.

The support program of the Ministry of Internal Affairs of Germany is directed to support of meeting Centers operation, out-of-school study of German language, educational work with children and young people, vocational education and training, as well as assisting in the social and humanitarian sphere. The Ministry of Internal Affairs of Germany promotes cultural and educational activities.

The program of the Federal Government of Germany is implemented within the framework of OSCE in accordance with agreements of the Council of Europe on protection of national minorities and bilateral treaties. Its purpose is to eliminate prejudices and to defuse tensions between titular population and national minorities that is an integral part of an active peace policy.

The Federal Ministry of Internal Affairs (BMI) bears the political responsibility for the program. The Federal Administrative Office (BVA) is responsible for administrative implementation. The German society on technical cooperation (GTZ) is engaged in implementation of projects in Russia, Ukraine, Kazakhstan, Kyrgyzstan and Uzbekistan.

Representative office of GTZ in Almaty coordinates the programs of the Ministry of Internal Affairs of the Federal Republic of Germany on support of the German diaspora in Kazakhstan, Kyrgyzstan and Uzbekistan. The underlying principle of work is joint planning, preparation and carrying out of measures.

Important area of activity is a rendering of humanitarian assistance to the socially needy. Social stations, which are organized in Astana, Karaganda, Kokchetau and Kostanai, distribute free lunches and provide medical assistance. Each year within the framework of the action "Winter aid" humanitarian deliveries for pensioners and disabled persons are organized. Since 2004 the Representative office of GTZ in Almaty (BMI) organizes and delivers the targeted humanitarian aid of the German Red Cross (DRK).

Representative office of GTZ in Almaty and its partners keep in touch and develop partnership relations with regional administrations, state and municipal educational, cultural and social institutions, public health organizations, as well as other non-governmental bodies and enterprises.

Important partners in Kazakhstan are Association of the Germans in Kazakhstan "Wiedergeburt", 18 regional societies of the German diaspora, the German-Kazakh Entrepreneur Association (DKAU), as well as vocational-technical colleges and social institutions.

Thereby the main goal of cooperation between Kazakhstan and Germany is strengthening of positions reached earlier by the Germans from Kazakhstan and

determination of principal directions and opportunities for their integration in Kazakhstan society. The Council of the Germans and its Bureau is a strong and experienced team capable to solve problems of 350,000 German peoples at the intergovernmental level.

The ethnic Germans obtain support in cultural sphere through many programs, which are held by society “Wiedergeburt” across the country. Twenty-three organizations of “Wiedergeburt”, located in the regions of the ethnic Germans residence, are worked under the guidance of head organization “Council of the Germans” in Almaty. The centers of this organization financially supported through training programs, organized and conducted by the embassy, Institute named after Goethe and the Society for Technical Cooperation (GTZ). In addition, the Institute named after Goethe provides financing to the German theater in Almaty (Deutsches Theater Almaty (DTA) (Мендикулова 1997).

Institute for International Relations (ifa) renders financial assistance to the newspaper (a half owned by state) “Deutsche Allgemeine Zeitung” (DAZ) by means of financing of one of the journalists from Germany. Support of the ethnic Germans in the sphere of culture is complicated by the continuing departure of the ethnic Germans to Germany. This phenomenon on the one hand reduces a number of the task group and on the other hand the knowledge of German language of remaining part became worse, regardless of the large offer of German language courses.

Associations of the Germans in Kazakhstan. In 1989 in Kazakhstan began an active process of self-organization of the German ethnos by means of establishment of various public associations – societies “Wiedergeburt” and cultural centers.

In 1992 at the first congress of the Germans of Kazakhstan, it was decided to establish the Republican public organization “Wiedergeburt”, combined all the regional communities to represent the interests of all Germans in Kazakhstan. In 1996 this organization was registered among the first in the Ministry of Justice, after that it was called “Union of public associations of the Germans of Kazakhstan “Wiedergeburt”.

The highest management bodies of Association consist from the Chairman and the Council with powers between conducting of Congresses. Executive Body of Association is Bureau of the Germans Council in Kazakhstan located in the German House, which implements the statutory tasks of Association, decisions of congresses, meetings of the Councils of Germans of Kazakhstan. The German Federal Government based on the Kazakh-German agreements renders assistance to the Kazakhstani Germans for overcoming of repressions and acquisition of prospects for national conservation and development among other nations of Kazakhstan (Немецкая диаспора в Казахстане вчера, сегодня, завтра?).

On August 25, 1994 in ceremonial atmosphere the Federal Ministry of Internal Affairs of Germany provided to the Bureau of the Germans of Kazakhstan a German House in Almaty and rendered corresponding assistance. Due to the interest of governments of two countries, Association of the Germans has become a subject of international relations and has affected on the revival of their own ethnic group. In spite of the difficulties of the reform period, consequences of emigration of the most part of the ethnic Germans the Association consistently created the conditions

for self-organization of the Germans, their social security, revival of the language and culture for solidarity and mutual responsibility.

Association of the Germans in Kazakhstan cooperates with Germans organizations from Russia, Ukraine, Kyrgyzstan, Uzbekistan, Turkmenistan, Tajikistan, Germany (Community of Russian Germans, Union of outcasts), Denmark (Union of the Germans in North Silesia). Association of the Germans is an active member of the Federal Union of European national minorities, which presented in the European Union.

Conducted in 1995 the meetings of the President of Kazakhstan N. Nazarbayev and the President of Germany R. Herzog with the leaders of Kazakhstan's German public organizations emphasized the political, economic and social importance of the German ethnic groups residing in Kazakhstan.

The German Council is working in close cooperation with the Government of Kazakhstan. In 1993 the Cabinet of Ministers of the Republic of Kazakhstan approved "Comprehensive program of ethnic revival of the Germans living in Kazakhstan" (21.10. 1993 under No. 1040).

This program has been continued on April 23, 1997 the Regulation of the Government of the Republic of Kazakhstan "About additional measures for revival of the ethnic Germans living in Kazakhstan" was issued.

Association of the Germans, thanks to partnership relations with the Federal Ministry of Internal Affairs of Germany, Embassy of the Federal Republic of Germany in Kazakhstan, the German Agency for Technical Cooperation, Goethe Institute in Almaty, IFA-Institute (Institute for Cultural Relations), the Government of Kazakhstan, Assembly of Nations of Kazakhstan and many other state and non-governmental organizations on the basis of actual operated structure has been working on the principal directions of social development of the German ethnic group:

- Study of German language
- Development of German culture
- Social support of those-in need
- Youth outreach
- Support of entrepreneurship
- Publication of German printed media

Six schools with intensified study of German language are successfully operating in Kazakhstan.

The regional, municipal and provincial societies, cultural centers and Centers of meeting are responsible for operation and development of the German national culture. Republican newspaper "Deutsche Allgemeine Zeitung", the German TV show "Wir Deutschen" and the German radio program promote to spread information on culture. Since 1997 as agreed with the German Society for Technical Cooperation medico-social stations on the basis of regional German societies, funded by the Government of Germany were opened (Официальный сайт Ассамблеи народа Казахстана).

Work of social stations is organized by the regional societies through an expert on social stations of the bureau of the German Society for Technical Cooperation.

The Union of German youth was established under the Council of the Germans in Kazakhstan in 1996. The Council of the Germans in Kazakhstan plans to consolidate the youth associations in the Central Asia region, to conduct regional conferences, study tours and seminars. The Youth work includes an international youth exchange, training and professional development by means of: linguistic camps, working conferences/seminars, computer clubs in Astana, Karaganda, Kokshetau, Petropavlovsk, Ust-Kamenogorsk, Zhezkazgan, Aktobe, Taldykorgan and Shymkent and internet clubs in Kokshetau and Karaganda. Vocational education of young Germans of Kazakhstan is conducted in schools and colleges (in the framework of the Kazakh-German cooperation) with the further prospect of employment. For development and realization of creative capacities of young people were opened the following shops: in Karaganda – souvenir and joiners shops, in Kostanay and Taraz – tailor’s workshop.

The “Kazakhstan – German Association of businessmen” has been registered in 2004. The support of entrepreneurship is directed to: consolidation of businessmen, analysis and consultations on business – planning, formation of databank of business- projects, search of foreign partners and financings, communications with governmental and other structures in Kazakhstan and Germany concerning the matters on support of small business, arrangement of visits of the European partners.

The important role in solving problems of Kazakhstan’s ethnic groups played the Assembly of Nations of Kazakhstan, founded in 1995. The Assembly unites all national and cultural centers and all representatives of the ethnic groups and has a status of advisory body at the President of the Republic of Kazakhstan.

The Assembly’s activity is directed to solving of the following tasks:

- Assistance in preservation of interethnic concord and stability in the country;
- Elaboration of proposals for conducting of public policy, contributing to the development of friendly relations between the nationalities living in Kazakhstan, assistance in their spiritual and cultural revival and development based on the principle of equality;
- Assistance in taking into account of multiform of national interests in national policy, carried out by the state.
- The Assembly of Nations of Kazakhstan became an institutional coordinator of interethnic relations in multicultural Kazakhstan society and strengthens the state sovereignty, integration in world community, growth of the image of the state in the international arena.

The idea of foundation of the Assembly of Nations of Kazakhstan has been set forth by the President of Kazakhstan N.A. Nazarbayev at the first ethnic forum of the country in 1992, at which the Chief of State has emphasized: “Not one generation of Kazakhstani people created our main property – friendship of people. Reconsidered all over again, the Kazakhstani people has not right to overspend its own abundances, to forget its heart-warming traditions. They were not formed during last decade and not by communist instructions. It is necessary and important

to hear daily a voice of each people and any nationality. That's exactly why it is necessary to conduct forum on a constant basis, to found the new public institution".

Today the Assembly of Nations of Kazakhstan has become an important element of political system of Kazakhstan, combined the interests of all ethnic groups, to ensure strict observance of the rights and freedoms of all citizens notwithstanding their nationality. Defining its priorities, the Assembly of Nations of Kazakhstan sets responsible goals and objectives: to strength the rebirth of statesmanship, to protect human rights and freedoms and interests of people and state, to move on to a new level of development, that meets the requirements of the civilized world community.

The Assembly with purpose of development of cultures and languages of ethnic groups, living in Kazakhstan, carries out festivals of Kazakhstani nations, festivals of languages, competitions of pupils of weekend schools on knowledge of state and native languages, international and republican research-to-practice conferences and seminars concerning language policy, "round tables", devoted to actual problems of ethnocultural development. The ethnographic museums of the various people living in territory of Kazakhstan are opened in many regions and cities of the Republic, and such people as Uigurs, Germans, Koreans and Uzbeks have their national theatres.

The future of national security and internal political stability in conditions of political ethnicity the country makes actual a necessity of development of new conceptual directions of ethnic interaction in Kazakhstan, directed on formation of united civil equivalence. For national revival and self-affirmation of the state it is necessary to strengthen the interethnic confidence. Concord, consolidation, understanding of interests and demands of each other, mutual assistance in their achievement are necessary.

The important priority for Kazakhstan is strengthening of originality of all ethnic groups, equitable development of all ethnic groups. The state plays a great role in ensuring of equality of interests. The modern state becomes a center of public institutions, connecting together the personality, social preferences and their realization.

On February 3, 2009 the President of the Republic of Kazakhstan Nursultan Nazarbayev has officially opened the Year of Kazakhstan in Germany. During this visit the meetings of two Leaders of the States, as well as Kazakh-German business forum were conducted. Within the frameworks of the Year of Kazakhstan in Germany about 100 measures will be conducted. These are political meetings, economic forums, cultural and humanitarian, educational and other projects which have been directed on development of bilateral relations (ОҢЖАНОВ 2009).

As explained by the Chairman of the East Kazakhstan regional society "Wiedergeburt" Anatoly Vize: "During our meeting the Minister on Affairs of Migration of Germany and the State secretary Mister Bergner had noted that the 'German diaspora is an original bridge, public diplomacy between Germany and Kazakhstan'. And it is quite true: this public diplomacy helps our countries to develop and strengthen our relations in all spheres of life. Evident of it is an announcement of the Year of Kazakhstan in Germany".

One of the functions of legal and social state which declares Kazakhstan about itself in the Constitution is ensuring of national, racial and confessional equality of citizens. Attitudes of the state first of all to legal protect of national, racial and confessional equality in many respects defines stability of civil society and personal security of citizens of the country.

The state establishes legal guarantees of equality of all citizens in all fields of economic, political, social and cultural life notwithstanding their national and racial origin and confession.

There is no division of united people into the titular nation and other nationalities in the Constitution of the Republic of Kazakhstan. It expresses the general civil principles of statesmanship, construction of the multinational state.

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Chapter 9

Complex Adaptive Leadership for Performance: A Theoretical Framework

Füsun Bulutlar and Rifat Kamaşak

9.1 Introduction

Traditional and hierarchical views of leadership became obsolete and less useful given the chaotic and the complex nature of our modern and dynamic business world (Lichtenstein et al. 2006; Boulton 2010; Houghlum 2012). In such an environment, leadership behaviors shifted from “relying on simplistic cause-and-effect relationships to embracing a more interdependent view of the world” (Houghlum 2012, p. 29). This complex, systemic, somewhat post-modern and independent worldview is delineated by the chaos-complexity theory in management and organization literature. In this study, the complexity theory along with the complex adaptive systems (CAS) will be investigated and the critical leadership behaviors that will establish the basis for complex adaptive leadership will be examined.

9.2 Leadership

Having trait theories of leadership become out of date, contingency leadership theories which tried to give recipes of good leadership behaviors in different situations emerged. However, contingency leadership theories were also found insufficient and regarded as the ones that describe what a good manager is. Therefore, most of the leadership theories strived to classify leadership behaviors and styles in terms of traditional management theories which have often presented organizational phenomena based upon discrete, divergent categories such

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as autocratic or democratic, formal or informal, and task oriented or relationship oriented, directive or laissez faire (Denison et al. 1995). The underlying assumption of those theories was that leaders or leader behaviors could be divided into diverse categories and these categories, in turn, could be paired with specific situations to achieve efficiency. Nevertheless, leadership in complex environments is not about clichéd actions and characteristics that are transferable to infinite contexts. Upon recognition of the paradoxical nature of leadership and occurrence of a paradigm shift towards emphasizing contradicting styles or behaviors that could indeed fit in multiple opposing situations (Denison et al. 1995), more flexible and complex theories of leadership began to emerge (Avolio et al. 2004a, 2009; Avolio and Luthans 2006).

These theories like transformational and authentic leadership (Avolio et al. 2004a; Avolio and Luthans 2006) drew attention to the fact that, even though some traits are important, leadership skills can also be improved. Before proceeding to develop a new model of leadership which will suit complex environments, the conceptual formulation of one of the latest leadership theories; authentic leadership theory, which is founded on transactional and transformational leadership theories and is in a way their enhanced form, needs to be explained in order to answer how leadership skills can be improved. For example authentic leadership has two main components; self-awareness and self-regulation. Self-regulation in turn has four dimensions; internalized regulation (setting internal standard)s, balanced processing of information (collecting and interpreting the information regarding the leader in an unbiased way, even if the information is negative) relational transparency (being open, sincere, and intimate besides establishing mutual trust in close relationships), and authentic behavior (which can be described as being the true self; acting in accordance with saying) (Gardner and Schermerhorn 2004; Gardner et al. 2005; Avolio and Luthans 2006).

The main premise that these theories lie upon is the fact that the leaders are change agents and especially the authentic leaders have the ability to transform their followers (Avolio and Luthans 2006). Additionally, Avolio and Luthans (2006) strongly suggest that these traits and abilities can be developed. Depending on this thesis, millions of dollars have been spent by the companies all over the world in order to develop the leadership abilities of their employees via several training programs (Lynham and Chermack 2006). Despite these efforts, leadership models of the last century have been effective for mediocly internationalized, mostly production oriented companies which used to operate in relatively stable environments, but are not well-suited for a more knowledge-oriented, information technology eminent, transnational companies which operate in astatic economies. Such as, Luthans and Slocum (2004, p. 227) suggest that “faced with an unprecedented economic, technological, socio-political, and moral/ethical tumultuous sea of change, there is a need for new theories, new applications and just plain new thinking about leadership”. In response to the need of a new leadership approach, several other theories were developed such as humble and complexity leadership theories. Although complexity leadership perspective seems to suit best for complex

environments, we would like to discuss about humble leadership and also by taking into account the authentic and transformational leadership theories with the expectation of proposing some additional issues to be considered. However before discussing the proposed model, more detailed explanations about the complexity and complex environments in which the contemporary companies have to operate should be given.

9.3 Chaos-Complexity Theory

The Chaos-complexity theory is based on observations that many systems including organizations and also many distinct systems like insect colonies, stock markets, weather etc., are nonlinear and do not obey simple laws. Although Chaos theory has developed from the pure sciences, it was instantly employed in management literature as well. Complexity theory, which is a more recent development, is similar enough to be combined with chaos theory. In chaos theory, simple laws can have complicated consequences whereas, in complexity theory, complex causes can produce simple effects, or complex systems can result in simple behavior. In chaotic systems, minute changes in the initial condition of processes can produce enormous changes in the outcome. Complex systems are chaotic in nature and can develop through a process of feedback on itself (Gribbin 2004). Gribbin (2004, p. 143) defines the complex system as “a system that is made up of several simpler components interacting with one another”. According to Edward Lorenz (1972) the famous mathematician and meteorologist who postulated the so-called “butterfly effect”, a butterfly flapping its wings in Brazil can cause a tornado in Texas, where chance nuances or events can lead to widely differing outcomes when fully played out.

To summarize, complexity theory hypothesizes that complex systems attain order through uncontrolled interactions in which various agents are involved. These interactions in turn produce unpredictable consequences (Plowman et al. 2007). Marion and Bacon (1999) postulate three main characteristics of complex systems:

1. The whole is greater than the sum of the parts, therefore dividing the whole does not ease understanding it (Peters 1992).
2. Understanding all of the inputs does not necessarily predict outputs stimulated by complex systems.
3. Behavior of complex organizations, which are placed at the edge of chaos, is neither predictable nor unpredictable. In other words, order and chaos exist together.

Despite many definitions of Complexity Theory, there has been no consensus on one unified description (Kontopoulos 1993; Lissack 1999; Axelrod and Cohen 1999). Complexity theory can be broadly defined as “a new set of ideas that transcends the physical, biological, and social sciences” (Schneider and Somers 2006, p. 354). Dent (1999, p. 5) describes complexity science as “an approach to

research, study, and perspective that makes the philosophical assumptions of the emerging worldview”.

At this point, to be able to understand this vague phenomenon it will be more advantageous to discuss it within the scope of management. The application of complexity to management starts with systems thinking. In systems thinking the universe is deemed as an enormous, interconnected, and interdependent whole (Kielhofner 1995). A system is a collection of elements that get together for a common purpose or function. While interacting with the environment, open systems have the ability to adopt and reorganize (Smith and Humphries 2004). The extension of this theory presupposes that upon feeding sufficient energy into systems of complexity, from chaotic states, new states of organization can emerge spontaneously (Haken 1987). Given these facts, a different type of leadership rather than the conventional leadership styles is needed. Complexity science tries to satisfy this need by suggesting Complexity Leadership Theory. In order to theorize this, it is necessary to narrow the complexity theory described above and the basic unit of analysis in complexity science should be uncovered. Scientists name this basic unit as complex adaptive systems (CAS) (Lichtenstein et al. 2006; Schneider and Somers 2006; Uhl-Bien et al. 2007), which are neural-like networks composed of interacting and interdependent agents that are connected in a dynamic system where mutual goals, attitudes, and needs exist (Uhl-Bien et al. 2007; Hanson and Ford 2010). These are unstable structures having multiple, overlapping hierarchies, and they are linked with each other in a dynamic, interactive network just like the individuals that they consist of (Uhl-Bien et al. 2007). In complex adaptive systems, leadership may be crucial to the process of self-organization and leaders might serve as context setters and designers of learning experiences (Brown and Eisenhardt 1997; Pascale 1999). In these systems, leadership is not only providing conformity of followers but it is deeply influencing them, therefore it does not rely on formal authority structures. In fact, to be able to stimulate the process of emergence or self-organization it generally contradicts to the formal authority structure (Schneider and Somers 2006). The required leadership properties might also differ, as such; the leaders serve as identifiers and influence other persons and processes (Marion and Uhl-Bien 2001). Marion and Uhl-Bien (2001) pointed out that command and control leadership has been regarded as a barrier rather than a gateway to organizational success in literature. Within this framework, leadership in complex systems incorporates interactions between agents that may occur in multi-dimensional processes (Avolio et al. 2009; Taylor et al. 2011). In complex environments, events are not predictable and traditional forms of focused, top-down leadership styles are expected to be ineffective (Schneider and Somers 2006).

However, as Marion and Uhl-Bien (2001) have also emphasized, previous leadership theories should not be undermined, and complexity leadership theories should be excelled under the light of such theories. Therefore, from hereinafter the complexity leadership theory along with its possible modifications with the help of traditional leadership theories will be discussed.

9.4 Conclusion

Despite the massive discussion about leadership roles and highlighting the importance of enabling, for the sake of not including personal attributes, the possible behaviors or traits that could facilitate this enabling function is not included in the Complex Leadership theory. It is claimed that leadership is emerging and it emerges through the interactions within complex adaptive systems. However, there is no evidence or necessary attributes for enabling leadership to emerge. In our opinion, in order to emerge and function as an enabling leader, some personal attributes are needed. In this phase, we think that authentic attributes are the underlying factors in emerging enabling leaders. Because, authenticity can be defined as “being the true self”, and thereby authentic leaders are defined as:

“those who are deeply aware of how they think and behave and are perceived by others as being aware of their own and others’ values/moral perspectives, knowledge, and strengths; aware of the context in which they operate; and who are confident, hopeful, optimistic, resilient, and of high moral character” (Avolio et al. 2004b, p. 4).

As it can be noted from the above given definition, these leaders are aware of the context, so they can be proactive in predicting the possible interactions of administrative and adaptive functions and act in a way that could foster creativity. Their resiliency is also a necessary attribute for complex ambiguous systems as such they can easily change at the edge of chaos. Additionally, although the behavior and style of these leaders may vary from participative to authoritarian, their behavior is under the guidance of deeply rooted personal values and convictions, as a result, they are credible, respected and trusted by followers. Hence, they can perform administrative, adaptive and enabling functions successively by catalyzing adaptive dynamics and manage the entanglement between administrative and adaptive leadership. Authentic leaders also encourage diverse viewpoints and build networks of collaborative relationships with followers (Avolio et al. 2004b). Authentic leaders, therefore, promote trust, encourage people to build on their strengths, broaden their thinking, and help them to believe that their decisions are valuable and right (Jensen and Luthans 2006). Hence, they can serve as mediators who are capable of unrevealing emergent leaders at any level.

This study aims to discuss and develop a theoretical framework that includes the necessary leadership attributes within the complex adaptive systems. The framework presents an integrative perspective of leadership that focuses on effective and necessary leadership attributes, reactions and interactions that are expected to create positive organizational performance in complex and chaotic environments. In addition to this, the dynamic systems theory that explains the spontaneous emergence of new organizational states by channeling sufficient energy that arises from chaotic states into the systems of complexity can also be integrated with the framework for extension purposes. Hence, in this article, we tried to develop a new model of leadership behaviors that would fit the requirements of complexities that occur in and out of the organization.

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Chapter 10

Chaos According to Teachers Attending PhD Programs and the Chaos Management in School

Elif Gamze Özcan and Hilal Zehra Uzun

10.1 Introduction

Changing of environment in which action exists so frequently and fast is a sign of experiences working organizations having in chaos environment (Mutlu and Sakinç 2006, p. 2). Today in which intense changes occur organizations have to fight against *Technology, Globalization, Rivalry, Change and Speed* (Tetenbaum 1998, p. 23).

The reason for many manager and transactors to look for way out when they encounter unpredictable and complex situations is their desire for avoiding the uncertainty. In fact, when managers understand chaos theory well, they know that these unpredictable situations are parts of a normal system and they organize their system according to that (Ertürk 2012, pp. 858, 859).

In this system chaos cannot be fully controlled but can be guided (Dolan et al. 2003, s. 26). In the management of education, there is no prescription which has standard rules and is considered as a best education method because linearity and predictability are impossible in educational management. Considering today, we cannot map the future.

With this research how chaos approach in Educational Administration which is included in Social Science because its subject area is human relations in educational organizations discipline is interpreted has been researched. Therefore, studies have been carried out on teachers from official formal education who are considered more conscious about management process in schools because they study for doctorate. Their sense about chaos and how chaos in schools is handled have been managed.

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10.2 Method

The study in which descriptive method is used has been carried out with teachers who study in the departments of Educational Administration at Ankara, Hacettepe, Gazi Universities and Middle East Technical University. The entire current universe has been included. Ten people who have been ascertained to create the universe have been communicated and data has been collected from eight of them. Semi-structured interview form which has been used as data source has been prepared upon the consultation of a professor from Hacettepe University. Participants are asked to answer seven questions about chaos and how chaos is managed in schools.

1. What is chaos?
2. What are the factors that lead to chaos in schools?
3. Why do chaotic situations happen in your school?
4. Is reaction shown in case of chaotic situations in your school?
5. Who shows reaction against chaotic situations in your school?
6. What kinds of reactions are shown against chaotic situations in your school? Would you please give an example?
7. According to you, how does the school management manage the chaos?

The analysis of data has been made through codification according to term from data.

10.3 Findings and Interpretation

Codes and personal information of participants who compose research staff take place in Table 10.1.

10.4 Description of the Term ‘Chaos’

Participants have described the term Chaos with 18 terms; regularity in irregularity, tumult before balance, complexity, obscurity, obscurity of factors, disturbance emerged from different expectations, conflict, irregularity, miscommunication, fight, randomness, solutionlessness, anxiety-causing, unpredictability of process, uncertainty, restlessness, disbelief, blank. The terms “regularity in irregularity” and “tumult before the balance” show the positive; and the rest of 16 terms show the negative perspective of the participants about the chaos. Viewing the descriptions of participants, it can be said that there is a common sense that chaos is a threat

Table 10.1 Information of participants

Code	KG28	KG31	KH31	KH32	KA32	KO33	EG38	EH32
Sex	Female	Female	Female	Female	Female	Female	Male	Male
Age	28	31	31	32	32	33	38	32
University	Gazi	Gazi	Hacet tepe	Hacet tepe	Ankara	ODTÜ	Gazi	Hacet tepe
School type	Secondary School	Secondary School	Anatolian High School	Vocational High School	Vocational High School	Vocational High School	Anatolian High School	Primary School

in school ($f = 27$). Irregularity in regularity, tumult before balance, obscurity of factors, blank and unpredictability of process are close to the terms which explain chaos in management process; which can be found in Tetenbaum (1998, p. 25), Töremen (2000, p. 204), Erol (2008, p. 135), and Ertürk (2012, p. 858).

10.5 Situations which Cause Chaos in School

Participants have stated that there are 15 situations which cause chaos in their schools. “Unfair treatment of school management towards the teachers”, “students who are disrespectful, aggressive, and uninterested in the lessons” and “communicational problems” are the prominent ones. The situations which cause chaos mostly arise from the weaknesses of school management ($f = 18$).

10.6 The Reason of Chaotic Situations in School

Third question asked in order to make clearer the sources of the chaotic situations. We can infer from the answers and the frequencies that, participants point thorough the terms “school management does not do the necessary regularities” and “not fitting in the time” that the sources of chaotic situations in schools are intramural situations ($f = 10$). Besides, it is important that participants point the educational policies as the reasons for chaotic situations and legislations which are the reflections of these educational policies are open to different interpretations ($f = 8$).

It was investigated whether the chaos which was regarded as a threat in schools was responded or not. Half of the attendants expressed that the chaos was reacted in the schools. This finding shows that, the necessary steps couldn't be taken while the management process should have run for turning the chaotic states into the advantages are remarkable.

10.7 The Organ of Reaction to the Chaos in School

It was asked from the attendants who responded to the question 4 affirmatively to respond to this question which researched who reacted to the chaos in school. School management and teachers are seen as the organs of reaction to the chaos in school ($f = 10$). Attendants coded KG28 and KG31 answered the previous question though they expressed that chaos hadn't been reacted in their schools. The reason for that may be the other organs, rather than the school managements, react to the chaos and the inadequacy of this react.

10.8 The Examples of the Reactions to the Chaotic Cases in School

It has been recorded that attendants gave examples to the chaotic cases for question 6; the change of the school form with the new education system, management's neglect to students' desire for having a seminar, inability to deliver the serious information to everyone, the physical inadequacy of the schools as there are many new branches, the tumult or noise students create during the courses or the breaks, their habit of smoking, student fights, constant change of the schedule and the threat of the ministry investigation to hinder the education. It has been detected that the reaction to the chaos has been given mostly by the management-teacher cooperation ($f = 4$).

10.9 The Ability of School Management to Manage the Chaos

Question 7 has been asked to investigate the reaction of the school management to the chaotic cases and whether the school has a certain strategy or not. Two of the attendants who thought that reaction were given to chaos found the school management partly successful. Only two attendants expressed that school management managed the chaos successfully.

10.10 Results and Discussion

The result that can be inferred from attendants' concepts interiorized from the theoretical literature, chaos and chaos management in schools were completed in the theoretical studies by using the sense that was in the school organizations, but the studies about commenting about the school applications according to theoretical ground didn't become common.

Participants attributed the states which made them feel the chaos to the many variants which affected the school and this arises from the nature of the chaos. It is an efficient reaction that necessary reactions are given cooperatively by the school management and teachers as it increases the extent of the response. But it is remarkable that attendants see the school management as the primary response organ to chaos and the participants generalize that the school is managed badly and the school management is not efficient in reacting.

Only the half of the participants expressed that chaos was reacted. Another matter which should be discussed comes from this point. "School Development Management Team" studies are legal necessities for asking the shareholders about

the works, detecting and doing what is necessary. This establishment has the power of making the decisions together with the school management and application. What should be discussed is why this power can't be used as required while the opportunity of awaking the internal dynamic of school is legally available with this way. School management and teachers should determine the measures and apply together as they face the chaos together. By this way, they can make their school productive along with providing the school activity.

The concepts 'leadership' and 'chaos' can be handled as related to each other (Erçetin et al. 2013, p. 90). When considered from this point of view, it is necessary for teachers as well as school managers to adapt to current conditions and take the lead to achieve this. Taking the necessary political steps to make the personnel willing to take more and more responsibilities in the organizations is necessary to provide chaos management before it's too late. Otherwise, it is clear that chaos will not be managed and its results won't be positive.

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Chapter 11

Chaos Approach in Educational Administration

Hilal Zehra Uzun and Elif Gamze Özcan

11.1 Introduction

In the administration literature, it is seen that articles about chaos and complexity approach has started to be published since the middle 1990s (Koçel 2007, p. 489). The idea that the chaos and complexity approach will enable businesses and organizations and their operating features to be understood much better has been developing by spreading as a result of the developments in the communication and information process technology which characterized the environment in the early twenty-first century.

With this study, it has been researched how the chaos approach, which deals with the human relations in the education organizations and so takes part in the Social Sciences, is interpreted in the Education Administration field.

11.2 Method

The study has been figured by the survey model. The data have been obtained from the books, articles and thesis written in this field and analyzed in a style based on the descriptive method. The obtained results have been examined and discussed in details.

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11.3 The Findings

11.3.1 *The Term ‘Chaos’*

Chaos, in the most general sense, is a situation in which elements behave irregularly and independently at a time and place not to enable to be described and put in a category (Erol 2008, p. 135). According to Gleick, chaos is the form of the physics’ uncertainty in the social sciences (2005, p. 6). If we are to say something more detailed, chaos concept seems to remind the crisis, disorder, imbalance, inconstancy, rapid and constant change and as a result of all these; unpredictability that results from the plans’ being upside down, tension, the fear of the unknown, system breakdown and the hard effect of the crashes (Farazmand 2003, p. 348).

But the disorder in the meaning of chaos is not just a simple mess or disruption (Öge 2005, p. 286; Dereli et al. 2006, p. 24). In another words, even though chaos concept means complexity and disorder from an external perspective; chaos concept means the disorder that is unpredictable and has figures which are lawless and similar for the scientists, in brief, a complexity that has an aim (Tetenbaum 1998, p. 25; Töremen 2000, p. 204).

11.3.2 *Chaos from Theory to Approach in the Light of the New Science*

Chaos concept and the approach was started by French mathematician Jules Henri Poincare in his book “Science and Methods” in which he told multivariate systems didn’t have permanent solutions and solutions would be in a vibrant position that could last forever and this position wouldn’t enable anybody to predict about the future in the systems (Öge 2005, pp. 286, 287; Erçetin et al. 2013, p. 90). Since the beginning of the twentieth century, invents in the physics have started the questioning about the mechanic understanding. Relativity and Quantum theories have planted the seeds of organic and monolith idea rather than the mechanic idea by turning down the Newtonist approach (Karaçay 2004, p. 5; Mutlu and Sakinç 2006, p. 5; Ertürk 2012, p. 850).

The most important contribution to the approach was made by Edward Lorenz who realized that the temperature figure rates changed while he was showing the temperature figures by keyboarding data and there were quite different functions. Lorenz, who observed that the rises and falls in the chart had a line like a butterfly, commented that weather forecasts couldn’t go beyond the short-term figures because of the chaotic behavior and so it wasn’t possible to estimate about the system that showed behaviors which weren’t periodic.

In this case, it can be said that the idea that all situations and events which can be observed in daily life and appear to be irregular and incidental are part of a system can qualify the process of transforming from the classic science to chaos (Öge 2005, p. 286).

11.3.3 Chaos in Educational Administration

One of the most important social science subjects affected by chaos approach is administration (Ertürk 2012, p. 853). It is asserted that using of chaos approach in administrative science started with the using of general systems theory in this area (Koçel 2007, p. 374). In other words, system theories form the ideational basis of chaos and complexity (Erçetin 2001, p. 36).

Formerly, namely in the beginning of twentieth century, administrators formed standard ways following each stage in administration process and tried to determine the best and only method that would give maximum efficiency (Öge 2005, p. 290). However, unpredictable future is determined by the effect of non-linear strong actions (Erol 2008, p. 137; Töremen 2000, p. 210; Öge 2005, p. 292; Yeşilorman 2006, p. 77; Mutlu and Sakınç 2006, p. 5).

Chaos approach presents a new administration paradigm for administrators and leaders. This paradigm is based on the assumption that although everything is known, there is something unknown (Ertürk 2012, p. 860). Educational systems are non-linear systems where everybody tries to learn specific things in specific times and develops their ideas about linear order of both micro and macro activities. In such an age, in order to deter the chaos, educational managers should make information and communication widespread in his/her organization, be open to new and creative ideas, place emphasis on team work and project management, provide diversity for different ideas to be produced in organization and while doing this, he/she should consider the values that must be preserved (Tetenbaum 1998, pp. 27–31). Çobanoğlu (2008, p. 114) brought out new suggestions including that the organization should be reconsidered about the subject, management method should be changed, small changes should be benefited from to create strong effects and appearing and state of nature should be integrated.

Leaders shouldn't determine a vision or make a long-term plan while practicing these, instead, they should stipulate the terms for innovations resulting from internal dynamic of system in terms of strategic problems (Öge 2005, p. 292; Hubler et al. 2007, p. 11). For employees to adapt themselves to each new situation they should be trained to acquire new skills and they should emphasize on the need to notify the principles with order in disorder beforehand and during balance and explain the nature of chaos and change to employees (Öge 2005, pp 297, 298).

11.3.4 Chaotic Situations in Schools

Schools are the organizations which are under the influences of one or more secret or plain factors and have the aim of creating different effects in the same time (Ertürk 2012, p. 862). Well-administered small factors can cause strong and positive results is a matter that educational managers who evaluate the chaos in a right way shouldn't miss. Because, if improvement and innovation are seen as necessary in education, they should start doing this from the lowest level of the system, not from the top. For example, multiple intelligence theory can be used as a solution offer to chaotic order in classes. In multiple intelligence theory, teachers accept that students have different skills, tendencies and capacities and categorize them differently according to these factors and lead them to benefit from the course more effectively. In evaluation process, teachers do not accept wrong behaviors and information as random. Rather they consider them as feedback to correct the information or regulate the behavior (Ertürk 2012, pp 861, 862).

Another example has also been given by Ertürk about acts of violence in schools (2012, p. 862). While explaining the causes of violence in schools, one of the chaotic cases, 'butterfly effect' is used unwittingly. The frequency of watching series or films containing violence, which is an extra scholastic factor, is seen as one of the cause of acts of violence in schools. This situation is seen as an example of sensitivity to initial conditions.

According to Ertürk, managing the schools in a way which will appeal to the individual features of students makes them think that they will have more knowledge and skills owing to the education system (2012, p. 862). And this makes them curious. In this case, teachers try to be more knowledgeable to present more activities and knowledge to fulfill the expectation of students. This situation reflects both on education system and all systems in the country. Therefore, chaos becomes a stimulus for education by creating a triggering effect.

11.4 Discussion and Result

In educational administration, there isn't something like 'standardized and best' regime the rules of which are definite (Ertürk 2012, p. 863). The reason for this is that in educational administration, linearity and predictability aren't possible. Future cannot be determined by evaluating the present. In other words, managers cannot rule their organizations according to standardized rules.

It is true that students take stimulants from the environment and use them, which is one of the most important parts of the educational system. In this case, the function of teachers shouldn't be conveying information as in the past; instead, it should be teaching the students how to react to stimulants from the environment in chaotic atmosphere they are in and how to use these (Ertürk 2012, p. 864). Therefore, variables from the environment should be evaluated and used to develop

this system. In other words, people and organizations should learn to create chaos instead of order and so they can form an order and system with which they can respond to changing environment (Töremen 2000, p. 206). In this system chaos cannot be fully controlled but can be guided (Dolan et al. 2003, p. 26).

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Chapter 12

Uncertainty, Complexity and Fuzzy Logic

İbrahim Özkan and I. Burhan Türkşen

12.1 Introduction

A Google search with keywords leadership and uncertainty yields millions of result. This is not surprising. Life is uncertain, knowledge is limited and measurements are imprecise. Future events can only be predicted with some confidence. Naturally decisions must be made in uncertain and complex environments. Leaders must make decision under uncertainty and in many cases uncertainty itself becomes the real problem for leaders. Uncertainty is a central theme for freedom. It makes us free to choose. It lets us use our heuristics for everyday decisions. More often decisions are made with criteria that satisfy our needs as put forward by Simon (1956). In some cases there may not be an optimal course of action. In some other cases there may not be a scientific method to find an optimal action. In all cases still we make decisions under uncertainty. Because of a rich and sub-optimal criteria for decisions, we are free to choose. In other words, freedom is a product of uncertainty.

Uncertainty is a central property of life and it has long been an important scientific research area. There is no commonly accepted theory of uncertainty in the literature. There are some attempts to construct uncertainty theories in mathematics (see for example, Liu 2004, 2010). Uncertainty theory might be a subject of a specific branch of mathematics that deals with human uncertainty that is usually

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not sufficient. It is generally a subject of several theories such as fuzzy logic (FL), probability theory (PT), complexity theory and philosophy, etc. There are different views and thoughts about uncertainty. These views and thoughts are all related with the nature of problems in different fields. For example, according to Walker's theory of uncertainty (2001), uncertainty has three dimensions and six types in legal fact-finding. Smithson (1989) sees uncertainty as the part of *incompleteness*. Knight (1921) and Keynes (1936) viewed uncertainty as something "*simply we do not know*". Uncertainty is seen in psychology as; (i) the psychological perception that creates fear and (ii) the motivation of communication (Edwards 1954; Becker and McClintock 1967; Koller 1993). There are countless examples where uncertainty can be found as the core of the problem. According to Weber (1997, 1999) these views are epistemologically biased. He states;

[...] the concept of uncertainty is epistemologically biased, in that uncertainty is viewed as an attribute of how we know what we know. This epistemological bias has led to the development of four branches of uncertainty literature based on an actor's (individual, group, or organization): (1) ability to gather and process information; (2) ability to predict consequences of actions; (3) use of intuition; or (4) perception of the environment. (Weber 1997, p. 455)

To start with explanations, more often we start with dictionary definition of uncertainty. One common definition of uncertainty is "*the state of being uncertain*". There are several meanings of "*uncertain*" used in natural language. Some examples are; not known, not definite, not sure of something, not precise, fuzzy, vague, contradictory, etc. For example, some information and knowledge are usually presented using some words that have no precise definitions. "*About*", "*approximately*", "*roughly*", "*low*", "*high*", "*big*" are some examples among them. Humans do understand them and communicate effectively using them. According to Parsons (2001), the meaning of the word "*uncertain*" falls into three categories. Something is uncertain because; (i) it hasn't been measured accurately enough, (ii) because it might change and (iii) the person who has the information is not confident.

The emphasis of this chapter is mainly on uncertainty and handling of uncertainty specifically with an application of FL. After the introduction of FL, fuzzy system modeling is introduced with a special application of perception based decision making. There are several attempts to classify the uncertainty with different points of view. We start first with a summary about taxonomies and studies about uncertainty in some selected fields. We want to express that the summary is rather incomplete since this is a topic of vast research area. It is then necessary to discuss little bit about the logic of handling the uncertainty.

12.2 Uncertainty

If one argues that perfect knowledge is not available, then it is self-conclusive that there is not only one theory of uncertainty. Uncertainty has been studied in many fields during the last few centuries. Discussions on uncertainty are frequently

encountered in the following fields, but not limited to them; decision science, artificial Intelligence, legal fact-finding, economics, medical science, organizational open system theory, psychology, physics, etc. In this section we attempt to discuss these concepts briefly since the research is voluminous.

Klir and Folger (1988) gives six groups of meanings for the term uncertain from Webster's New Twentieth Century Dictionary: (i) not certainly known, questionable, problematic, (ii) Vague, not definite or determined, (iii) doubtful, not having certain knowledge, not sure, (iv) ambiguous, (v) not steady or constant; varying, (vi) liable to change or vary, not dependable or reliable. Parsons (2001) also states that Collins English Dictionary gives the meaning of 'uncertain' in similar manner. Among other dictionaries, Webster's Ninth New Collegiate Dictionary also gives similar meanings. Although some words like "confident", "precisely", "accurately" contain *linguistic uncertainty* in their meanings, still it is possible to understand what is being defined. Uncertainty is a cognitive process. It is appropriate to give some perspectives from selected fields.

12.2.1 *Game of Chance, Decision and Probabilities*

One famous historical example is Bernolli's St. Petersburg paradox,¹ which is a game problem that shows probabilities may not be sufficient for betting under uncertainty. Initially, discussions were more probabilistic in a sense and later they were enhanced by twentieth century philosophers for real world probabilities. Again Bernolli's definition of '*moral certainty*' (Bernstein 1998) is a good example of an attempt to give a meaning of certainty. According to this, an event can be said certain if that event happens '*1000 times in 1001 trials*'. Otherwise all the events that do not conform to this principle are said to be uncertain events. In most scientific research, we test our hypotheses with some criteria, or "*with a confidence interval*". Generally speaking, it is necessary to follow such steps, otherwise the complexity of real world problems cannot be simplified and solved. Game of chance may not be a subject of uncertainty as put forward by several philosopher. For example, Keynes stated that:

By 'uncertain' knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty... The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence... About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know. (Keynes 1937)

¹The paradox asked the price of a game that has the following expected return: $E(y) = \sum_{k=1}^{\infty} \frac{1}{2^k} 2^k = \frac{1}{2}2 + \frac{1}{4}4 + \dots = 1 + 1 + 1\dots = \infty$. Daniel Bernoulli solves this paradox by assuming that the utility of the return is decreasing with increasing wealth.

According to Keynes, uncertainty cannot be measured by means of probability since uncertainty represents the matters where there is no scientific methodology to calculate or assign probabilities to them. He also described uncertainty as something that *nobody knows*. Similarly, Knight (Knight 1921, p. 219) before Keynes, expressed that “if the real probability reasoning is followed out to its conclusion, it seems that there is ‘really’ no probability² at all, but certainty, if knowledge is complete.” Both Keynes and Knight expressed that there is a relation between knowledge and uncertainty. According to them, uncertainty represents a situation about an event when the underlying probability distribution is unknown while risk³ represents a situation about an event when the underlying probability distribution is known.⁴ Uncertainty is viewed as “*lack of knowledge*”, “*bias*” and “*psychological perception*”⁵ in at least some of many disciplines (Koopman 1940a, b; Simon 1997; Henderson and Nutt 1980; McCalla 1992; Hey 1993; Baird 1989).

We would like to give a meaning of uncertainty in the *game theory*, since a new meaning is brought to uncertainty in this context. Earlier theories accepted uncertainty as a fact of life and did little to identify its sources. Game theory states that the true source of uncertainty in a game lies in the intentions of players. Every decision we make is the result of a series of negotiations in which we try to reduce uncertainty by trading off the expected payoff. One may see that the uncertainty as a motivation of the understanding and communication which is similar to the interpretation in psychology.⁶ Von Neumann (1928) is one of the founder of Game Theory (See von Neumann 1928, p. 13, n.1. The paper was received by *Mathematische Annalen* on July 24, 1927). To summarize his thought about uncertainty the following quote is taken from Bernstein (1998):

A colleague interested in probability analysis once asked von Neumann to define certainty. Von Neumann said first design a house and make sure the living-room floor will not give way. To do that, he suggested, “Calculate the weight of a grand piano with six men huddling over it to sing. Then triple that weight.” That will guarantee certainty.

²Probability has been discussed and used to deal with uncertainty. There are different ways to classify the thoughts on probability theories (about the meaning of the probability), as for example, “objective”, “subjective”, “epistemic”, “logical relationist”, “propensity” views of probability. For the discussion on this we refer to several philosophical contributions. Bernoulli (1713), Laplace 1795- ‘*Exposition du système du monde*’; von Mises 1928; Reichenbach 1949; Piere 1910; Popper 1959; Ramsey 1926; Bruno de Finetti 1931, 1937; Knights 1921; Keynes 1937). We skip the discussions on probability theory.

³Risk and uncertainty are used interchangeably in many situations (Baron 2008)

⁴Keynes defined probability as a logical relation. It is a “logical connection between one set of propositions which we call our evidence and which we suppose ourselves to know, and another set which we call our conclusions and which we attach more or less weight to the grounds supplied by the first” (Keynes 1973). Keynes’s theory of probability is based on a logic in which the *degree of belief is sustained* under specific circumstances.

⁵Uncertainty is thought to be then converted to fear that motivates to take some action. In this view it is a cognitive process.

⁶All the tools are created in order to overcome the uncertainty in the context of our cognitive process.

The discussions on game of chance lead to the idea of separating expected return with expected utility. Von Neumann-Morgenstern completed the Theory of Games and Economic Behaviour in 1944.⁷ Based on Expected Utility Theory (EUT), the “rational” way to make decision is to maximize the expected utility. To understand more about the real life problems, these discussions were held in toy domain. However imperfect knowledge in real life makes life difficult for the proponents of EUT. Friedman and Savage (1948) proposed the axioms of subjective expected utility theory. To show the systematic deviation from the EUT, Allais (1953) published “*Allais Paradox*”. Thus, Non-Expected Utility Theory (NEUT) came into existence. In late 1960s decision under ignorance revived. Instead of *normative* theories, researchers started to look for more *descriptive* theories of decision. Several seminal contributions have been made for decision under uncertainty (sometimes called as under “*ignorance*”, “*risk*”). Among the contributors, Kahneman and Tversky (1979), Tversky and Kahneman (1992), Machina (1982, 1987), Fishburn (1982), Kahneman et al. (1982), Lichtenstein and Slovic (1971) can be given.

12.2.2 *Legal and Medical Legal Fact-Finding*

In this context, we briefly discuss the uncertainty from the view of Walker (2001), where generally in legal fact finding, inferences are uncertain and decisions are more difficult. According to Walker (2001), the central task in legal fact-finding is evaluating the warranty for finding an inference from the evidentiary proposition to a conclusion. In case where inferences are uncertain, this task becomes more difficult. Walker gives two examples of the general problems behind uncertain inferences which are, (i) distinguishing the scientific knowledge from the “*junk science*” and (ii) evaluating inferences about unique historical events. A principle goal is the generation of findings that are accurate and warranted by the available evidence. In other words, fact-finding in a legal context must have its “*epistemic objective*”. Walker also proposes that uncertainty has three dimensions which are *linguistic*, *logical* and *causal*. We will touch upon this taxonomy later.

Edwards (2002), states that the inference from evidence can be about the characteristics of the evidence, or of the data generation process that produces the evidence. According to him;

The medical-legal model [...] treats observations as unique, it does not need, and indeed typically has trouble using, any notion of sampling. Observations occur with probabilities that depend on what state the world is in, but nothing like sampling is involved in collecting or interpreting them. In fact, I don't really know where the probability of an observation, given the state of the world, comes from. It is simply a number that can be judged by a human being.

Since some taxonomies about uncertainty will later be given, it will be argued that probability may not be sufficient as a scientific approach for handling uncertainty.

⁷Due to the war-time difficulties, it was first published in 1953.

12.2.3 Taxonomies

Researchers have tried to identify the different types and dimensions of uncertainty. Among them, Smithson (1989), Smets (1997), Bosc and Prade (1997), Klir and Yuan (1995), Walker (2001) and Parsons (2001) can be mentioned.

Smithson (1989) breaks down Ignorance (or non-knowledge) into two categories that are *Error* and *Irrelevance*. In Smithson's taxonomy, uncertainty is a part of *Incompleteness* which results in from *Errors*. Moreover, uncertainty is split into *Vagueness*, *Probability*, and *Ambiguity*. *Vagueness* is also split into *Fuzziness* and *Nonspecificity*. His taxonomy gives us some hints about handling of uncertainty where both fuzzy theory and probability theory are useful.

Smets (1997) proposes that uncertainty and imprecision are the basic parts of ignorance. Furthermore, uncertainty can be split into objective and subjective uncertainties. Objective uncertainty can be random or likely. On the other hand, subjective uncertainty can be believable, unreliable and irrelevant. Data with and without errors are the subclasses of imprecision. His taxonomy splits data without errors into, *approximate*, *fuzzy*, *vague*, *incomplete* and *deficient*. Data with errors can be split into categories of *Incoherent*, *Incorrect*, *Inconsistent*, *Inaccurate*, *Invalid* and *Conflicting*.

Dubois and Prade (1988) define the items of information as a quadruple of *attribute*, *object*, *value* and *confidence*. In this context, they distinguish the concept of imprecision and uncertainty in a way that, imprecision relates to the content of *value* of information. Uncertainty relates to its truth or the *confidence* of information. According to them, the uncertainty of an item of information can be assessed by means of *probable*, *possible*, *necessary*, *plausible*, *credible* or similar qualifiers. For the imprecision there are other qualifiers such as *vague*, *fuzzy*, *general* and *ambiguous*.

Bosc and Prade (1997) suggest that uncertainty arises from a “*lack of information*” closely related to the probability theory proponents which assess the probability as lack of knowledge. According to Bosc and Prade, ignorance can be split into, *imprecision*, *vagueness*, *uncertainty* and *inconsistency*. Uncertainty can be split into objective which is related to propensity and subjective which is related to the belief.

Klir and Yuan (1995) identifies three basic types of uncertainty. These are, *nonspecificity*, *strife* and *fuzziness*. Klir also argues that *nonspecificity* and *strife* are well captured by the term ambiguity (which they relate to one-to-many relation). *Nonspecificity* includes variety, generality, diversity and imprecision. *Fuzziness* includes *vagueness*, *cloudiness*, *haziness*, *unclearness*, *indistinctness* and *sharplessness*.

According to Walker (2001) theory of uncertainty has three dimensions in legal Fact-finding. These are, linguistic, logical and causal dimensions. First it has a linguistic dimension since inconsistent propositions are still propositions and expressed in language. Languages carry the words that have ambiguity and sometimes linguistic expressions have inconsistency which vanishes once they are correctly understood. Clarification of the meaning or reference can disclose

the inconsistency. Secondly the strongest form of inconsistency is the logical inconsistency. It is demonstrable by considering the logical relationships among propositions and the meanings of the propositions. Theory of uncertainty should identify inferences that are warranted by the rules of logic. Thirdly, the conclusions based on the data depend on a *causal* account of how the study was designed and how the data were gathered. Walker classified the uncertainties into six types for scientific evidence about generic causation. These are; *concept uncertainty*, *measurement uncertainty*, *calculation uncertainty*, *sampling uncertainty*, *mathematical modeling uncertainty* and *causal uncertainty*. Each type of uncertainty arises at a distinct step in the scientific process of warranting a conclusion about generic causation.

As the summary of taxonomies point out there are several keywords that appear in the context of uncertainty. They have no precise meaning at all. They have characteristics of information uncertainty. Before we discuss the handling of uncertainty, it may be useful to review the sources of uncertainty in information.

12.2.4 Sources of Uncertainty in Information

One can list several reasons behind the information uncertainty. A partial list would include:

- Concepts that are ill-defined
- Concepts that are *fuzzy*
- Incomplete knowledge of the domain of the problem
- Reduction of the problem⁸
- Assumptions employed to simplify the concepts⁹
- Imprecision of the language that is used to describe the events

Even in the case where the above list is absent, uncertainties in information may come from variety of sources:

- Aggregation of Information from different sources
- Unreliable information sources
- Subjective sources
- Data may be stored in terms of statistical measures and hence it inherently contains uncertainty

⁸Many decision theoretic books start with examples in complex world and then they provide one natural approach to simplify the complexity with an application of divide-and-conquer strategy. In simple terms, this leads to reductionism.

⁹Friedman (1953) in his famous article states that the models can only be evaluated in terms of their explanatory (or predictive) power. They cannot be evaluated in terms of the assumptions employed or whether the model is sufficiently complicated enough to capture relevant details of real life.

- Data may include irreducible uncertainty¹⁰
- Incomplete data (data may not be available¹¹)
- Data cleaning and pre-processing (missing value treatment, transformation of the data, scaling etc.).

In real world, information and knowledge have a complex nature and using some quantitative measures such as probability may be found to be difficult and or time to time misleading. It appears that humans tend to use heuristics as the first tool for reasoning under uncertainty. It is a quick and dirty way of handling uncertainty (Parsons 2001). There is a need for a formal system to handle uncertainty to ensure that the information is effectively used. There are three widely studied systems that can be found in literature for this purpose. They are the probability, the possibility and the evidence theories. In this chapter, we focus on possibility theory or in particular Zadeh’s Fuzzy Logic and Fuzzy System Theory. Both the probability and the evidence theories will be untouched since they are out of the scope of this chapter.¹²

12.3 Fuzzy Theory

After Zadeh’s (1965) introduction of Fuzzy Logic and Fuzzy Sets, a vast volume of literature appeared about fuzzy logic and fuzzy system modeling (FSM) in particular. There are at least two advantages of FSM that attracts researchers: (i) its power of linguistic explanation with resulting ease of understanding, and (ii) its tolerance to imprecise data which provides flexibility and stability for prediction. But, very few studies, if any, have been devoted to the study of the “Philosophical Grounding of Fuzzy Theory” since then. For this purpose, we briefly review the ontological and epistemological foundations. We ask certain essential questions. Our inquiry contains seven steps as shown in Table 12.1. These seven steps are re-stated for Classical theory in Table 12.2 and Fuzzy theory in Table 12.3. Next we expose newer insights to be gained by the grand paradigm shift from the classical to the fuzzy theory. Naturally, this is a limited partial exposition (Turksen 2006).

Ontology lays the ground for the structural statements that are either equivalences for the case of the classical theory or uncertainty intervals for the case of the fuzzy theory. Furthermore it states the Laws of Conservation based on assumptions of existences.

¹⁰For example, in quantum mechanics, Heisenberg’s uncertainty principle states that both position and momentum of the particle cannot be precisely calculated.

¹¹It is not necessary that the data are not observed. Data may be made incomplete for security reasons or due to legal issues.

¹²We would like to encourage interested readers to examine both theories and their role in reasoning under uncertainty.

Table 12.1 Hierarchy of levels of theoretical inquiry and their questions

Application Level	vii. How do people, decision-makers, feel, think, behave, and interact? How can we provide them with better decision-making tools? “How can we provide them with a better PNL?”
Domain-specific epistemological level	vi. How do we validate knowledge appropriately in this domain specific field? What methodological approaches are appropriate to it? “What ought to be ‘Domain specific’ PNL for validity of our investigations?” v. What can we know or hope to learn within this domain-specific field or discipline? What are the limits or boundaries to it? “What specific expressions of ‘Domain-specific’ PNL could and should be used to specify the limits or boundaries of our knowledge?”
General epistemological level	iv. How do we validate our knowledge? How do we know it is true? What criteria do we use to assess its truth-value? “What PNL expressions cause the assessment of truth and knowledge?” iii. What is our access to truth and knowledge in general? Where is knowledge and its truth to be found? How or from what are they constituted? “What PNL encoding allows us to assess truth or knowledge?”
Ontological level	ii. What is our position or relation to that Reality (if we do assume that it exists on level 1 below)? “What PNL expressions capture our positions to reality?” i. Is there any reality independent or partially independent of us? Does any absolute truth exist? Does fuzziness exist?

Table 12.2 Positions taken by classical set and logic theorists on the hierarchy of levels of theoretical inquiry

Application level	vii. Emphasis on mechanistic Super additive systems theory of interactions, relations, equations, etc.
Domain-specific epistemological level	vi. Validity and methodology dictated by meta-physical theories, e.g., principle of determinism, symmetry, invariance and randomness v. Objective facts and truth accessible, but limited only by e.g., subjective distortions (introduction of uncertainty)
General epistemological level	iv. Correspondence theory of validity only objective iii. Objectivist, empiricists, certain
Ontological level	ii. sRo Cartesian dualism i. Realism, crisp meaning representation of linguistic Variables and connectives are defined with two-valued sets and logic theory. Equivalences in “normal forms” together with classical laws of conservation, as well as formulae for Belief, Plausibility, Probability, etc.

At this level, our inquiry is to be stated as:

What linguistic expressions can capture our positions to reality in Computing with Words (CWW)?

What, Precisiated Natural Language (PNL), expressions can capture our positions to reality?

Table 12.3 Position taken by some of fuzzy set and logic theorists on the hierarchy of levels of theoretical inquiry

Application level	vii. Emphasis on humanistic Decision and Control Systems that contain highly complex non-linear interactions, relations, equations, etc.
Domain-specific epistemological level	vi. Validity and methodology dictated by Meta theories of Modal Logics. e.g., principle of non-determinism and overlapping patterns v. Subjective and objective facts accessible by perceptions and meaning representation of linguistic terms of linguistic variables, linguistic quantifiers and linguistic connectives Principle of uncertainty
General epistemological level	iv. Correspondence theory of Validity both objective and subjective Approximate Reasoning iii. Subjective-objective, experimental and empiricist, e.g., expert and fuzzy data mining based
Ontological level	ii. $s \xleftrightarrow{R} o$ schema gives credence both the Level subject and the object interaction i. Realism – fuzzy and uncertain Generation of “Fuzzy Canonical Forms” that are not equivalent to each other in contrast to “Classical Normal Forms”. Generation of new Laws of Conservation for t-norms, co-norms, Belief, Plausibility, Probability, etc.

What are the basic equivalences or uncertainty intervals and the Laws of Conservation that capture our position to reality?

This theoretical inquiry shown in Table 12.1 is stated in general terms in classical theory as shown in Table 12.2 and in terms of the fuzzy theory in Table 12.3.

Since our aim is to expose the fuzzy theory in contrast to the classical theory, we would like to introduce the fuzzy theory in a very brief manner. We suggest readers make their own interpretations as they move from the classical to the fuzzy theory.

Briefly in the fuzzy theory, every element belongs to a concept class, say A, to a partial degree, i.e., $\mu_A: X \rightarrow [0,1], \mu_A(x) = a \in [0,1], x \in X$, where $\mu_A(x)$ is the membership assignment of an element ‘x’ to a concept class A in a proposition. Unfortunately most of all concepts in fuzzy theory are assumed to be definable to be true to a degree.

However on the ontological level, the positions taken by fuzzy set and logic theorists on the Hierarchy of Levels of Theoretical Inquiry shown in Table 12.3. In particular, subject, s, in relation, R, to object, o, schema gives credence to both levels, i.e., subject and object interaction. Furthermore, CWW expressions ought to be structured on the basis of meta-linguistic axioms of Fuzzy Set & Logic Theory. These meta-linguistic axioms generate an interval of uncertainty between the Fuzzy Disjunctive and Conjunctive Canonical Forms, FDCF and FCCF (for details see Türkşen 1986, 1996, 2002, 2006, 2007). An investigation of the meta-linguistic axioms and the associated combination of concepts for any two fuzzy sets A and B, when they are represented by fuzzy sets, turns out to generate an interval of uncertainty whose boundaries are defined by FDCF and FCCF.

It should be further emphasized that in CWW, the imprecise and varying meanings of linguistic connectives should not be *precisiated* in an absolute manner. Since in the fuzzy theory, our position is that there is no absolute *precisiation* of the meaning of words. This provides a framework for the representation of *uncertainty* in the combination of words and hence in reasoning with them as a foundation for CWW.

12.3.1 Perception Base Decision with FL

In modeling human decision process, one may distinguish the descriptive and prescriptive type approaches. In these approaches, descriptive modeling attempts to identify system structure that capture the behavior characteristics as best as it can, whereas the prescriptive modeling attempts to determine the best approximate reasoning schemas that produce the best prediction of system behavior for a given descriptive model.¹³ Human decision processes depend on the perceived world and a decision maker faces uncertainties at any stage of a decision process.

According to mainstream theoretical studies, rational individuals use all the available information during the expectation formation process and they optimize the expected value of a well defined objective function under the assumptions of von Neumann and Morgenstern's expected utility theory. The assumptions of von Neumann and Morgenstern's theory may not be fulfilled since most real world probabilities are imprecise or immeasurable. Even if it is a measurable case, when there is a tolerance for imprecision which can be exploited through granulation to achieve tractability, interpretability, robustness and economy of communication, there is a rationale which underlie granulation of attributes and use of linguistic variables (Zadeh 2005). Furthermore, as discussed above sections, uncertainty may appear in different forms such as ambiguity, vagueness, discord, imprecision and fuzziness (Klir and Yuan 1995). It is an attribute of information and information is a generalized constraint on the values which a variable is allowed to take (Zadeh 2005). Uncertainty is the key ingredient of the most, perhaps all, real life decision making problems. Under these circumstances, it becomes necessary to use uncertainty as a source of information that may be helpful to reasoning. As Zadeh (1997) pointed out, information can be analyzed by perception based theory of approximate reasoning which is a generalization of classical reasoning that contains the capability to operate with perception based information. Fuzzy logics and the fuzzy sets lay the grounds for this kind of information processing and decision making.

Following Zadeh's seminal paper on Fuzzy Sets (1965) and Fuzzy Decision Analysis (Belman and Zadeh 1970), during 1970s and 1980s the principles of

¹³See Baron (2008) Chaps. 5 and 6, for a clear exposition of descriptive and prescriptive modeling in decision making.

the fuzzy theory were applied to the classical statistical decision theory. These contributions include “fuzzy acts” (Asai et al. 1975; Tanaka et al. 1976, 1977, 1978), “fuzzy events” (Asai et al. 1975; Tanaka et al. 1976, 1977, 1978), “fuzzy probabilities” (Dubois and Prade 1984; Whalen 1984), “fuzzy utilities” (Jain 1976; Yager 1981; Rommelfanger 1984; Whalen 1984), and “fuzzy information” (Asai et al. 1973; Tanaka et al. 1976, 1977, 1978), “fuzzy linguistic modeling” (Herrera et al. 1996; Herrera and Herrera-Viedma 2000; Delgado et al. 1998). With these contributions classical statistical decision theory is transformed into a fuzzy decision theory. The importance of formulations of perceptions in a fuzzy decision theory and formulations of perception based probabilistic reasoning with imprecise probabilities are articulated by Zadeh (1997, 2000).

Human perception process is a flexible function of experiences. Studies have shown that attention can be directed to objects that are defined on the basis of generic grouping principles based on previous experiences (Zemel et al. 2002). Previous experiences determine the familiarity of the objects. In most experiments, it is demonstrated that object-based attention are stronger for highly familiar objects than for unfamiliar ones (Vecera and Farah 1997). For instance, gestalt perceptual grouping principles which have proximity, similarity, continuity, common movement, and common fate properties are sufficient to define the objects.

Often objective function based approaches uses clustering algorithm which assigns a membership value for each observation. This value represent the degree of belongingness to each clusters. Membership functions that calculate membership values can often be assigned linguistic labels such as “low”, “medium” or “high”. Such labeling provides linguistic meaning representation for understanding.¹⁴

Ozkan and Turksen (2007) employ perception based inference method where fuzzy clusters are treated as dictionary catalogs that serve for the basis of objects. According to this approach any object can be defined as a pattern that is generated by experience. Clustering the similar patterns provide the definition of translation catalogs that are used in approximate reasoning. This approach is a process which has four properties that are; (i) clustering, (ii) similarity, (iii) flexibility, and (iv) resolution of uncertainty. In this manner, they embed gestalt perceptual prototypes by their properties of similarity, grouping, proximity and continuity in their model. Such models start with definition of decision problems given as:

[...] Assume that d is the decision problem, s , is the state of nature, f is the inference function, p is payoff, $\bar{X} = (x_1, x_2, \dots, x_n)$ is an information vector (input vector), $\bar{v}_x = (\bar{v}_{x,1}, \bar{v}_{x,2}, \dots, \bar{v}_{x,c^*})$ is the cluster center matrix and $\bar{v}_{x,j} = (v_{1,j}, v_{2,j}, \dots, v_{n,j})^T$ is the j th cluster center projected to input space. The decision problem can be presented as: $d = (\bar{X}, s, \{p = f(\bar{X}, \bar{v}_x)\})$, and inference function can be written as, $f(\bar{X}, \bar{v}_x) = \sum_{j=1}^{c^*} g_j(\bar{X}) \left(\frac{\mu_j(\bar{X}, \bar{v}_x)}{\sum_{i=1}^{c^*} \mu_i(\bar{X}, \bar{v}_x)} \right)$ where g_j is j th cluster's fuzzy regression function and μ_j is membership values to j th cluster for information vector \bar{X} and the normalization term is equal to one. $f(\bar{X}, \bar{v}_x)$ is simply a smooth interpolation of the local regression

¹⁴See Hoppner et al. 1999, Chap. 8. Rule Generation with Clustering

models and the weights on each local model is the value of the membership function.

Local regression function g_j is: $g_j(\bar{X}) = \beta_{j,0} + \sum_{i=1}^{nv} \beta_{j,i} x_i$ and membership function is

$$\mu_j(\bar{X}, \bar{v}_x) = \left[\sum_{i=1}^c \left[\frac{Dist(\bar{X}, \bar{v}_{x,j})}{Dist(\bar{X}, \bar{v}_{x,i})} \right]^{\frac{2}{m-1}} \right]^{-1}. \quad (\text{Ozkan and Turksen 2007})$$

12.4 Conclusion

Leaders, policy makers, authorities and all parties in society are making decisions everyday with some complexities and under uncertainties. With complexities, we mean both the environment of the decision problem and the consequences of decisions are not well understood, defined or changing with unpredictable patterns. It may be helpful to understand the uncertainty and the tools that help us to make decision under uncertainty. In order to do so, a brief summary about uncertainty with a taxonomy is given. Then fuzzy logic is introduced as a tool to make decision under uncertainty.

Uncertainty is a phenomena that has a deep root in daily life. It makes us free to choose. Our brain converts uncertainty into fear in order to create a motivation to do something. But we do not have a common theory of uncertainty or common understanding about its taxonomy. Hence some selected taxonomies together with some discussions in social sciences are good starting point to gain some knowledge. We do understand that it has several dimensions and types. It has characteristics that may be modelled with classical probability theory, evidence theory or fuzzy logic. The reasons and the sources of information uncertainty make the task of handling uncertainty quite important. Starting from heuristics to the modern tools of handling uncertainty is a vast area of research. Fuzzy logic is an approach that has been used effectively to decide under uncertainty.

After Zadeh's (1965) seminal paper about the fuzzy logic, researchers were attracted to use this tool for complex problems in almost every fields. The body of research has been increasing very fast and the branches of fuzzy system research has been becoming more established and accepted. Applications started with modeling expert knowledge which can be classified as subjective modeling first. Then Bezdek's (1974) introduction of fuzzy clustering opened the path for objective modeling where data speak for themselves. Generally first discussions are about Type 1 fuzzy logic where the degree of memberships are assumed to be precise. This approach is relatively easy to understand but one may think that the idea of fuzziness loses ground with this type of approach. Hence the new discussions where the degree of membership become fuzzy takes place. This new approach is called as Type 2 (and of course higher order) fuzzy systems. Fuzzy logic and fuzzy system modeling proved a close approximation of human decision making and perception based processes. Therefore as an application of fuzzy system modeling perception based decision making is introduced as the last section in this paper.

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Chapter 13

Primary School Principals' Crisis Management Skills

İlknur Çalışkan Maya

13.1 Introduction

Organisations, which are open systems, survive in a quite dynamic atmosphere. Their achievement and permanency depend, to a great extent, on their sensitivity to the environment. This situation, in turn, requires that organisation leaders recognise the surrounding difficulties and opportunities in time and that they make use of appropriate strategies. The fact that, along with rapid changes in every field today, the organisations of the third millenium exist in more complex societies (Erçetin 2001; Fullan 2001) has made uncertainty and the phenomenon of crisis more remarkable and more important than ever.

Crisis affects organizations negatively by appearing in an unexpected time. Crisis also threatens educational organizations as they occur in all organizations. The term “crisis” for the school organizations can be defined as “a sudden and unexpected situation which deeply and negatively affects an important part of the school population” (Atkinson 2002). The process of crisis management on organisational basis concerns mostly the administrators who will manage in crises. This study aims at determining crisis management skills of primary school principals.

13.2 Method

This research, which was conducted by using a quantitative paradigm, was conducted with 404 teachers working in public primary education schools in Canakkale in the 2011–2012 academic year. It employs a 31-item scale which is named “Crisis

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Management Skills Scale of Primary School Managers”, which was developed by Aksu and Deveci (2009). The scale constituted three sub-dimensions: Before crisis period, crisis period, and after crisis period. The alpha reliability coefficients calculated were: .95 for period before crisis, .95 for period of crisis, and .98 for period after crisis.

13.3 Findings

13.3.1 Primary School Principals’ Crisis Management Skills

Table 13.1 below shows primary school principals’ crisis managements skills as perceived by teachers while Table 13.2 presents primary school principals’ crisis management skills on three sub-dimensions.

According to Table 13.1, primary school principals’ crisis management skills are at the “medium level” according to teachers’ perception. Similarly, Tanrıögen and Savcı (2011) suggest in their research that high school teachers state that the crises faced in their school are managed “at the medium level”, that is to say, partly scientifically.

On the other hand, it is clear from Table 13.2 that, according to teachers’ perception, principals display crisis management skills “at the medium level” on all of the sub-dimensions of pre-crisis period, crisis period and post-crisis period. In contrast to the findings of this research, the study performed by Aksu (2009) found that primary school teachers perceived the crisis management in their school at the level of “I agree” or “I quite agree” according to the overall scale and on all the sub-dimensions of the scale.

Table 13.1 Primary school principals’ crisis management skills

	N	\bar{x}		Mean interpretation
Crisis Management Skills	404	2.90	1.17	Moderate

Table 13.2 Primary school principals’ crisis management skills according to dimensions

Dimensions	N	\bar{x}		Mean interpretation
Pre-crisis period	404	3.00	1.17	Moderate
Crisis period	404	2.79	1.16	Moderate
Post-crisis period	404	2.93	1.19	Moderate

Table 13.3 Primary school principals' crisis management skills on the sub-dimension of pre-crisis period

Questionnaire items	\bar{x}	
1. He/she can perceive the signals of crisis from different sources before the crisis arises	3.01	1.19
2. He/she creates crisis scenarios before the crisis is encountered	2.87	1.14
3. He/she can detect the problems potential to cause dangers beforehand	2.95	1.14
4. He/she pursues the crises arising in the neighborhood	3.09	1.15
5. He/she carefully analyses the states capable of causing a crisis	3.03	1.16
6. He/she is sensitive to crisis signals	3.07	1.21
7. He/she is knowledgeable about the strategies for protection from the negative effects of a crisis	3.04	1.20

13.3.2 Primary School Principals' Crisis Management Skills on the Sub-Dimension of Pre-Crisis Period

Table 13.3 below shows primary school principals' crisis management skills on the sub-dimension of pre-crisis period according to teachers' perception. As is evident from the Table, primary school principals hold crisis management skills in relation to the pre-crisis period "at the medium level", according to teachers' perception.

Findings also demonstrate that arithmetic averages for primary school principals' crisis management skill scores on the sub-dimension of pre-crisis period range between 2.87 and 3.09. According to teachers' perception, items 4 and 6 are the items in which the school principals display their administrative skills the most on this dimension while 2 and 3 are the ones in which they display the administrative skills the least. Therefore, it may be said that the school principals are not capable of creating scenarios before the crisis arises and they are not able to detect the dangers beforehand, and that they only pursue the crises in the neighborhood.

In a similar vein, the research conducted by Aksu (2009) demonstrate that the teachers in primary schools score the highest points for the item "pursuing the crises arising in the neighbourhood" and the lowest points for the item "creating crisis scenarios before a crisis arises" on the sub-dimension of pre-crisis period. It may be recommended that crisis scenarios should be created based on the crisis related with the school and they should be shared with the school employees through online modules for an effective crisis management (Smith and Riley 2012). On the other hand, findings obtained by Çelikten (2001) displaying that the school principals are inadequate in perceiving the crisis signals are supportive of our findings.

It was found in this research that teachers agreed with item 7 related to the principals' "being knowledgeable about the strategies for protection from the negative effects of a crisis" "at the medium level" (3.04). However, the findings reached by Sayın (2008) show that the secondary education administrators' levels of knowledge concerning crisis management are "very low". In a similar way, the research by Tanrıöğen and Savcı (2011) reveals that high school teachers think that the staff in secondary education schools need training in crisis management.

Table 13.4 Primary school principals' crisis management skills on the sub-dimension of the crisis period

Questionnaire items	\bar{x}	
8. He/she prepares written crisis management plans for protection from crises	2.77	1.12
9. He/she prepares crisis communication plans according to the crisis management plans	2.75	1.11
10. He/she prepares emergency action plans to implement in the case of crisis	2.82	1.16
11. He/she pioneers for the crisis management team to take the necessary precautions	2.83	1.16
12. He/she forms teams for crisis control and risk check	2.84	1.16
13. He/she informs all the employees of the crisis management plan	2.84	1.19
14. He/she provides students with confirmed information on the crisis faced	2.85	1.16
15. He/she holds training sessions for all the staff in crisis management	2.64	1.17

13.3.3 Primary School Principals' Crisis Management Skills on the Sub-Dimension of Crisis Period

Table 13.4 shows primary school principals' crisis management skills on the sub-dimension of crisis period according to teachers' perception. Accordingly, the principals' crisis management skills are "at the medium level" on the dimension of crisis period, in the teachers' views. The findings show that arithmetic averages for primary school principals' crisis management skill scores on the sub-dimension of the crisis period range between 2.64 and 2.85. On this dimension the items 14, 13, and 12 are the items in which the principals display their administrative skills the most while 15 and 9 are the ones in which they display their administrative skills the least.

In a similar way, Aksu (2009) found that primary school teachers assigned the lowest score to the item "holding training sessions for all the staff in crisis management". Sayın (2008), however, found that the level of knowledge of the administrators in secondary education institutions concerning crisis management was "very low", that they themselves and the staff needed training in this respect, and that the number of schools having detailed plans against crises was "very small". On the other hand, Çelik (2007), in research with regard to the management of crisis period in schools, suggests that schools should have emergency plans and they should constantly be updated, and that training sessions and practice works should be done in this matter.

Aksoy and Aksoy (2003) recommends that school administrators should form crisis intervention teams and train them, and in addition to that, they should work on preparing an intervention plan for crises and on implementing it. Besides, researchers also emphasise that coordinated work taking the local, regional and national plans and applications into consideration should be performed in schools in crisis periods.

Table 13.5 Primary school principals' crisis management skills on the sub-dimension of post-crisis period

Questionnaire items	\bar{x}	
16. He/she facilitates coordination between employees in the process of crisis management	2.79	1.15
17. He/she assures that employees participate in the decision-making process	2.97	1.17
18. He/she eliminates the hurdles hindering efficient work in the crisis period	2.93	1.13
19. He/she constantly revises the goals and the targets of the organisation	3.00	1.10
20. He/she makes multi-perspective evaluations concerning the process of crisis	2.93	1.15
21. He/she analyses the state in the post-crisis period	3.05	1.14
22. He/she sets new goals and targets for the post-crisis period	3.00	1.16
23. He/she evaluates the crisis management conducted and determines the inadequacies	3.04	1.15
24. He/she conducts structuring work for the post-crisis period	2.92	1.15
25. He/she develops the vision of the organisation in the post-crisis period	2.90	1.15
26. He/she can see the strengths and weaknesses of the organisation in the post-crisis period	2.96	1.16
27. He/she develops effective methods for struggling with crises	2.87	1.19
28. He/she transforms the crises encountered into opportunities and thus makes them bene-ficial to the organisation	2.87	1.20
29. He/she makes it possible to offer the crisis management team training in line with the new developments	2.86	1.19
30. He/she establishes new strategies and tac-tics to cope with probable crises	2.91	1.18
31. He/she offers opportunities to employees to develop new skills and to use them	2.91	1.22

13.3.4 Primary School Principals' Crisis Management Skills on the Sub-dimension of Post-Crisis Period

Table 13.5 shows primary school principals' crisis management skills on the sub-dimension of post-crisis period. Table 13.5 makes it clear that according to teachers' perception, primary school principals' crisis management skills for the post-crisis period are "at the medium level".

The research findings demonstrate that arithmetic averages for primary school principals' crisis management skill scores on the sub-dimension of post-crisis period range between 2.79 and 3.05. Thus, items 21 and 23 are the items in which the primary school administrators display the most administrative skills while 16 and 19 are the ones in which they display the least administrative skills. These findings reveal that primary school principals are able to analyse the post-crisis state but that they are inadequate in offering the staff training service in the post-crisis period just as in the pre-crisis period.

13.4 Conclusion

The research results showed that primary school principals were “at the medium level” in terms of the average crisis management skills. On the other hand, when each dimension was considered separately, the principals were found to be “at the medium level” in administrative skills on each of the sub-dimensions of pre-crisis period, crisis period, and post-crisis period. In the light of these findings, the following recommendations may be made:

1. Primary school principals should be offered theoretical as well as applied training so as to raise their crisis management skills. Such training should be given by university lecturers studying in this matter, and crisis scenarios should be used in the training sessions (Pollard and Hotho 2006).
2. The phenomenon of crisis can stem from the internal and external changes. Therefore, it should be assured that the school directors are educated in the new management approaches such as change management, strategic management, risk management and stress management.
3. Effective crisis management involves planning preparations prior to a crisis. Hence, it may be said that school directors should design plans for crisis management and that they should constantly update the plans considering the internal and external environment of the school.
4. The skill of effective crisis management necessitates team work. Therefore, school administrators should form crisis management teams in schools and make sure that the team work in cooperation.

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Chapter 14

Evaluation of Post-Graduate Students' Perceptions of Transformational Leadership According to Some Variables

Fırat Kıyas Birel and Meltem Yalın Uçar

14.1 Introduction

Leadership is the process of influencing (Yukl 2010) others to understand and agree about what needs to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish targeted or shared organizational purposes. Role, (Adair 2012), defined role as a mission performing by a player in a game however this notion refers to individual's features when it is used in broad sense. Thus, the mission which a leader appreciate for himself, makes him to be qualified by various leadership notions. The leader who consider himself having qualities of 'transformational leadership', a term modifying leadership, is expected perceive social and institutional organizations, changes and differences around before or in time. Long-term and efficient organizations have to anticipate indications and parameters and need to make required orientation and transformation before these changes located.

In this rapidly changing age, individuals, societies and organizations which don't transform themselves with this change will inevitably be lack of power, adaptation and time. Transformational notion first initiated in 1978 by Burns and gained its popularity with Bass (Leithwood and Poplim 1992). Transformational leadership or change leadership is a leadership style which directs and pioneered rapid change and development process in societies, organizations and groups. Accordingly, it refers to leadership that reconciles today and tomorrow (Erişen 2011, s.111). In contrast to leadership based on individualism, transformational leader organizes

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a social structure (Burns 1978) and has ability to handle variables to courage cooperation and this process contains hope, synergy and good (Roberts 1985). Transforming leadership process makes transforming possible both for leaders and followers this process enables leader and followers to develop themselves and has great contribution to organizational development. Transformational leadership can help followers in building leadership competence and facilitate leaders to develop their superior skill (Aydın 2005, p. 309). Transformational leadership is mutually encouraging, fostering, motivating, strengthening process, and has characteristics of meeting high level of needs, and contribute in forming of moral and ethical leadership (Aydın 2005 cited from Owens 1998). Transformational leadership fosters relations and communication among group members in doing so, it builds up confidence by knowing each other. Transformational leaders aims to transform their followers having sense of critical thinking, to be independent, and in this way, lead followers to be innovative and make useful contribution to organization. They confront risks and they don't afraid of make mistake (Tengilimoğlu 2005, s.6 cited in Çakmakçıyan 2009, p. 12). They perceive mistakes as a opportunity to develop themselves. It may be asserted that transformational leadership is one of the basec role of educational administrators regarding today's conditions. It is clear that transformational leadership has critical role in transforming and realizing desired purposes. Also, following the meta-analyses of many studies conducted, existing features of leadership is portrayed as a result of obtaining positive relationship between job satisfaction scales and transformational leadership traits (Dumdum et al. 2002). In this sense, it is essential to determine master students' perception in educational leadership towards transformational leadership.

Due to reasons mentioned above. The purpose of this study is to determine Division of Educational Administration, Supervision, Planning and Economics students' perception of characteristics of transformational leadership, to find out whether these perceptions vary according to certain variables, and whether there is a significant relationship. In doing so, we intend to clarify at what extend educational administrators', working in the system, behaviours are compatible with educational leadership style.

The researchers have addressed the following questions;

1. What is level of Division of Educational Administration, Supervision, Planning and Economics master students' perception of characteristics on transformational leadership of educational administrators, they monitor?
2. Division of Educational Administration, Supervision, Planning and Economics master students' perception of characteristics of transformational leadership about educational administrators they monitor, Students' views draw on;
 - (a) Gender
 - (b) In Service training
 - (c) Tenure
 - (d) Work/Job position
 - (e) Work-unit
 - (f) University/Education are there significant differences between these variables and transformational leadership?

14.2 Methodology

The study was conducted with a descriptive analysis method. This method was preferred to test present fact, and to understand the linkage among the facts (Karasar 2003). Descriptive research method was used to master students' perception on 'transformational leadership' to find out what factors effect these perceptions.

14.3 Universe and Sample

The study was conducted with master students, enrolling at three universities, Dicle University, Sakarya University and Adnan Menderes University. Respondents were consisted of 172 master students, in Educational and Supervision program. One hundred and twenty-one students from Dicle University, 23 students from Sakarya University and 28 students from Menderes University. The study was descriptive according to some variables such as, gender, in Service they have participated, tenure, job position, place of work University.

14.4 Data Collection

MLQ-5X Short Form was used in this study as data collection tool. Turkish 20-item version of Multifactor Leadership Questionnaire (MLQ Leader form 5x form), developed by Bass and Avolio in 2000 and adapted into Turkish language by Arslantas, C and Cakmayapan, S from faculty of Management was implemented to asses transformational leadership. Transformational leadership scale, consisted of eight under dimension of ideal affect, under cognitive, inspirational, motivation and individual interest dimensions the scale consisted of 12 questions (four times each). Measurement tool which has four sub-dimensions, consisted of 20 questions and was put into order as idealized influence, intellectual Stimulation, inspirational leadership, individualized consideration. Reliability of data collecting tool was tested and it was updated. Cronbach alfa reliability Coeffiency was found as 0.95. Coeffiency for sub-dimensions: idealized influence .82, Intellectual Stimulation: .92, Inspirational leadership: .88 and individualized consideration; .85.

14.5 Analysis of Data

Descriptive statistical and divergence tests were used in analyzing of findings obtained through data collecting tool. Transformational leadership perception was analyzed with regard to variables in order.

14.6 Findings

Findings related to the first sub-problem: View of participants on transformational leadership.

Table 14.1 presents score of transformational leadership arithmetic mean. Results shows that standard deviation was found as .88. The mean of transformational leadership scores for students was measured as moderate level. The results of sub-dimensions of leadership reveals that, inspiring leadership mean was 2.76, on the other hand, scores of students for intellectual stimulation was found as highest with 2.65 mean, while examining extend of ideal effect the score seems to be rather with 2.62 and lowest arithmetic scores was obtained with extend of individual as 2.54.

Findings related to second-sub problem:

- (a) *View of respondents on transformational leadership according to gender variable.*

Table 14.2 shows that there is no significant difference between gender and respondents transformational leadership and its sub-dimensions, ideal effect, intellectual stimulation, inspiring leadership and individual consideration. However, arithmetic mean for females ($X = 2.66$) is higher than male ($X = 2.62$) on transformational leadership.

- (b) *Findings linking respondents' view on transformational leadership according to receiving in-service variable (Table 14.3)*

Table 14.1 Results of transformational leadership characteristics

	N	\bar{X}	S
Idealized influence	172	2.62	.82
Intellectual stimulation	172	2.65	1.05
Inspirational leadership	172	2.76	1.04
Individualized consideration	172	2.54	1.01
Transformational leadership	172	2.65	.88

Table 14.2 Finding linkage to transformational leadership according to gender

	Gender	N	\bar{X}	SS	t	p
Idealized influence	Male	116	2.63	.84	.199	.843*
	Female	55	2.60	.79		
Intellectual stimulation	Male	116	2.65	1.09	.108	.914*
	Female	55	2.63	.99		
Inspirational leadership	Male	116	2.53	1.01	-.007	.994*
	Female	55	2.53	1.00		
Individualized consideration	Male	116	2.67	1.00	-1.550	.123*
	Female	55	2.93	1.10		
Transformational leadership	Male	116	2.62	.88	-.271	.787*
	Female	55	2.66	.84		

* $p > 0.05$

Table 14.3 Findings linking respondents' view on transformational leadership according to receiving in-service training variable

	In-service training	N	\bar{X}	SS	t	p
Idealized influence	Had	97	2.55	.84	-1.534	.127*
	Didn't have	72	2.74	.81		
Intellectual stimulation	Had	97	2.52	.99	-2.012	.046**
	Didn't have	72	2.85	1.12		
Inspirational leadership	Had	97	2.43	1.01	-1.858	.065*
	Didn't have	72	2.81	1.66		
Individualized consideration	Had	97	2.66	.99	-1.774	.078*
	Didn't have	72	2.94	1.08		
Transformational leadership	Had	97	2.54	.85	-1.979	.049**
	Didn't have	72	2.81	.93		

* $p > 0.05$; ** $p < 0.05$

Significant difference ($t = -1.979$; $p < 0.05$) was found between transformational leadership and receiving in-service variables. On the other hand, no significant difference was observed between receiving in-service and sub-dimensions of transformational leadership; ideal effect ($t = -1.534$; $p > 0.05$), individual interest ($t = -1.774$; $p > 0.05$), and inspiring motivation ($t = -1.5858$; $p > 0.05$), but significant difference was captured between receiving in-service and intellectual motivation sub-dimension of transformational leadership.

(c) Respondents' scores for transformational leadership according to tenure;

Table 14.4 reveals that there were no significant differences in ratings of tenure variables ($F = .642$; $p > 0.05$) on transformational leadership. Similarly there were no significant differences in ratings of idealized influence ($F = .250$; $p > 0.05$), inspirational leadership, ($F = 1.779$; $p > 0.05$) intellectual stimulation ($F = .243$; $p > 0.05$), individualized consideration ($F = 1.114$; $p > 0.05$) on transformational leadership.

(d) Respondents' scores for transformational leadership according to work/job;

Mean ratings by respondents' work/job position for the transformational leadership are presented in Table 14.5. Students responses mean that there were significant differences between work/job position variables ($F = 2.863$; $p < 0.05$) and transformational leadership. To determine the main reason of significant differences between work/job variables and transformational leadership, as result of LSD analyze significant differences were measured between teachers, vice-manager, assistants and those work in other field. Similarly, significant differences were found between respondents' work/and idealized influence ($F = 3.088$; $p < 0.05$) one of the features of transformational leadership. LSD analyze states that this difference was captured between teachers, vice-manager, assistants and those who work in other fields. On the other hand, no significant difference were measured between idealized influence, inspirational leadership ($F = 1.832$; $p > 0.05$) intellectual stimulation ($F = 2.357$; $p > 0.05$), and individualized consideration ($F = 2.863$; $p > 0.05$).

Table 14.4 Findings linking to tenure for transformational leadership characteristics

	Tenure	N	\bar{X}	SS	F	P
Idealized influence	1–5 years	57	2.66	.85	.250	.779*
	6–10 years	58	2.65	.81		
	11 and above	57	2.56	.81		
	Total	172	2.62	.82		
Intellectual stimulation	1–5 years	57	2.67	1.11	.243	.785*
	6–10 years	58	2.70	1.02		
	11 and above	57	2.57	1.05		
	Total	172	2.65	1.05		
Inspirational leadership	1–5 years	57	2.87	1.84	1.779	.172*
	6–10 years	58	2.47	.99		
	11 and above	57	2.46	.94		
	Total	172	2.60	1.33		
Individualized consideration	1–5 years	57	2.92	1.11	1.114	.331*
	6–10 years	58	2.70	1.01		
	11 and above	57	2.65	.99		
	Total	172	2.76	1.04		
Transformational leadership	1–5 years	57	2.75	.97	.642	.542*
	6–10 years	58	2.64	.83		
	11 above	57	2.56	.85		
	Total	172	2.65	.88		

* $p > 0.05$

- (e) *Findings linking respondents' view on transformational leadership according to place of work;*

Table 14.6 shows the correlation between place of work and transformational leadership characteristics. No significant differences were found between place of work variables ($F = 1.649$; $p > 0.05$) and transformational leadership characteristics. Also, there were significant differences in ratings of idealized influence ($F = 1.765$; $p > 0.05$), inspirational leadership, ($F = .933$; $p > 0.05$), intellectual stimulation ($F = 1.644$; $p > 0.05$) individualized consideration ($F = .993$; $p > 0.05$) on transformational leadership.

- (f) *View of respondents on transformational leadership according to education/university;*

Table 14.7 presents that there were significant differences between university the respondents enrol variables ($F = 25.344$; $p < 0.01$) and transformational leadership. LSD Analyze was used to clarify the main reason of difference. As result of analyze significant differences were measured between students', enrolling at Sakarya University, Dicle University and Adnan Menderes University, views linking to managers they monitor. Similarly, significant differences were found between respondent's university they enrol related to sub-dimensions, in ratings of idealized influence ($F = 25.672$; $p < 0.01$), inspirational leadership, ($F = 18.968$; $p < 0.01$) intellectual stimulation ($F = 19.381$; $p < 0.01$), individualized consideration ($F = 10.911$; $p < 0.01$) on transformational leadership.

Table 14.5 Respondents 'scores for transformational leadership according to work7 job variables

	Work/job	N	\bar{X}	SS	F	P	Source of divergence (LSD)
Idealized influence	Teacher	83	2.58	.78	3.088	.029**	2-4
	Vicemanager	45	2.71	.96			3-4
	Assistant	22	2.98	.66			
	Other	22	2.26	.68			
	Total	172	2.62	.82			
Intellectual stimulation	Teacher	83	2.63	.96	2.357	.074*	
	Vicemanager	45	2.72	1.22			
	Assistant	22	3.02	1.04			
	Other	22	2.20	.93			
	Total	172	2.65	1.05			
Inspirational leadership	Teacher	83	2.68	1.60	1.832	.143*	
	Vicemanager	45	2.52	1.06			
	Assistant	22	2.95	1.02			
	Other	22	2.07	.67			
	Total	172	2.60	1.33			
individualized consideration	Teacher	83	2.78	1.03	1.777	.154*	
	Vicemanager	45	2.80	1.13			
	Assistant	22	3.02	.95			
	Other	22	2.32	.87			
	Total	172	2.76	1.04			
Transformational leadership	Teacher	83	2.65	.87	2.863	.038**	1-4
	Vicemanager	45	2.69	.99			2-4
	Assistant	22	2.99	.76			3-4
	Other	22	2.22	.69			
	Total	172	2.65	.88			

* $p > 0.05$; ** $p < 0.05$

14.7 Conclusion

It was revealed that the level of school leaders' transformational leadership feature was at the moderate level. It is not desirable that school leaders' idealized influence, intellectual stimulation, inspirational leadership and individualized consideration effect at their institutions is at an average level. It is a known fact that institutions need school leaders having transformational vision to develop. This fact requires school leaders to be trained in high-quality in service training courses or in pre-service education programs developed to provide necessary transformation. When the transformational leadership features is 'good' and 'very good', the performance of the institution is expected to be parallel with the features of leadership. It was seen that the mean score of inspirational leadership sub-dimension of the scale was higher than the other sub-dimensions. The items in this sub-dimension describe the future with optimistic emotions. These optimistic features of school leaders-despite at a

Table 14.6 Findings related to place work on transformational leadership characteristics

	Place of work	N	\bar{X}	SS	F	P
Idealized influence	Village/country	33	2.54	.85	1.765	.174*
	District	53	2.49	.83		
	City	86	2.74	.80		
	Total	172	2.62	.82		
Intellectual stimulation	Village/country	33	2.51	1.13	.933	.395*
	District	53	2.56	1.01		
	City	86	2.76	1.05		
	Total	172	2.65	1.05		
Inspirational leadership	Village/country	33	2.48	1.07	1.644	.196*
	District	53	2.38	.91		
	City	86	2.78	1.59		
	Total	172	2.60	1.33		
Individualized consideration	Village/country	33	2.78	1.20	.993	.372*
	District	53	2.59	.93		
	City	86	2.85	1.04		
	Total	172	2.76	1.04		
Transformational leadership	Village/country	33	2.57	.94	1.649	.195*
	District	53	2.50	.82		
	City	86	2.77	.89		
	Total	172	2.65	.88		

* $p > 0.05$

moderate level- are full of hope for the system itself because school leaders' positive vision will affect the efforts to develop the institution positively. Inspirational leadership is important in terms of keeping the path of development open through the transformation. Considering the contribution of arising inspiration to creativity, this result is thought to be relatively significant compared to the other factors. Because, it is a desired feature for transformational leaders to be proactive and courageous (Bulach et al. 2008). Also, it can be said that administrators take part in practices about inspirational leadership more than the other sub-dimensions. It can be referred that in the level of activity their leading in this sub-dimension is higher. Inspirational leadership was followed by intellectual stimulation, idealized influence and individualized consideration -with the lowest mean score- respectively. Female and male participants described the transformational leadership features at the same level. This result is said to increase the results of reliability of qualities they observed. There was a significant difference with respect to in-service training variable. This situation resulted in favor of those without in-service training seminar. So, on the contrary, the awareness created by the in-service training seminars, the participants attended, affected observations about transformational leadership. Participants attending in-service training described the transformational leadership features lower than the others. This result can be explained as administrative awareness gained by training increase the expectation scale about administrators' features. This result of the study is also important in terms of corresponding to literature and meeting the expectations. According to same variable there was a

Table 14.7 Findings of respondents on transformational leadership according to education/university

	University	N	\bar{X}	SS	F		Source of divergence (LSD)
Idealized influence	Sakarya	23	2.16	.57	25.672	.000*	1-2
	Dicle	121	2.51	.76			1-3
	Adnan M.	28	3.49	.67			
	Total	172	2.62	.82			
Intellectual stimulation	Sakarya	23	2.32	.72	19.381	.000*	1-2
	Dicle	121	2.47	1.01			1-3
	Adnan M.	28	3.67	.87			
	Total	172	2.65	1.05			
Inspirational leadership	Sakarya	23	2.13	.58	18.968	.000*	1-2
	Dicle	121	2.39	.96			1-3
	Adnan M.	28	3.87	2.17			
	Total	172	2.60	1.33			
Individualized consideration	Sakarya	23	2.23	.71	10.911	.000*	1-2
	Dicle	121	2.69	1.04			1-3
	Adnan M.	28	3.48	.92			
	Total	172	2.76	1.04			
Transformational leadership	Sakarya	23	2.20	.53	25.344	.000*	1-2
	Dicle	121	2.52	.82			1-3
	Adnan M.	28	3.58	.75			
	Total	172	2.65	.88			

* $p < 0.01$

significant difference in the sub-dimension of intellectual stimulation in favor of those without in-service training. Thus, depending on the awareness gained by training, it was revealed that observation level of participants taking training is lower than those without in-service training. There was not a significant difference among participants' transformational leadership perceptions according to their tenure. The same result was also found for the each sub-dimensions of the scale. Tenure did not have a special meaning on the effect of transformational leadership. There was significant difference among participants' observations of transformational leadership features according to their work position. When the results were examined, the significant difference was found between teachers and vice-principals, and between assistants and the other positions. Mean score of teachers and vice-principals was lower than the research assistants'. Research assistants do not involve in the education system or administration process directly. They observe the system from outside. So, it was expected that their mean score was higher. Observations of features stem from experience in real situations are thought to be more reliable. For this reason, this result can be accepted as parameter increasing the validity and reliability of the study. Furthermore, it is getting become clear that the work position is an important and decisive factor in practices of transformational leadership. It is possible for administrators to develop appropriate motivation in accordance with their job positions. Therefore, it can be considered as natural to have differences

among performed tasks and practices. When the quality and status of the task differentiate, the perceptions of transformational leadership may vary depending on this. There was not a significant difference between transformational leadership and job location variable. The same result was also found for the each sub-dimensions of the scale. It is obvious that job location did not produce positive results in terms of transformational leadership effects. Jobs and related practices carried out in different locations did not differentiate the perceptions on transformational leadership. There was a significant difference among participants' observations on transformational leadership according to their university. These differences were also found on idealized influence, intellectual stimulation, inspirational leadership and individualized consideration sub-dimensions of the scale according to university variable. In this context, it can be said that universities made differences in opinions about transformational leadership. It is possible to draw conclusion that opinions about transformational leadership may vary depending on the administrative and educational culture of the university, and the quality and aim of the education. At the same time, it should be kept in mind that the cities', where the universities located, way of giving importance to formal education process, success oriented approaches and transformation-development efforts can affect the participants observation results.

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Chapter 15

Evaluating Market Basket Data with Formal Concept Analysis

Alp Üstündağ and Mert Bal

15.1 Introduction

Today, in parallel with the development of computer technology and electronic commerce applications, large amounts of data has been accumulated in the hands of organizations. Data mining is one the important methods used to extract strategic and meaningful information for the organization from the large amounts of raw data. The main purpose of data mining is to find out the meaningful and useful patterns (relations) in databases, so association rules are one of the main application areas of data mining. The main objective of market basket analysis which is a special case of association rules is to determine the interesting patterns providing the minimum support and confidence criteria levels. Market basket analysis gives information about purchasing behaviour of the customer in a company by extracting rules from the sales data. These rules can be used to estimate the future preferences of the customers. Consider a supermarket database with a large volume: $X \rightarrow Y$ association rule determines the percentage of customers purchasing product X purchases also product Y . As an example, the rule “70 % of customers purchasing cola purchases also corn chips” can be extracted from the sales data. With such rules, it can be determined which products are sold together. Additionally, using this information, marketing campaigns can be arranged and therefore the sales volume can be increased.

FCA is a field of applied mathematics that aims to formalize the notions of a concept and a conceptual hierarchy by means of mathematical tools. It facilitates the use of mathematical reasoning for conceptual data analysis and knowledge

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representation and processing. In this study, a market basket analysis based on Formal Concept Analysis (FCA) is conducted to identify a customer purchasing behaviour. So, this method provides to create association rules based on lattices reflecting the relationships among the attributes in a database.

15.2 Association Rule Mining

Association rule mining which is one of the tasks of data mining searches for the interesting relationships among items in the data sets of database (Agrawal et al. 1993). Association rules provide an approach for the dependencies among the specifications in databases. There are many kinds of association rules such as hierarchical, negative, quantitative and multi-level, etc. Association rule mining problem will be defined below:

Let $I = \{i_1, i_2, i_3 \dots \dots i_n\}$ be a set of distinct literals, called items. Let D be a set of transactions, where each transaction T is a set of items. Such that $T \subseteq I$. Note that, the quantities of items bought in a transaction are not considered, meaning that each item is a binary variable representing if an item was bought. Each transaction is associated with an identifier, called TID. Let X be a set of items. A transaction T is said to contain X if and only if $X \subseteq T$. An association rule is on implication of the form $X \rightarrow Y$, where $X \subset I, Y \subset I$ and $X \cap Y = \emptyset$. X is called antecedent while Y is called consequent, the rule means X implies Y (Han and Kamber 2001; Agrawal and Srikant 1994).

If we express above mentioned $X \rightarrow Y$ rule generally, we can represent it as $X_1 \wedge X_2 \wedge \dots \wedge X_i \rightarrow Y_1 \wedge Y_2 \dots \wedge Y_j$.

Discovering association rules is a non-supervised data mining task that aims to induce symbolic conditional rules from a data file (Adriaans and Zantinge 1996). The conditional rule has the following syntax: “*IF Conditions THEN Results*”

The combination of conditions leads to a descriptive rule like (Maddouri 2005): *IF A AND B AND NOT C THEN D AND E*”. Various measures like support, confidence, lift, conviction, leverage are proposed in the literature in order to evaluate the interestingness of rules that are produced after an association rule mining. The formulas for support and confidence measures are given below:

$$Supp(X \rightarrow Y) = Supp(X \cup Y) = P(X \cup Y) \quad (15.1)$$

$$Conf(X \rightarrow Y) = Supp(X \cup Y) / Supp(X) \quad (15.2)$$

$$Conf(X \rightarrow Y) = P(X \cup Y) / P(X) = P(Y|X)$$

Here, confidence measure shows $P(Y|X)$ conditional probability.

The rules generated by association rule mining algorithms can be divided into three categories. These categories are defined below (Maddouri 2005):

Useful Rules: that a human expert can understand and use.

Trivial Rules: that represents evidence. They are valid but never used.

Weak rules: those are not acceptable by the expert and not understandable.

15.3 Formal Concept Analysis

Formal Concept Analysis (FCA) is a theoretical method for the mathematical analysis of scientific data and was found by Wille in the middle of 1980s during the development of a framework to carry out the lattice theory applications (Wille 1982). FCA models the real world as objects and attributes. FCA will define concepts in their given content and study the inter-concept relationship regarding the structure of the lattice that corresponds to the content. The mathematical notion of concept has its origin in formal logic (Deogun and Saquer 2004). This common definition can be made by two routes, extent and intent. The intent provides the attributes of context while extent covers the objects that are included in the concept. Many applications of FCA to real-life problems in intelligent data analysis, data mining, knowledge representation and acquisition, software engineering, database systems and information retrieval and may other disciplines (Deogun and Saquer 2004).

15.4 Formal Concept and Formal Concept Lattice

A *formal concept* of the formal context $K := (G, M, I)$ is a pair (A, B) such that $A \subseteq G$, $B \subseteq M$, $A' = B$, and $B' = A$; (this is equivalent to $A \subseteq G$ and $B \subseteq M$ being maximal with $A \times B \subseteq I$) the sets A and B are called the *extent* and *intent* of the formal concept (A, B) , respectively (Stumme 1996; Stumme et al. 2002). The hierarchical subconcept-superconcept-relation of concepts is formalized by: $(A_1, B_1) \leq (A_2, B_2) : \iff A_1 \subseteq A_2 (\iff B_1 \supseteq B_2)$.

The set of all formal concepts of a context K together with the partial order relation the \leq is always a complete lattice, called the concept lattice of (G, M, I) and denoted by $\underline{B}(K)$. This means that for every set of concepts there exists a unique largest subconcept (the infimum) and a unique smallest superconcept (the supremum). Theoretical foundation of concept lattice is derived from the mathematical lattice theory that is a popular mathematical structure for modeling conceptual hierarchies. Concept lattice can be used to analyze and mine the complex data for such as association rule mining, classification, clustering etc. Furthermore, concept lattice also provides an effective tool of knowledge visualization (Hu and Foghlu 2008). The fundamental theorem of FCA shows that each concept lattice is a complete lattice and the set of its intents is closure system (Wille 1982).

15.5 Application

In this application, Cola, Butter, Bread and Chips are the products in the transaction database of a supermarket (Table 15.1). Here, Transaction ID (TID) indicates the products purchased by a customer. In TID 1, the customer who purchases Cola purchases also Bread and Chips. With 20 % minimum support and confidence levels, the association rules are determined in Table 15.2.

Investigating the customer purchasing behaviour, it is noticed that customers purchasing cola purchase also bread with 60 % support and 100 % confidence level in 11th rule. Similarly, customers purchasing bread, butter and chips purchase also cola with 20 % support and 50 % confidence level. Lattice miner, an FCA

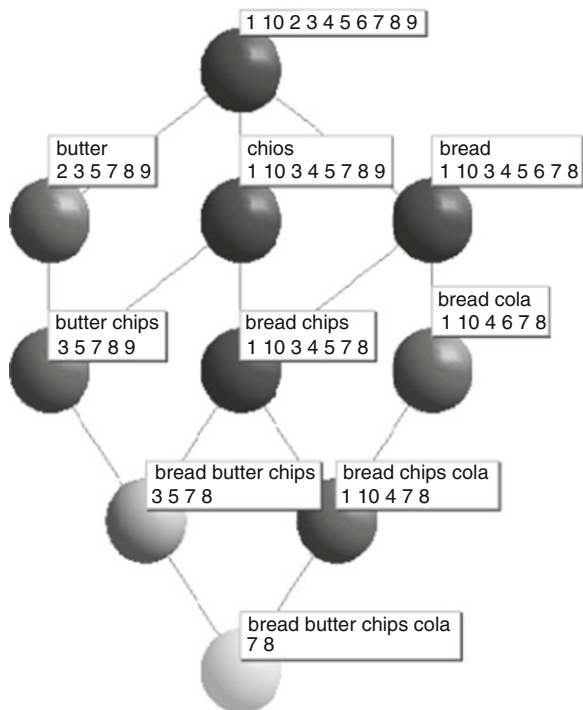
Table 15.1 Transaction of purchase database

Transaction ID (TID)	Cola	Butter	Bread	Chips
1	X		X	X
2		X	X	
3		X	X	X
4	X		X	X
5		X	X	X
6	X		X	
7	X	X	X	X
8	X	X	X	X
9		X		X
10	X		X	X

Table 15.2 Association rules

Rules No	Antecedent	=>	Consequent	Support (%)	Confidence (%)
1.	{bread}	=>	{chips}	69.99	77.77
2.	{bread}	=>	{cola}	60.0	66.66
3.	{bread}	=>	{butter}	50.0	55.55
4.	{chips}	=>	{bread}	69.99	87.5
5.	{chips}	=>	{butter}	50.0	62.5
6.	{butter}	=>	{bread}	50.0	83.33
7.	{butter}	=>	{chips}	50.0	83.33
8.	{bread, chips}	=>	{cola}	50.0	71.42
9.	{bread, chips}	=>	{butter}	40.0	57.14
10.	{cola}	=>	{chips}	50.0	83.33
11.	{cola}	=>	{bread}	60.0	100.0
12.	{bread, butter}	=>	{chips}	40.0	80.0
13.	{butter, chips}	=>	{bread}	40.0	80.0
14.	{chips, cola}	=>	{butter}	20.0	40.0
15.	{chips, cola}	=>	{bread}	50.0	100.0
16.	{bread, butter, chips}	=>	{cola}	20.0	50.0
17.	{butter, cola}	=>	{bread, chips}	20.0	100.0

Fig. 15.1 The formal concept lattice



software tool, is used to model the products in a concept lattice in Fig. 15.1. Also various support and confidence values and association rules (approximate rules) and implications (or exact association rules) are obtained using this software.

15.6 Conclusion

Market basket analysis informs about the customer purchasing behavior by extracting association rules from the sales data. So, these rules help estimating the customers’ future preferences. In this study, a market basket analysis based on Formal Concept Analysis (FCA) is conducted to identify a customer purchasing behaviour. This method provides to create association rules based on lattices reflecting the relationships among the attributes in a database. In real life applications, meaningful rules provide benefits for the companies having huge volume of transaction databases. These companies also need fast algorithms to extract the association rules. So, this study points out a data mining method based on FCA for market basket analysis.

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Chapter 16

Managing on the Edge of Chaos

Ali Balcı

16.1 Introduction

Joseph Schumpeter (1934; cited by Taylor 2003) states that in every 50 years occurs a technological revolution. As appreciated, a technological revolution leads to destruction and breakdown in current systems, destroys old industries and clears the space for new ones. Nowadays, excessively competitive markets and especially information and communication technologies lead to redesigning of organizations, since conventional programmed approaches have fallen away from solving contemporary problems. In this context, conventional hierarchical and segmented structuring has lost its characteristic of being effective organizational structure and transformed into career structures. For this reason, it is essential that organizations be restructured and reengineered against contemporary technologies and excessively competitive market conditions (Drucker 1991; Taylor 2003).

It is seen that a dominant paradigm on which management theories of any period of time were based, had historically adopted that time period's paradigm of scientific theories. Science has been Newtonian and Cartesian until this century; it has been affected by their scientific principles. Furthermore the paradigm behind science is positivism. According to the positivist paradigm, the natural state of systems is equilibrium. Systems always aim to keep their equilibrium. Because departures from equilibrium weaken the systems. Reductionism and determinism are essential to understand a system. By understanding components of a system and interaction style among them, it is theoretically possible to foresee the future condition of that system. In this context, in nineteenth century and at the beginning of the twentieth century, management theory was positivist and thus reductionist

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and determinist. Needless to say that social sciences were also dominated by this paradigm. As expressed by Battram (1999), Fayol and similar management thinkers had developed administrative and control mechanisms based on machine metaphor for organizations; and Taylor integrated these opinions into scientific method understanding and rendered a consistent management philosophy.

Both information and communication technologies which have marked the current age, and science and management understanding which has undergone a transformation collinearly with these technologies have required contemporary organizations to be structured and managed with a new understanding. In this framework, the phenomenon of “managing on the edge of chaos” has been discussed as an approach that has developed in parallel with the scientific and managerial understanding of current period.

16.2 Chaos and Related Concepts

16.2.1 *Chaos*

Chaos can be defined as nonlinear and disordered dynamic systems with unpredictable deterministic behaviors. It is not wrong to see chaos as a “new organization science” superseding the bureaucracy. Nowadays to predict organizational behavior has increasingly become difficult due to enormous amount of information, for human systems have acted chaotically. Management theories still convey that deterministic elements or components of chaos may be useful for formulating vital strategies. These elements or components have focused on preparing the organizations for the changes in outer environment (Hillon 1999/2011).

Chaos theory anticipates that systems are disordered at clarity, but underlying order can be discovered via random sceneries. Chaos was developed and tested by meteorologist Edward Lorenz. According to Lorenz’s detections, the data produced by his computer were able to reveal some patterns despite of their chaotic natures. These patterns could meaningfully elucidate certain developments. As a result of the analysis of the data, Lorenz determined that a little change in weather conditions in a city had caused enormous effects in another city. This condition is known as “butterfly effect” or “sensitive dependence” in chaos theory. These findings reveal that little changes in initial conditions may alter the behavior of the system in the long run. Chaos as a system theory can therefore be seen as an attempt for understanding nonlinear and unpredictable systems. The concept was originally applied to natural sciences to discover certain actions. Over the years, the fact that most of the social sciences exhibit nonlinear and unpredictable characteristics has been revealed. Consequently chaos theory has been started to be applied to social sciences such as education.

In chaos nothing is fixed and predictable. It is difficult to reverse the chaos. Conversely stability has the problem of self-deception. Due to the general absence of rejection, everything seems comfort and going well. A situation just as “boiled

frog metaphor” happens. To reverse this situation is difficult, because stability is a desired condition; but, contrary to what is expected, the absence of negative or ill conditions leads to death of an organization. Under these circumstances organism dies, adaptation and development disappear (Brock u.k.). Accordingly, contrary to what is supposed, a strategy which allows the organization for departing from equilibrium should be followed.

16.2.2 Complexity

The term “complexity” has its origin in Greek and means what is “woven together”. In daily use, complexity means mixed, multipartite and telescopic (collapsible) things with internal links. Scientifically complexity of a thing depends on the relationships or links between the components of that thing more than the number or the variety of its components. There is no generally accepted scientific definition for complexity, but the definition of Santa Fe group has been widely accepted. According to Santa Fe group, “complexity refers to an integrated and at the same time, so rich and varied condition of the universe that we can not apprehend through usual mechanic or linear ways. . . . Complexity is related to the nature of emergence, innovation, learning and self-adaptation” (Battaram 1999).

Complexity is a potential aroused from complex and unpredicted events. Economy, human brain, developing embryos and ant colony systems can be quoted as examples of complex evolving systems. These systems are networks consisting of numerous units moving collaterally. Neurons in a brain and species in ecology are such units. In evolving systems, each unit (or component) finds itself in an environment which is composed by interactions with other units. Each unit constantly reacts to other units according to their actions. That’s why nothing is fixed in this environment. In this way, such kind of nonlinear systems are operated by a set of simple sub-processes (Storr 1999).

The connection between chaos and complexity is problematic. Chaos requires a system to transform itself into a higher level complexity and leads to irreversible changes. In this case, though a dynamic system can be seen as chaotic, its identity, history and sense of purpose define the limits and lead its evolution and development. One of the biggest surprises of chaos theory is that simplicities and deep universal patterns have totally been hidden in the behavior of the chaotic dynamic system. Specifically complexity is constituted as a result of self-organization of a dynamic system (Kayuni 2010).

16.2.3 The Edge of Chaos

The edge of chaos implies that an order is not an ordinance, but it is a predictability and a stereotyped behavior. The edge of chaos is available in all self-adaptive

systems; it reinforces learning and creativity. The edge of chaos can be specified as a region-zone in which an order transforms into a complexity. The edge of chaos defines the point where an order leaves the scene to a turbulent behavior, so to speak, it is the point where “ice turns into water or water turns into vapor” (Battram 1999). Clearly, the edge of chaos is not an edge but a zone; fundamentally it is one of the four behavior categories occurring from time to time. Four behavior categories can be listed as static condition, order, chaos and complexity-the edge of chaos. Complexity, stated as a fourth category in the listing, occurs between order and chaos. In other words, complexity exists “on the edge of chaos” occurring between order and chaos. The concept of the edge of chaos was invented by the founders of the complexity theory, such as Stuart Kauffman and Chris Langton (Battram 1999).

Intrinsically all living systems function in the zone of complexity. Complexity zone is not a comfortable place. Refraining from chaos is an automatic tendency in human systems; on the other hand, on the contrary to what is supposed, the order itself is a zone to be abstained from. Therefore the location to be sited on should be the edge of chaos/ the zone of complexity. Because the order in human systems is not a machine operating like clockwork; conversely it is a predictability and a stereotyped behavior. A well ordered or organized structure or system is an insensitive organization which is non-self-adaptive and non-reactive to changes, and is just repeating the moves and certain reaction patterns. The edge of chaos is available in all self-adaptive complex systems. All self-adaptive complex systems existing within swarms or groups exhibit certain patterns of adaptation and creative behaviors. They are entirely sensitive to their environments; they learn from it, change it and are changed by it during interaction processes. Completely self-adaptive complex systems are at the same time self-producing systems. The ongoing tension which is dubbed as the complexity between order and chaos, or in other words the edge of chaos can be seen as the result of two dynamic processes constantly interacting with each other. The first of these two dynamic processes is the necessity of self-production in the form of sustaining the identity, producing the self continuously, resisting the change and focusing inwards. The other one is the necessity of surviving of living beings in the form of changing, flourishing and exceeding the limits (Battram 1999). This contradictory dilemma can be expressed as sustaining the unity and integrity interiorly, but adapting exteriorly.

The opportunity zone can be considerably expanded on the edge of chaos. These zones or regions are the locations where the creative ideas are produced by individuals or groups. Furthermore creativity occurs on individuals' own edge of chaos when they have opportunity to work freely. Concisely, the edge of chaos is a strong metaphor; it is at the point at which systems interact with their environments, but on the other hand it is always at the risk and at a point open to collapse. The edge can be seen in such forms: The edge of an entire organization, a unit or a team, the edge of ideas, the edge of learning, the edge of an acceptability of suggestions, etc. As seen, the concept of “edge” has a characteristic enabling it to be applied to every situation requiring learning, dialogue, information transfer and creativity (Battram 1999).

An organization's ability to move primarily requires a change at mentality and perspective to the organization and environment. Conventionally accepted assumption on this subject can be explained as such: Future is a continuation of past. Therefore, we can predict a phenomenon's future linearly provided that we know its beginning. Nevertheless this assumption is not valid in today's world. In 1960s, Edward Lorenz had radically changed this world view by discovering non-linear dynamic systems. According to chaos model, chance, changing conditions and creativity can penetrate into a complex system at any point and change its direction. So, in addition to expecting for achieving the change and reacting it, an organization has the option of proactivity (i.e. changing the necessary conditions, promoting the creativity). The planned arrangements of an organization may influence the change as the same way as they trigger it. Complexity theory anticipates that an organization's capability of mobility will lessen or even disappear in the event of too tightly structuring, and correspondingly an organization will not be able to act either in the event of chaotic structuring. So, organizations can only act on the edge of chaos. If organizations have sufficient structuring, they can hold the people and processes together; and sufficient flexibility allows for overhauling and adaptation (Wah 1998).

Apparently being on the edge of chaos requires the ability to strike a balance between chaos and order, just like a skier's losing his/her footing and struggling to regain his/her balance. Then organizations should decrease inactivity to some extent and loosen the control. Ralph Stacey has dubbed this situation as bounded instability while Darly Conner has dubbed it as structured flexibility (Wah 1998).

If that's so, how can organizations provide flexibility? According to survey results and specialists, adaptation constitutes the core of competing on the edge of chaos. That's why organizations should be complex adaptive systems. These systems are like non-linear feedback systems. An important characteristic of these systems is that they have no centralized control structures. On the contrary to centralized control, they consist of autonomous and mutually interacting units. These interactions produce the final structure of the system.

A classical example for such systems is collective/ simultaneous motion of geese. Geese follow a few simple rules while flying. "Do not hit each other" and "Fly congruent with the speed of the geese flying close" can be stated among these rules. One of the geese undertakes the leadership when they get tired; they always stick to the group. In this example, there are compliance to the group and continuing feedback, and also achieving the objective of surviving in changing conditions (Wah 1998). Additionally, immune system in human body, ecological systems and human cultures are long termed complex and adaptive systems with weakly centralized control mechanisms. Instead of leaders, employees yield answers in these systems. Leaders provide only flexible processes enabling the empowerment of employees. A managerial understanding, which requires the involvement of all employees, and a dynamic organic structure are necessary to operate these organizations. Moreover multiple participants are connected to each other in complex adaptive systems. It is formidable to build such organizations. Such organizations are living systems and function as a unity; their capacity is not the function of parts but of their sum.

For example, ant colonies are more intelligent and adaptive to the environment. All ants in a colony have their reflections and beings everywhere; their collective intelligence and action make all the system adaptive and develop it. According to Kelly Rogers, when people have the right of decision making in accordance with local conditions, “the sense of shared moment” is created and collective intelligence is employed in an organization. Also, in the event that a leader accepts the fact that intelligence is spread to every unit and people in an organization, employees have a feeling of confidence and willingness to make decisions (cited by Wah 1998).

Beside the abilities of additional interaction and collective intelligence, complex adaptive systems should have the ability of absorbing the shocks to manage the future. According to Connor, it is possible to depict such organizations with “sponge” metaphor. He states that complex adaptive systems are like sponges; they manage to absorb the changes in uncertain environments. Unless an organization can absorb environmental changes, there are two remedies to apply: If to explain with a suitable comparison, the first one is to squeeze the changes and throw out of the sponge. The second one is to employ more resilient employees to increase the capacity of change. It is a matter of fact that human capital has got a critical role on building the capacity of flexibility during the time of change. Flexible systems can only be built via the presence of confident and loyal employees, the transfer of responsibility and power of decision-making to employees and the delegation of power to lower levels by seniors. Apparently the existence of organizations in future is possible with their being flexible systems. The other way to decrease the future shock in organizations is to search and analyze it continuously. In these organizations spontaneous team employees can use their own innovative ways to solve the problems. Moreover organizations should have a few short-termed, not longer than a year, strategic plans to comply with future shocks, since short termed plans can facilitate the adaptation process to future changes. Finally, an organization must not be excessively environment-dependent in managing the future. It needs to, so to speak, have an internal watch regulating the rhythm of the change. It is a watch independent from what is happening in the environment. This phenomenon is called “time pacing” (Wah 1998).

Whether or not we’re aware of that, we all live on the edge of chaos while something is changing. This change may be personal or organizational/ national. The type or time of change makes no difference; we are forced to act on the edge of chaos to cope with it. To be compelled to go to the edge of chaos take place on unexpected occasions like a death of a beloved person, bankruptcy, failure on job completion and healthy relationship construction. The edge of chaos is a zone or region where the great ideas arise and personal, occupational and interpersonal actual change occurs. This zone is a place requiring the learning how to cope with the change to refrain the collapse of persons due to its effects. Living on the edge of chaos may lead to divergent thinking to solve a problem. Living on the edge may require new data that may not have been necessary in the past for the realization of the change in a desired way. For this reason, it entails to take the ownership for a situation of the change. It is appreciated that we are not supposed to impact a change without controlling it (Finklestein 2011).

16.2.4 Managing on the Edge-Brink of Chaos

To live on the edge of chaos requires thinking from a global perspective. This action necessitates to understand their impact on others and knowledge-based, responsible and planned- deliberate choice (Finklestein 2011).

For the last 30 years, the slogan that organizations should be structured horizontally to adapt the changes and developments has been heavily occupied the agenda. In this way, it is accepted that the flatter a thing is (namely, farther from hierarchy), the better it is. However the researches have revealed that some of the subsystems of an organization are required to be structured shallow and simply while the others need to be structured more deeply. The units, specialized for communication, should be simply built to allow rapid dissemination of messages; whereas the complex decision-making units should be built more deeply. Briefly the most convenient structuring is the one suitable to performed job. Stamps and Lipnack (2009) have developed the following hypothesis at the end of their research: "While an organization seeks for simplifying and reducing the communication ways, it should maximize the complex decision-making capacity". According to these authors, organizations are like stable and ordered islands during the period of chaos. In the sea of chaos is necessary to look beyond the near-local horizons. Because a storm may occur unexpectedly and cause a chaotic change. Nonetheless, in this chaotic atmosphere are the world events such as developmental technologies, estimated competitors and security incidents. In fact, such kinds of storms strengthen the organization and enhance its ability to move. Ultimately, the organization sees the unwieldiness of its old structuring and may move to the new structure. Briefly the organization needs rebalancing the order and the chaos. Organizations require order, stability, flexibility and creativity even if they are opposite phenomena. Therefore, the organizational structure should allow sufficient limiting to maintain the integrity and sufficient freedom to maintain innovation and adaptation (Stamps and Lipnack 2009).

It appears that the CEOs or leaders have difficulties while working on the edge of chaos. Because, they have to manage the forces conflicting with each other; they have to centralize some of the things in the organization while decentralizing some others. In the same way, leaders are obliged to simplify some functions in organizations while on the contrary they are compelled to complicate some others. On the one hand, they have to promote cooperation in some cases, and on the other hand, they have to promote competition. Today's organizations are defined as complex adaptive systems. The whole system is composed of adaptive and mutually interrelated components. These parts learn from their experience to change and evolve. Eventually, these parts require a complex system when they produce a new level of order. Shortly, what emerged is a transition to order from chaos (Stamps and Lipnack 2009). In this context, having necessary changeability enabling an organization to adapt internally to changes in outer world is significant in a complex system. The organization invites the relative chaos to its ordered world by providing changeability of some positions via increasing the number of people employed and

by allowing, or even promoting different views to raise their voice. Of course, the final destination is not the order. What matters is living the partial chaos without losing the order. Briefly what is difficult is to maintain a balance between chaos and order (Stamps and Lipnack 2000).

That is to say, the opinion of the requirement for contemporary organizations to be structured horizontally does not seem quite right. According to the research, an organization damages the managing capacity of complexity when it eliminates its echelons or levels or reduces them excessively. Eventually the organization is too simplified. However by reducing the number of levels, an environment convenient for people's clustering into bigger groups is prepared and eventually it leads to more centralization. As for multiple levels, you need to change significantly the distribution of control areas and dimensions. As a result, organizations should not be managed from the top and that governance teams arise from business networks, and the results or products stem from the integrity of local choices should not be forgotten (Stamps and Lipnack 2000).

The edge of chaos is indispensable for adaptive systems. Because, a system's survival depends on living on this edge. The role of a leader is to ensure these conditions (Brock u.k.).

Just like a biological system, an organization consists of sub-systems and their interactions; it is a result or a product of these interactions. However, sub-systems are complex structures. A milieu which is appropriate for interaction and cooperation of sub-systems should be established in order to achieve organizational objectives. For this reason, senior leader's role is to integrate organizational sub-systems in an environment which allows self-organizing. When the future of an organization is specified as a vision; contents, times and methods of employees and sub-systems of the organization are required to be combined to achieve the vision. When the leadership sets the vision, the main job, that is implementation of the vision, will be done by employees. Therefore, they should have the freedom of choosing the means and devices, and deciding how to perform the work. What to be done by the senior leader is to specify the work to be performed and facilitate the process (Brock u.k.).

The chaos occurs when employees in the organization see, hear or perceive two or more different change methods and messages. In this case, a leader moves over to an acceptance of new ideas supported by new information flow when he/she dissolves different messages and the same old methods totally.

Refreshed and reinforced employees find themselves in the middle of the conflict between the new and old methods and messages due to the introduction of new ones. This conflict turns the equilibrium of the organization into chaos. Needless to say that, a relational integrity between employees, suppliers and customers that are spirally distributed downward through an organization in equilibrium is constituted. In this instance, a leader or a manager has to accept the non-functionality between two or more methods or messages and then has to integrate the initiative and efforts to manage chaos effectively. By diagnosing and accepting chaos, people can adapt the condition occurring on the edge of chaos. Being on the edge of chaos requires the new creative ways such as learning for developing and sustaining the organization.

But there are some organizations which perceive themselves in a condition of fighting for survival; they haven't defined chaos yet to understand it. Such a chaos arises from lack of information and the need for change. That's why the organizations fighting for survival should diagnose the chaos components created by unshared change efforts and lack of information. Also note that: Unless leadership and management can provide integrity of methods and messages, employees fail to achieve self-organizing; and they are unable to manage the organization through chaos. On the other hand, transformation occurs when the organization is led and managed via new information (Deragonj 2012).

16.3 Conclusion

As noted above, chaos is a disordered but recognizable form of which disordered behavior patterns are exhibited in a complicated, unpredictable and regularly disordered manner. The focus of chaos is a network of feedback cycles which are available in all systems. Today's organizations consist of people and extremely complicated non-linear feedback systems. Nowadays, the operation of non-linear enlightening fast technology in an increasingly globalized and competitive environment can be possible via chaos management. Today, we could imagine the managing people like tightrope walker. On the one hand you want to disturb people enough to create in the organization, to be innovative and to try something etc. On the other hand, you can not move them; an innovation or a change does not happen. Because, it is not possible to manage the complex organizations via Newtonian approach which envisages the organizational structures from top to down; they will need to be managed by chaos management.

These lines show that the chaos management is very risky leadership model. Therefore, the managers stand away from the chaos management. The principle in chaos management is "rapidly fall down, and then be successful." First you fall, you have a failure; but you will learn from the failure and then you will be successful. If you do not do something, you come to a standstill. In the core of chaos management lies self-organizing. Chaos is self-organizing and trust is an important component of chaos. Also employing competent people is an important component. Provided that you empower and trust people, they can organize themselves. If competent people hold the right positions, they organize themselves.

All living systems, organizations are chaotic. Because chaos is creativity in the process. Namely, chaos is the breaking point between the old and the new. Living systems interact internally and with their environment; connections are established between them; relationships are formed; information is created; choices are made. Chaos is not random; and also not lawless; and even it is not a frivolous behavior. In contrast, chaos means globally stability and locally unpredictability. Too much order and change leads to insurmountable limits. On the other hand, too much chaos and system loses its own organization. As reported by Saul (1999), chaotic behavior refers the continuity of the edge of chaos. The edge of chaos is a maximized zone

of activity, balanced order and chaos and a region where the creativity is developed through new patterns (processes and structures). Self-organization requires these new patterns, processes and structures.

In chaos conditions, planning, executing and generating new ways to achieve objectives are formidable or even impossible; only “being able to exist” is possible. Because in a complex living system (Saul 1999);

- Cause and effect link is frequently unknown.
- The importance of planning for identity or self increases.
- Collective intelligence and adaptation of the organization can be improved by increasing connections between people and determining the flow of information.
- Leadership is distributed and changes are contextual. Hierarchy is disabled.
- Creativity and adaptability are at the greatest extent on the edge of chaos.

Management of today’s organizations is not possible anymore via Cartesian and Newtonian approaches which envisage a hierarchical structuring from top to bottom. Such management is not sufficient for both keeping their identity and personality, and complying outwardly. For this reason, classical management paradigm which foresees equilibrium and aims at order in an organization must be replaced. On the contrary, an organization should adopt methods and strategies driving the system away from steady equilibrium state to provide internal unity and integrity and external adaptation. In fact, this is an initiative to ensure an organization’s functioning in a zone between order and chaos, that is on the edge of chaos. For this reason, it is required that leadership should allow employees to organize and manage themselves, and that some jobs and structures should be structured tightly whereas some of them should be structured loosely. Briefly, today’s organizations are to be managed on the edge of chaos in order to survive and grow. Managers of the organizations have to learn the requirements of managing on the edge of chaos and should implement them in their organizations.

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Chapter 17

Controlling Chaotic Behavior of the Stepper Motor Using Genetic Algorithms

Yosra Miladi, Hanene Medhaffar, Moez Feki, and Nabil Derbel

17.1 Introduction

The hybrid two-phased stepper motor is a common electromechanical converter widely used in robotic field and small devices positioning systems such as disk drives and X-ray scanning equipments. Originally, stepper motors were designed to provide precise discrete positioning in an open-loop control mode. However, it has been shown in (Robert et al. 2000) that using the stepper motor in an open loop configuration gives poor performance if it is driven using higher stepping rates than advised by the constructor. Indeed, authors have shown that quasi-periodic as well as chaotic behaviors appear as the power supply frequency is increased and this is due to incompatibility between the motor inertia and the driving speed. Therefore, controlling the chaotic behavior of the stepper motor becomes a worthwhile endeavor.

The interest in controlling chaotic systems has revived after the pioneering work of (Ott et al. 1990). Since then, several strategies to control chaos have been developed (Pyragas 1992). Several controlling methods are considered worthless since they simply consider chaotic systems as nonlinear systems and their aim is to stabilize the equilibrium points. Some other methods are worthier since they concern stabilizing the unstable periodic orbits of chaotic systems such as in power converters (El Aroudi et al. 2009; Kaoubaâ et al. 2010; Robert and Feki 2011).

A widely considered controlling strategy is Pyragas' method which consists in adding a time delayed input signal to the chaotic system to attempt to stabilize an unstable periodic orbit. This strategy has been approached using linear control as well as nonlinear control methods (Fourati et al. 2010; Postlethwaite and Mary

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2007). In (Robert et al. 2006) the time delayed control method was used in conjunction with the absolute stability theory to extend the stability of the stepper periodic behavior for higher values of the power supply frequency.

In this work, we design a new controlling method to extend the operating domain of the stepper motor to frequencies larger than advised by the constructor. Our approach consists in using a genetic algorithm to calculate the optimal switching instances to excite the stepper to advance one step forward in a periodic manner while respecting the predetermined angular velocity.

This paper will be organized as follows, in Sect. 17.2 we present the dynamical model of the stepper motor. In Sect. 17.3, we introduce basics of the genetic algorithms and we explain how to use them in the control of the stepper motor. Section 17.4 is devoted to simulation results and their analysis. Finally, conclusions and perspectives are given in Sect. 17.5.

17.2 State Space Model of the Stepper Motor

The stepper motor is described by the following dynamical model:

$$\begin{aligned}\frac{dI_\alpha}{dt} &= -\frac{R}{L}I_\alpha + \frac{k_e}{L}\Omega \sin(z_r\theta) + \frac{E}{L}U_\alpha(t) \\ \frac{dI_\beta}{dt} &= -\frac{R}{L}I_\beta - \frac{k_e}{L}\Omega \cos(z_r\theta) + \frac{E}{L}U_\beta(t) \\ \frac{d\Omega}{dt} &= -\frac{k_h}{J}I_\alpha \sin(z_r\theta) + \frac{k_h}{J}I_\beta \cos(z_r\theta) - \frac{k_d}{J} \sin(4z_r\theta) - \frac{F}{J}\Omega - \frac{\Gamma_c}{J} \\ \frac{d\theta}{dt} &= \Omega\end{aligned}$$

where $I_\alpha, I_\beta, U_\alpha$ and U_β are the currents and voltages in phases α and β respectively. Ω is the rotor speed and θ is the rotor position. The voltages $U_\alpha(t)$ and $U_\beta(t)$ are periodic functions of time given by:

$$U_\alpha(t) = \text{sign}(\cos(2\pi F_0 t))$$

$$U_\beta(t) = \text{sign}(\sin(2\pi F_0 t))$$

where F_0 is the input signal frequency that determines the motor angular velocity. In the sequel simulations are carried out using the following parameters: $R = 45\Omega$, $L = 275$ mH, $z_r = 12$, $J = 18 \times 10^{-6}$ kgm², $F = 10^{-4}$ Nms, $k_h = 0.463$ Nm/A, $k_e = 0.463$ Vs/rd, $k_d = 16$ mNm, $\Gamma_c = 0$, and $E = 24$ V. Clearly, the motor performs 48 steps to complete a single complete turn. That is, each step corresponds to $\frac{2\pi}{48}$ rd or 7.5° and on each period T_0 the motor performs four steps.

17.3 Genetic Algorithms and Control

Genetic algorithms are based on the process of genetic evolution of organisms living through generations. Recently, they became a powerful and broadly applicable stochastic search and optimization techniques (Gen and Runwei 2000). In general, to optimize a problem of a cost function J , the genetic algorithm is summarized by the following steps. A population of individuals is chosen and maintains over a generation T_g . Each individual represents a potential solution to the problem. Each individual is evaluated using the cost function to give a measure of its fitness. According to a threshold criterion, only the most fit individuals are kept. To regenerate the initial number of population the chosen individuals undergo genetic operations to form new individuals. There are two types of transformation: crossover which creates individuals by combining parts from parent individuals, and mutation which creates new individuals by applying a stochastic change on single individuals. New individuals, called offsprings, together with the most fit individuals form the new generation which is then evaluated. After several generations, the algorithm converges to the best individuals, which hopefully represent an optimal solution. A general structure of the genetic algorithm is as follows:

1. Choose a random generation of an initial population of N individuals;
2. Evaluate the adjustment rate of each individual and eliminate the least fit;
3. Select a pair of parents following an appropriate procedure;
4. Cross two parents with a probability P_c to generate two children;
5. Mutate the two children with a probability P_m ;
6. Repeat steps 3, 4 and 5 until the new population contains N individuals;
7. Iterate from step 2 until the algorithm converges, or the maximum number of iterations is reached.

Genetic algorithms are non conventional approaches because they do not consist in finding an exact analytical solution, or a good numerical approximation, however they are efficient in locating the global optimum.

The stepper model can be regarded as a switched dynamical system where over one period $T_o = \frac{1}{F_o}$ of the input signal the model can be described using the following differential equation:

$$\dot{x}(t) = f_{\sigma}(x(t)) \quad (17.1)$$

where $x(t)$ is the state vector $x = (I_{\alpha}, I_{\beta}, \Omega, \theta)^T$ and f_{σ} is a collection of continuously differentiable functions. $\sigma \in \{1;2;3;4\}$ and f_{σ} differs according to the values of the pair (U_a, U_b) which belongs to the set $\{(-1, -1); (-1, 1); (1, -1); (1, 1)\}$. With t confined in the interval $[0, T_0]$, switching between different functions f_{σ} normally occurs regularly on instances $\tau_{\sigma} = \sigma \frac{T_0}{4}$. Under mild conditions, the behavior of the stepper is periodic.

However, when the frequency F_0 is raised beyond a critical frequency advised by the constructor, the behavior of the stepper turns out to be chaotic. That is

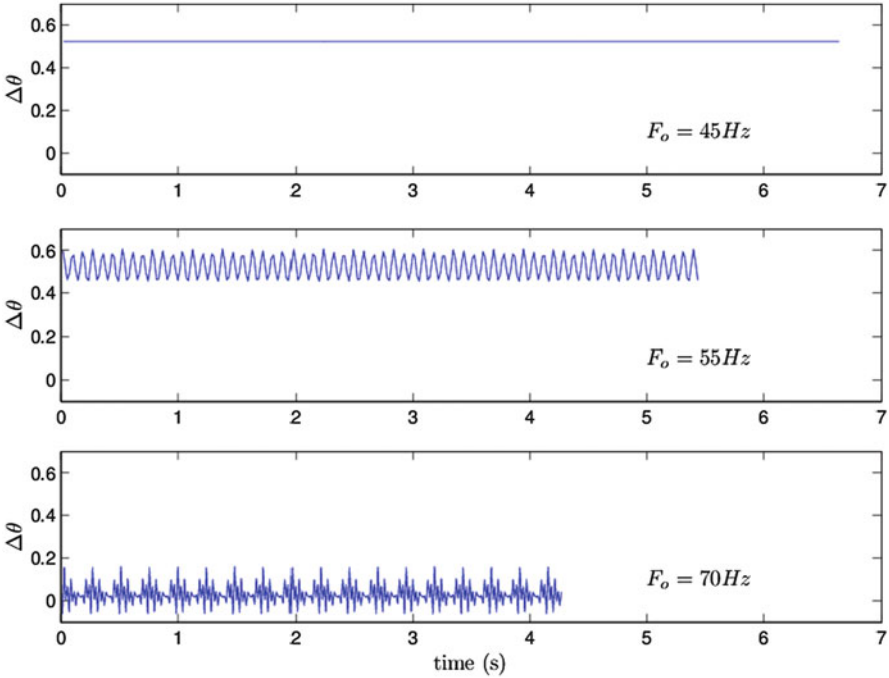


Fig. 17.1 Behavior of the step size for different frequencies registered over 25 motor revolutions

the steps of the motor become irregular and changes size in an unpredictable manner. Figure 17.1 depicts simulations carried over 360 periods, 60 transient periods were omitted and 300 periods are shown which is equivalent to 25 motor revolutions. The curves show the step size over a period of T_0 (four motor steps) for different frequencies. Clearly when the input frequency is 45 Hz the step size is constant equals to $\frac{2\pi}{12}$ rd, however, when the frequency is raised to 55 Hz the step size becomes variable around the expected value. Should the frequency be further raised to 70 Hz, then the step size variation becomes unacceptable. The bifurcation diagramon Fig. 17.2 shows that the variation of the step size actually becomes chaotic when the frequency is gradually raised.

The aim of our approach is to modify the switching instances τ_σ in order to achieve regular steps while respecting the predetermined angular velocity prescribed by the chosen frequency. Indeed, we can choose a population of $N = 50$ individuals that are equally distributed over an interval of $\pm 20\%$ around $\frac{T_0}{4}$. The cost function of the k^{th} generation is evaluated as follows:

$$J(k) = \sum_{n=1}^N \left| \frac{2\pi}{48} - \widehat{\Delta\theta}(k, n) \right| \quad (17.2)$$

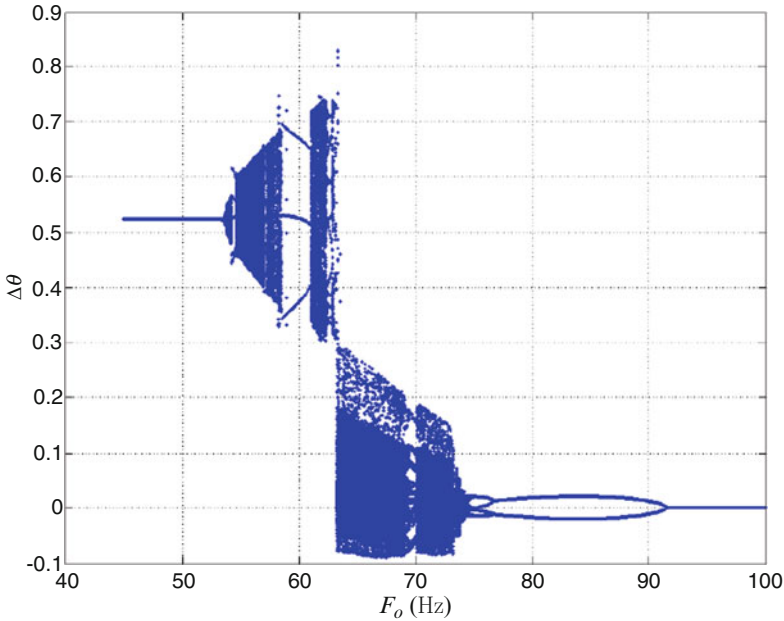


Fig. 17.2 Bifurcation of the step size when the frequency is varied beyond the critical value

where $\widehat{\Delta\theta}(k, n)$ is the estimated step size using the n^{th} individual of the k^{th} generation. Next, the fitness function of the k^{th} generation is given by:

$$Fitness(k) = \frac{1}{1 + J(k)} \quad (17.3)$$

After eliminating the least fit individuals, the population should be augmented to its initial size and for this purpose the reproduction probability of individuals is proportional to their fitness and it is given by:

$$P(i) = \frac{Fitness(i)}{\sum_{j=1}^{Fit_{pop}} Fitness(j)} \quad (17.4)$$

with $Fitness(i)$ is the fitness of individual i and Fit_{pop} is the total number of individuals with good fit. Besides, we select a crossover operation between parents as a convex relation so that good fitting individuals will more likely produce good fit offsprings. By iterating the genetic algorithm N times, the population ends up with a single optimum individual that represents the best switching time that leads to the fixed motor step size.

17.4 Analysis of Simulation Results

The described genetic algorithm has been applied to the stepper motor under different frequencies. Figure 17.3 depicts the velocity and four-steps size of the uncontrolled stepper motor under the input signal having a frequency 45 Hz. The velocity of the motor is $\Omega = 23.562\text{rd/s}$ as expected and four-steps size is $\frac{2\pi}{12}$ rd. Although its behavior in open loop mode with 45 Hz is satisfactory, the proposed controller has been applied to the motor at that frequency to investigate its effect. Figure 17.4 shows that the controller does not degrade the motor behavior.

Figure 17.5 shows that the motor cannot be used in open-loop control since at 55 Hz the velocity and the four-steps size are not constant. The application of the controller stabilizes the motor behavior as delineated in Fig. 17.6 where we can verify that the four-steps size is $\frac{2\pi}{12}$ rd and the velocity correspond to the input signal of 55 Hz that is $\Omega = 28.8\text{rd/s}$. Finally, Figs.17.7 and 17.8 show that the genetic algorithm controller is also efficient to stabilize the behavior of the stepper at 70 Hz with the angular velocity $\Omega = 36.65\text{rd/s}$ whereas in open-loop control the motor behaves chaotically.

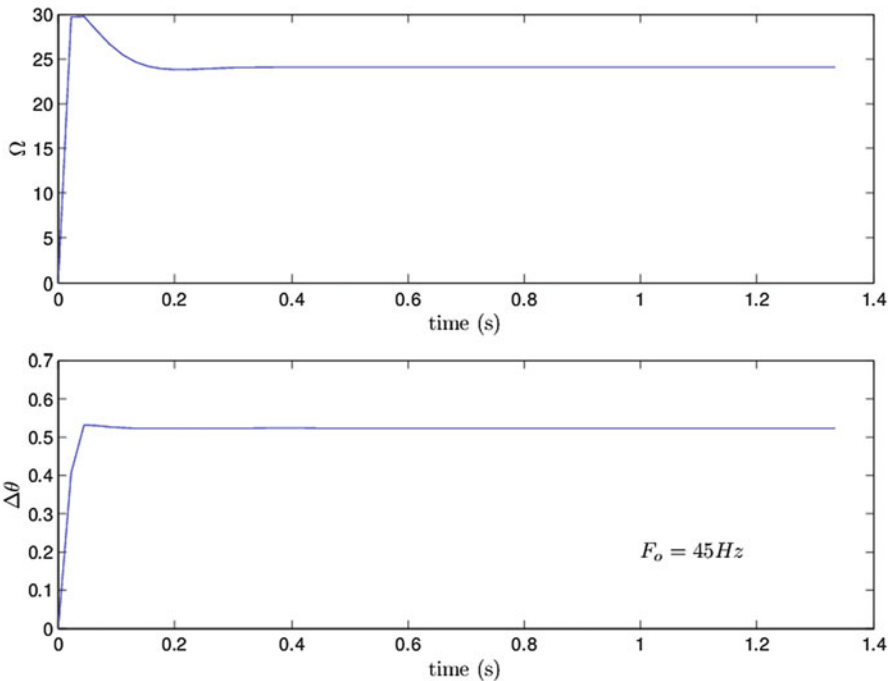


Fig. 17.3 Behavior of the uncontrolled stepper at 45 Hz

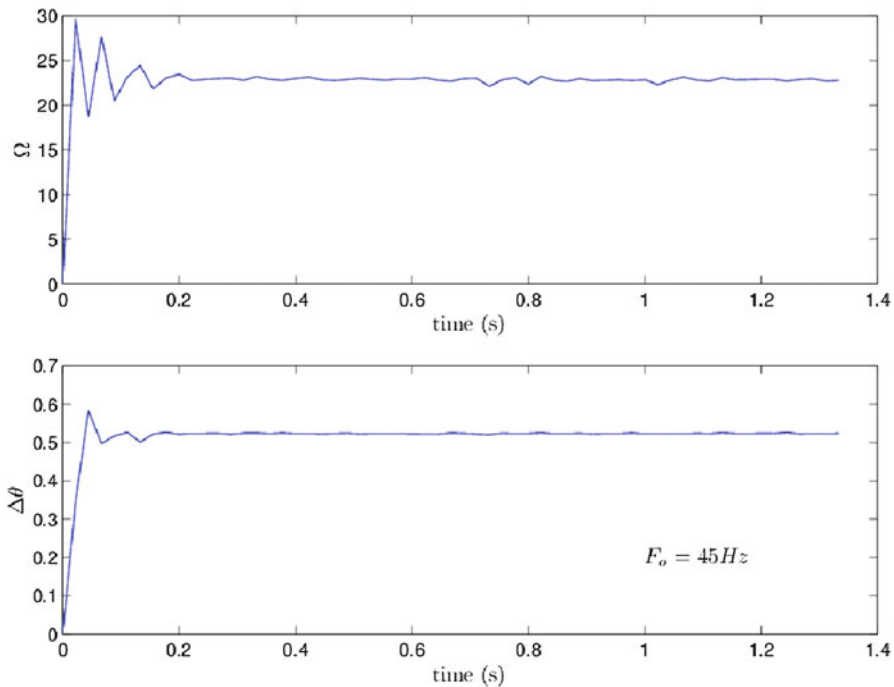


Fig. 17.4 Behavior of the controlled stepper at 45 Hz

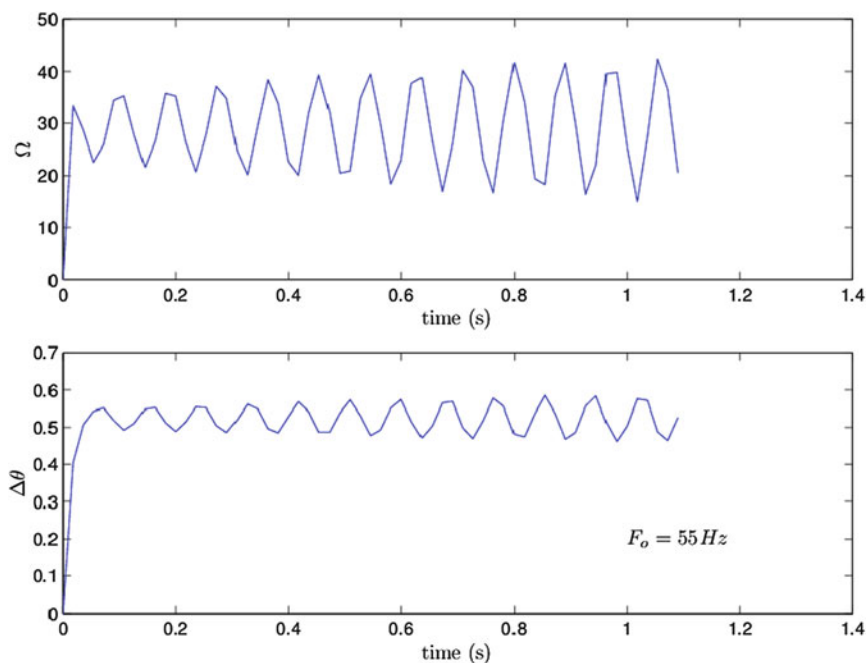


Fig. 17.5 Behavior of the uncontrolled stepper at 55 Hz

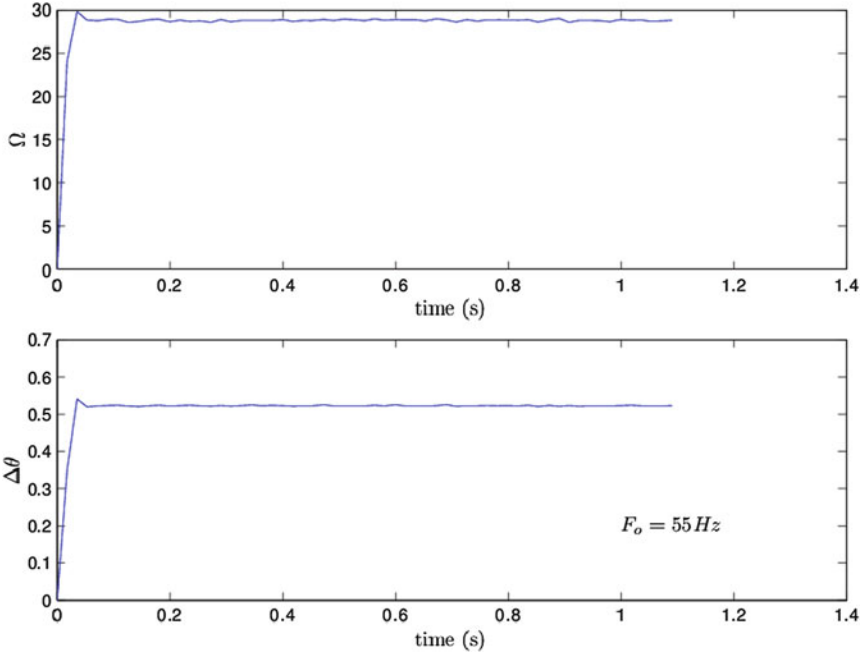


Fig. 17.6 Behavior of the controlled stepper at 55 Hz

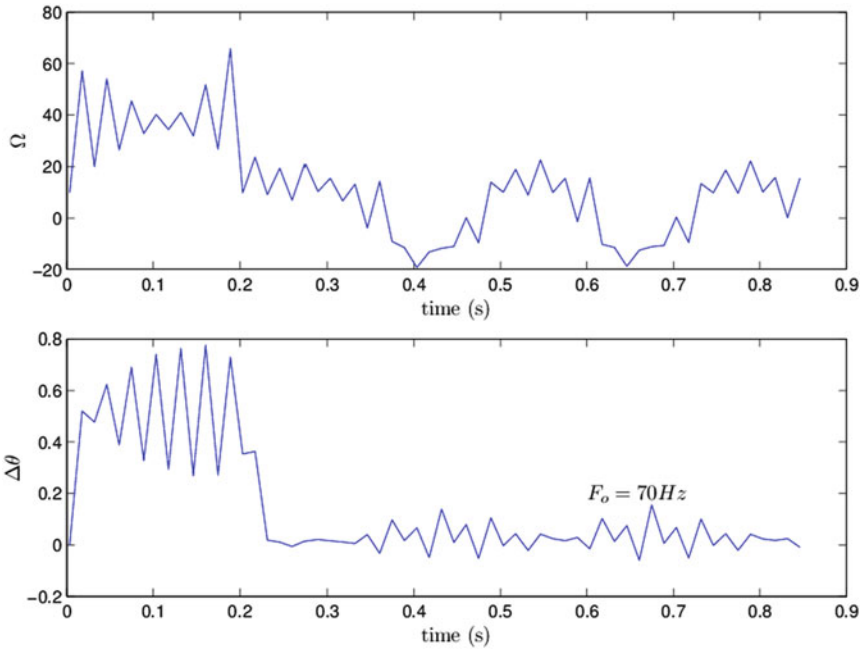


Fig. 17.7 Behavior of the uncontrolled stepper at 70 Hz

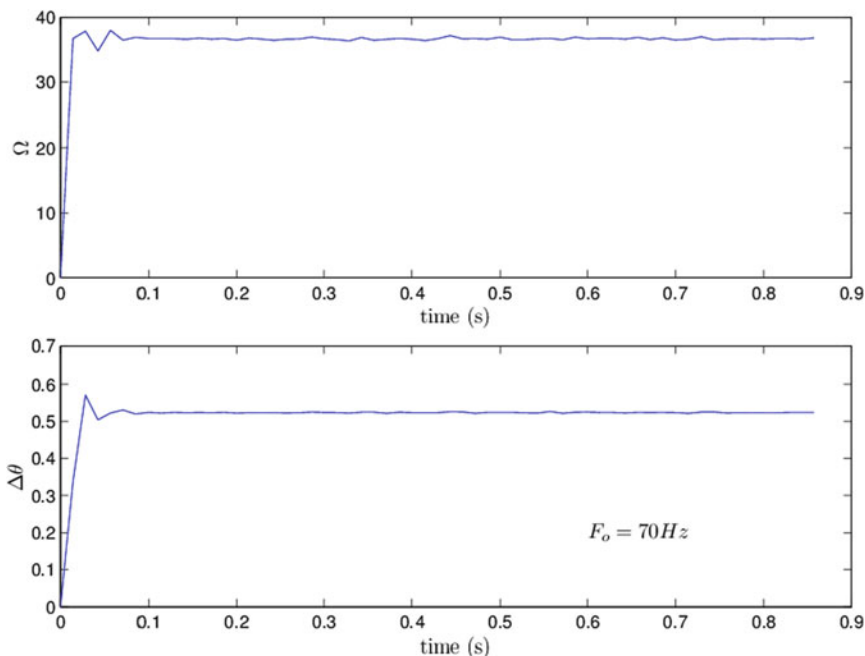


Fig. 17.8 Behavior of the controlled stepper at 70 Hz

17.5 Conclusion

In this paper we have presented a method to control the chaotic behavior of the stepper motor into a periodic one. This work is motivated by the need to use the stepper motor at higher control rating. The main advantage of the presented method is the efficiency to stabilize the stepper behavior at several high frequencies. On the other hand we need to optimize the algorithm in order to make it available for online application. The promising numerical results are to be investigated on a real setup using dSpace acquisition and control card.

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Chapter 18

Robust Chaos Synchronization for Chua's Circuits via Active Sliding Mode Control

Olfa Boubaker and Rachid Dhifaoui

18.1 Introduction

Chaos theory is a current research area extensively investigated in many application fields including robotics, non smooth mechanical systems and nonlinear electrical circuits (Banerjee et al. 2011, 2012, 2013). Principally, Chaos synchronization (Luo 2009) is the most important research field in this area. Synchronization implies that two systems which start from two different initial conditions are forced, using a control law, to have identical dynamics after some transitory time (Mkaouar and Boubaker 2011; Boubaker 2009). Control and synchronization of chaos systems was investigated in many research papers using different control strategies approaches (Chua et al. 1996; Yang and Chua 1997; Haeri and Khademian 2006; Mkaouar and Boubaker 2012a, 2013). In this research area, the Chua's oscillator (Kennedy 1993; Mkaouar and Boubaker 2012b) considered as the most famous electrical circuit to exemplify chaos (Chua et al. 1986, 1993), was used to verify the efficiency of the most proposed approaches.

In the other hand, active control approach (Bai and Lonngren 1997; Agiza and Yassen 2001), is one of the most interesting control strategies for its simplicity. A generalized design of the active control strategy is developed in (Ho and Hung 2002) while the adaptive design is investigated in (Tang 2008). The non-adaptive active control strategy is easy to design but cannot be adapted to cases with unknown parameters. However, adaptive active control is more powerful in presence of unknown parameters but the controller is usually expensive and complex to implement. Since system parameters fluctuate in real experimental situations by

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internal and external factors (Banerjee and Roy Chowdhury 2009), the active sliding mode control strategy is a better alternative. Active sliding mode control is one of the most recent techniques used in chaos synchronization. It is renowned for its simple design and robustness in practical applications. Several recent results exist in this field; see for example Zhang et al. (2004) and Cai et al. (2010). However, in our best knowledge, active sliding mode control approach was never applied to synchronize Chua’s circuits. The lack of results can be justified by the complexities of the dynamics introduced by the Chua’s circuit designed by a piecewise linear system (Mkaouar and Boubaker 2012a, 2013; Boubaker 2008).

In this paper, we propose a new procedure to design a robust controller for master slave chaos synchronization for two modified Chua oscillators via active sliding mode control strategy. The master circuit is considered as a nominal system whereas parameter uncertainties just affect the slave system. Using a Lyapunov approach and a reaching condition to the sliding surface and assuming some conditions on the uncertainties and noise magnitude, we will show that finite time synchronization can be guaranteed. The paper is organized as follows: The problem formulation will be exposed in the next section. In Sect. 18.3, the design procedure of active sliding mode control is established for synchronizing two identical modified Chua oscillators with known parameters. Robust synchronization will be developed in Sect. 18.4. In Sect. 18.5, simulation results will be finally presented to prove the robustness of the proposed approach.

18.2 Problem Formulation

Let consider the most famous electrical circuit to exemplify chaos: the Chua’s circuit shown in Fig. 18.1 with its well-known nonlinear Chua diode having the resistor R_V (Kennedy 1993). The Chua circuit can be described by its modified model as (Chua et al. 1993):

$$\begin{cases} \dot{x}_1(t) = \alpha (x_2 - x_1) + f(x_1) \\ \dot{x}_2(t) = x_1 - x_2 + x_3 \\ \dot{x}_3(t) = -\beta x_2 \end{cases} \tag{18.1a}$$

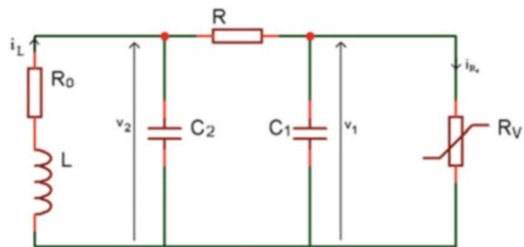


Fig. 18.1 Nonlinear Chua’s circuit

where:

$$f(x_1) = -\alpha \left(bx_1 + \frac{1}{2} (a-b) [|x_1 + 1| - |x_1 - 1|] \right) \quad (18.1b)$$

$x(t) = [x_1(t) \ x_2(t) \ x_3(t)]^T \in \mathcal{R}^3$ is the state vector and α, β, a, b are some constant parameters.

For a specific range of these parameters, it is shown that the modified Chua circuit model (18.1a) can have a chaotic behavior (Kennedy 1993). In this case, all state variables are bounded.

Consider now, a master system described by the Chua nominal model (18.1a) and a slave system described by the following uncertain model:

$$\begin{cases} \dot{y}_1(t) = (\alpha + \Delta\alpha)(y_2 - y_1) + f(y_1) + \Delta f(y_1) + u_1(t) + p \\ \dot{y}_2(t) = y_1 - y_2 + y_3 + u_2(t) \\ \dot{y}_3(t) = -(\beta + \Delta\beta)y_2 + u_3(t) \end{cases} \quad (18.2a)$$

where:

$$f(y_1) = -\alpha \left(by_1 + \frac{1}{2} (a-b) [|y_1 + 1| - |y_1 - 1|] \right) \quad (18.2b)$$

$y = [y_1 \ y_2 \ y_3]^T \in \mathcal{R}^3$ is the state vector of the slave system, p is the external perturbation and $\Delta\alpha, \Delta\beta, \Delta f(y_1)$ some internal perturbations. The objective of the synchronization problem is to design a control vector $u(t) = [u_1(t) \ u_2(t) \ u_3(t)]^T \in \mathcal{R}^3$ such that chaos synchronization between systems (18.1a) and (18.2a) is achieved in a finite time. It is clear that the finite-time synchronization problem can be transformed into the equivalent problem of the finite-time stabilization of an error system.

To solve the finite time synchronization problem, let define the error between the master and slave systems as follows:

$$e(t) = y(t) - x(t) \quad (18.3)$$

Therefore, subtracting (18.2a) from (18.1a), the error dynamics is obtained as follows:

$$\begin{cases} \dot{e}_1(t) = \alpha(e_2 - e_1) + f(y_1) - f(x_1) + \Delta f(y_1) + \Delta\alpha(y_2 - y_1) + p + u_1 \\ \dot{e}_2(t) = e_1 - e_2 + e_3 + u_2 \\ \dot{e}_3(t) = -\beta e_2 - \Delta\beta y_2 + u_3 \end{cases} \quad (18.4)$$

Definition 1 The master system (18.1a) and the slave system (18.2a) are synchronized in a finite time if there exist a constant time T such that:

$$\lim_{t \rightarrow T} \|e(t)\| = 0 \quad (18.5)$$

and $e \equiv 0$ if $t \geq T$.

The last problem will be solved under the following assumptions:

A₁: The uncertainties $\Delta\alpha$ and $\Delta\beta$ are assumed to be unknown but constant in time and bounded such that:

$$|\Delta\alpha| \leq L_1, \quad |\Delta\beta| \leq L_2$$

A₂: Parameters α, β, a, b are chosen such that the slave Chua's system model (18.1a) has a chaotic behavior. Therefore, the state variables $x_1(t), x_2(t)$ and $x_3(t)$ are all bounded.

A₃: In spite of uncertainties, slave Chua's system (18.2a) must also have a chaotic behavior. Therefore, the state variables $y_1(t), y_2(t)$ and $y_3(t)$ are all bounded.

A₄: The non linear uncertainty $\Delta f(y_1)$ is bounded such that:

$$\|\Delta f(y_1)\| \leq L_3 \|y_1\| + L_4$$

A₅: p is assumed to be a white noise: The external perturbation is then bounded such as:

$$|p| \leq L_5$$

L_1, L_2, L_3, L_4, L_5 are some positive constants.

18.3 Active Sliding Mode Control Synchronization

Active sliding mode control is a discontinuous control strategy which will be designed in two design stages. The first stage is to select an appropriate active controller in order to overcome the nonlinearities in the error dynamical model between the master and the slave systems. The second stage is to design a sliding mode controller to achieve the synchronization.

In this section, design procedure of the active sliding mode controller is established for synchronizing two identical modified Chua oscillators with known parameters.

The internal and external perturbations are then not considered here. So, the dynamical error system (18.4) can be written as:

$$\begin{cases} \dot{e}_1(t) = \alpha(e_2 - e_1) + f(y_1) - f(x_1) + u_1(t) \\ \dot{e}_2(t) = e_1 - e_2 + e_3 + u_2(t) \\ \dot{e}_3(t) = -\beta e_2 + u_3(t) \end{cases} \quad (18.6)$$

18.4 First Stage: Active Controller Design

To overcome the nonlinearities in the error dynamical model (18.6), let define the active control vector $u(t)$ as:

$$u(t) = v(t) - \tilde{F} \quad (18.7)$$

$v(t) \in \mathcal{R}^3$ and $\tilde{F}(t) \in \mathcal{R}^3$ are respectively defined by:

$$v(t) = \tilde{R}e(t) \quad (18.8)$$

where:

$$\tilde{R} = \begin{pmatrix} -r_1 + \alpha & -\alpha & 0 \\ -1 & 1 - r_2 & -1 \\ 0 & \beta & -r_3 \end{pmatrix} \quad \tilde{F} = \begin{pmatrix} f(y_1) - f(x_1) \\ 0 \\ 0 \end{pmatrix}$$

Substituting (18.7) in (18.6) we get:

$$\dot{e}(t) = -Re(t) \quad (18.9)$$

where:

$$R = \begin{pmatrix} r_1 & 0 & 0 \\ 0 & r_2 & 0 \\ 0 & 0 & r_3 \end{pmatrix}$$

For all constants $r_1, r_2, r_3 > 0$, the error system (18.6) is asymptotically stable for the active control law (18.7).

18.5 Second Stage: Active Sliding Mode Control Design

Let, now, define the active sliding mode control vector $u(t)$ as (18.7) where:

$$v(t) = \tilde{R}e(t) + kw(t) \quad (18.10)$$

where $k = [k_1 \ k_2 \ k_3]^T \in \mathcal{R}^3$ and $w(t) \in \mathcal{R}$ is a bounded input scalar. Substituting (18.10) in (18.6) we get:

$$\begin{cases} \dot{e}_1(t) = -r_1 e_1(t) + k_1 w(t) \\ \dot{e}_2(t) = -r_2 e_2(t) + k_2 w(t) \\ \dot{e}_3(t) = -r_3 e_3(t) + k_3 w(t) \end{cases} \quad (18.11)$$

For $r_1 = r_2 = r_3 = r$, the system (18.11) can be written as:

$$\dot{e}(t) = -rIe(t) + kw(t) \quad (18.12)$$

where $I \in \mathcal{R}^3$ is the identity matrix. Let now impose to the input vector $w(t)$ to verify (Boubaker et al. 2001):

$$w(t) = \begin{cases} w^-(t) & \text{if } s(e) < 0 \\ w^+(t) & \text{if } s(e) \geq 0 \end{cases} \quad (18.13)$$

where $s(e) \in \mathcal{R}$ is a sliding surface defined by:

$$s(t) = Ce(t) \quad (18.14)$$

where $C = [C_1 \ C_2 \ C_3] \in \mathcal{R}^3$. Furthermore, impose to the sliding surface to satisfy the reaching condition (Boubaker and Babary 2003):

$$\dot{s}(t) = -q\text{sign}(s) - rs(t) \quad (18.15)$$

Substituting (18.12) in the derivative of (18.14), we obtain:

$$\dot{s}(e) = C\dot{e}(t) = C(-rIe(t) + kw(t)) \quad (18.16)$$

Equating (18.15) to (18.16), we obtain the expression of the input vector such that:

$$w(t) = -(Ck)^{-1}q\text{sign}(s) \quad (18.17)$$

Theorem 1 For all scalars $r > 0$ and $q > 0$, the system (18.12) is finite time stable for the active sliding mode control (18.17) using the sliding surface (18.14) and its trajectories converge to the equilibrium $e \equiv 0$ in a finite time.

Proof Impose to the error dynamics (18.12) to have a Lyapunov function:

$$V = 0.5s^2 \quad (18.18)$$

The derivative of the Lyapunov function is then given by:

$$\frac{dV}{dt} = \dot{V} = s\dot{s} \quad (18.19)$$

Using (18.16) and (18.17) in (18.19), the derivative of the Lyapunov function can be written as:

$$\dot{V} = sC \left(-rIe(t) - k(Ck)^{-1}q\text{sign}(s) \right) \quad (18.20)$$

Using (18.14), the derivative of the Lyapunov function is given by:

$$\dot{V} = -q s \text{sign}(s) - r s^2 \quad (18.21)$$

For all scalar $r > 0$ and $q > 0$ we always have $\dot{V} < 0$ for $e \neq 0$. The computation of the reaching time can be made using the reaching condition (18.15).

18.6 Robust Chaos Synchronization

Theorem 2 *If the assumptions A_1 to A_5 are fulfilled, the master system (18.1a) and the slave system (18.2a) are synchronized in a finite time for the control law:*

$$u(t) = \bar{R}e(t) - \tilde{F} - k(Ck)^{-1}q\text{sign}(s) \quad (18.22)$$

where:

$$\bar{R} = \begin{pmatrix} -r + \alpha & -\alpha & 0 \\ -1 & 1 - r & -1 \\ 0 & \beta & -r \end{pmatrix} \tilde{F} = \begin{pmatrix} f(y_1) - f(x_1) \\ 0 \\ 0 \end{pmatrix}$$

using the sliding surface defined by (18.14) whatever the constant vectors $C = [C_1 \ C_2 \ C_3] \in \mathcal{R}^3$, $k = [k_1 \ k_2 \ k_3]^T \in \mathcal{R}^3$ and if there exist a positive definite scalar μ satisfying for all positive definite scalars r and q :

$$|s| < \mu \|C\|/r \quad (18.23)$$

Proof Impose to the error dynamics (18.4) to have the Lyapunov function (18.18). Using (18.14) and (18.17) for the error dynamics (18.4), the derivative function (18.19) can be written as:

$$\dot{V} = sC \left(-rIe + M(y) - k(Ck)^{-1}q\text{sign}(s) \right) \quad (18.24)$$

where:

$$M(y) = \begin{pmatrix} \Delta\alpha(y_2 - y_1) + \Delta f(y_1) + p_1 \\ 0 \\ -\Delta\beta y_2 \end{pmatrix} \quad (18.25)$$

Using (18.14), the derivative of the Lyapunov function (18.24) is given by:

$$\dot{V} = -q s \operatorname{sign}(s) - r s^2 + s C M(y) \quad (18.26)$$

or equivalently:

$$\dot{V} = -q s \operatorname{sign}(s) - s (r s - C M(y)) \quad (18.27)$$

$\dot{V} < 0$ is always guaranteed if:

$$\begin{cases} r s - C M(y) < 0 & \text{if } s > 0 \\ r s - C M(y) > 0 & \text{if } s < 0 \end{cases} \quad (18.28)$$

or equivalently:

$$|s| < \mu \|C\| / |r| \quad (18.29)$$

where μ is some positive scalar constant satisfying:

$$\|M(y)\| \leq \mu \quad (18.30)$$

The constant μ can be computed using assumptions **A₁** to **A₅**.

18.7 Application

To prove the efficiency of the proposed approach, simulation results are conducted using the parameters $(\alpha, \beta, a, b) = (10, 18, -1.28, -0.69)$. For the nominal master system (18.1a) and the uncertain slave system (18.2a). Uncertainties in the slave Chua's circuit are fixed as: $\Delta\alpha = 0.1\alpha$, $\Delta\beta = 0.1\beta$, $\Delta f(y_1) = 0.1f(y_1)$, $|p| = 0.1$. The chaotic dynamics of the modified Chua's circuit are shown by Fig. 18.2 whereas the attractor is point up by Fig. 18.3. Robust synchronization is achieved using the Theorem 2 for the parameters:

$$k = [100 \ 100 \ 100]^T; C = [1 \ 1 \ -1]^T; r = 100; q = 10$$

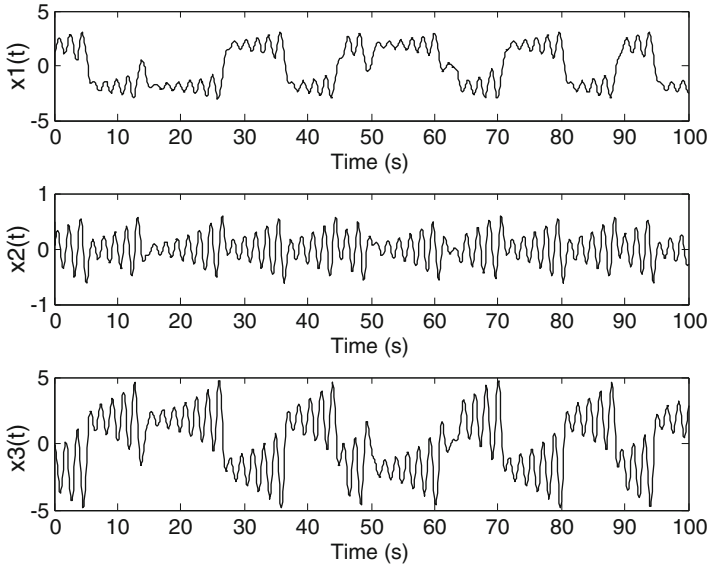
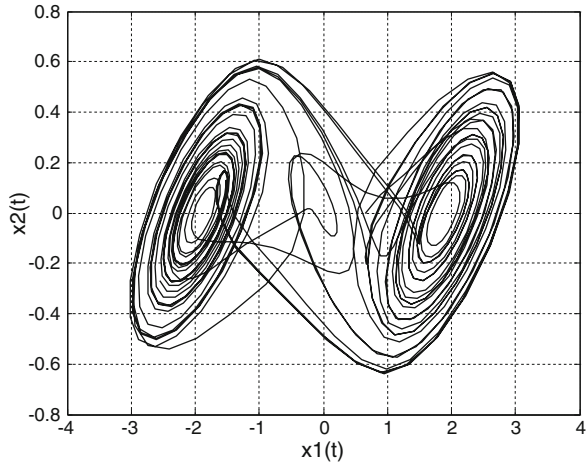


Fig. 18.2 Chaotic dynamics of the Chua's circuit

Fig. 18.3 Chua's circuit attractor



The error dynamics between master and slave systems are displayed by Fig. 18.4 whereas the sliding surface is given by Fig. 18.5. Simulation results prove that robust chaos synchronization is well achieved in a finite time.

Furthermore, when comparing our approach to related works, we can confirm that the synchronization problem of the Chua's systems (18.1a) and (18.2a) can't be solved using the approaches proposed in Zhang et al. (2004) and Cai et al. (2010).

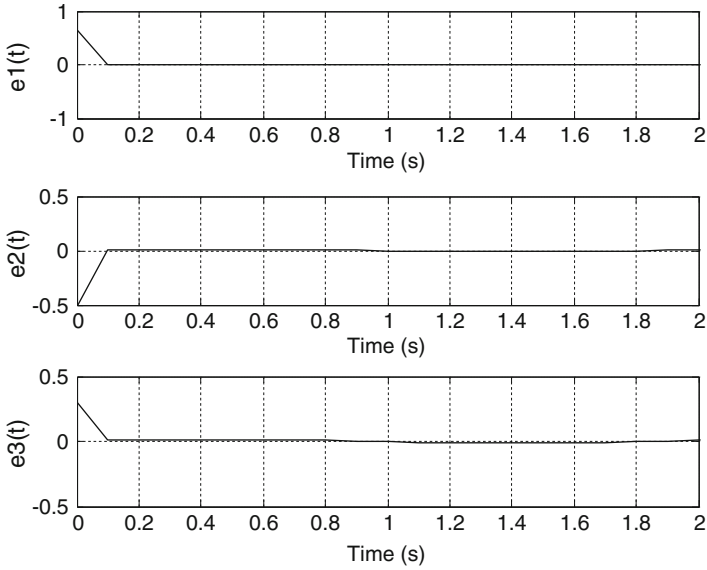
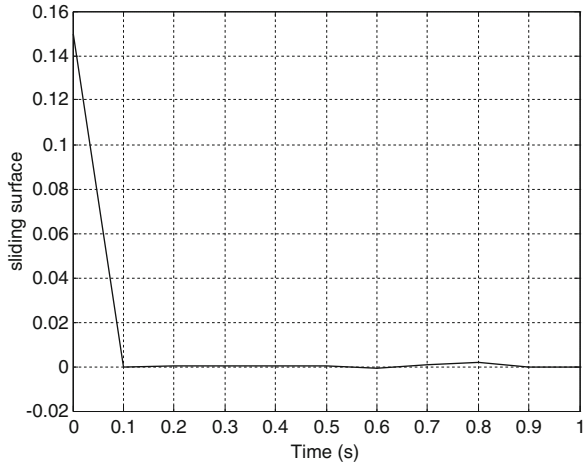


Fig. 18.4 Error dynamics

Fig. 18.5 Finite time reaching time



18.8 Conclusion

Robust chaos synchronization problem is solved for master slave Chua’s circuits using an active sliding mode control approach. An explicit relation between control parameters and the level of uncertainties was derived for which the robust controllers ensure finite time stabilization of error dynamics between the master and the slave Chua’s circuits.

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Chapter 19

A Modeling Approach Based on Fuzzy Least Squares Method for Multi-Response Experiments with Replicated Measures

Özlem Türkşen and Ayşen Apaydın

19.1 Introduction

Multi-response experiments, in which a number of responses are measured simultaneously for each setting of a group of input variables, are very common in many real world application problems. One of the objectives in the multi-response experiments is to estimate the unknown relationship between each response and input variables. Response Surface Methodology (RSM) is a useful statistical and mathematical method for defining the analytical relationship between input and response variables in multi-response experiments (Khuri and Cornell 1996; Myers and Montgomery 2002). In RSM, regression analysis is used as a main tool for the model building phase with some assumptions that the relationship is linear or quadratic. However, in most practical problems, this relationship has complexity, nonlinearity, vagueness, and imprecision. Besides that, the number of observations can be inadequate, or there is difficulty verifying that the modeling error is normality distributed, or there is ambiguity associated with the event, or there is uncertain information about the data (Shapiro 2005). In such cases, fuzzy approach, which is firstly introduced by Zadeh (1965), is used commonly for model building stage of multi-response experiments. Kim and Lin (1998) used a fuzzy modeling approach to model the relationship between responses and input variables. Xu and Dong (2006) assumed that the observed responses are triangular fuzzy numbers and estimated the unknown triangular fuzzy model parameters by using fuzzy least squares (FLS) method. In some situations, the observed response values can be composed of replicated measures of responses. Hence, the observed response values are uncertain due to the vagueness or fuzziness of the observed responses for each experiment condition. In this case, fuzzy numbers and fuzzy values are more proper

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for representing uncertain information of the data Bashiri and Hosseinezhad (2009) used a fuzzy modeling approach for the replicated measures of responses.

In this work, a multi-response experiment with replicated measures of responses is considered. The replicated response values are considered as triangular fuzzy numbers in order to incorporate the uncertainty of the responses to the model. The fuzzy model parameters, represented as triangular fuzzy number, are estimated by using FLS method with Diamond’s distance metric (Diamond 1988). The paper is organized as follows. Section 19.2 contains proposed fuzzy modeling approach. In Sect. 19.3, a numerical example is given to illustrate the proposed methodology. Section 19.4 draws the conclusions.

19.2 Fuzzy Modeling for Replicated Measures of Responses

The first stage of a multi-response experiment is data gathering which is called design of experiment enables us to find the most valuable information about the features of the problem. The Table 19.1 shows a multi-response experiment design, which includes replicated measures of responses.

In Table 19.1, the X_{ij} and Y_{iks} represent the j th input level value, $j = 1, 2, \dots, p$, and k th response value, $k = 1, 2, \dots, r$, for the s th replicate, $s = 1, 2, \dots, t$ in i th experiment, $i = 1, 2, \dots, n$, respectively. The observed values of a response are obtained differently for each replication of the multi-response experiment. It can be possible to say that there is a vagueness rather than randomness on the replicated measures. This vagueness can be represented as triangular fuzzy numbers. In this case, the design of multi-response experiment with fuzzy observed responses can be shown in Table 19.2. In order to represent the observed replicated measures of r th response value $\mathbf{Y}_r = [Y_{ir1} \ Y_{ir2} \ \dots \ Y_{irt}]$ as a triangular fuzzy number, the mean and standard deviation of the replicated measures are calculated. The triangular fuzzy value of r th response is given as $\tilde{Y}_{irs} = (Y_{irs}^l, Y_{irs}^c, Y_{irs}^u)$, $i = 1, 2, \dots, n; s = 1, 2, \dots, t$ in which

$$\begin{aligned}
 Y_{irs}^l &= \text{mean}([Y_{ir1} \ Y_{ir2} \ \dots \ Y_{irt}]) - \text{std.dev}([Y_{ir1} \ Y_{ir2} \ \dots \ Y_{irt}]) \\
 Y_{irs}^c &= \text{mean}([Y_{ir1} \ Y_{ir2} \ \dots \ Y_{irt}]) \\
 Y_{irs}^u &= \text{mean}([Y_{ir1} \ Y_{ir2} \ \dots \ Y_{irt}]) + \text{std.dev}([Y_{ir1} \ Y_{ir2} \ \dots \ Y_{irt}]).
 \end{aligned}$$

Table 19.1 Results of a multi-response experiment with replicated measures

No	Input levels				Responses								
					\mathbf{Y}_1				\mathbf{Y}_r				
	X_1	X_2	\dots	X_p	Y_{i11}	Y_{i12}	\dots	Y_{i1t}	\dots	Y_{ir1}	Y_{ir2}	\dots	Y_{irt}
1	X_{11}	X_{12}	\dots	X_{1p}	Y_{111}	Y_{112}	\dots	Y_{11t}	\dots	Y_{1r1}	Y_{1r2}	\dots	Y_{1rt}
2	X_{21}	X_{22}	\dots	X_{2p}	Y_{211}	Y_{212}	\dots	Y_{21t}	\dots	Y_{2r1}	Y_{2r2}	\dots	Y_{2rt}
.
.	.	.	\dots	.	.	.	\dots	.	\dots
.
n	X_{n1}	X_{n2}	\dots	X_{np}	Y_{n11}	Y_{n12}	\dots	Y_{n1t}	\dots	Y_{nr1}	Y_{nr2}	\dots	Y_{nrt}

Table 19.2 Results of a multi-response experiment with fuzzy responses

No	Input levels				Fuzzy responses			
	X_1	X_2	...	X_p	\tilde{Y}_1	\tilde{Y}_2	...	\tilde{Y}_r
1	X_{11}	X_{12}	...	X_{1p}	\tilde{Y}_{11}	\tilde{Y}_{12}	...	\tilde{Y}_{1r}
2	X_{21}	X_{22}	...	X_{2p}	\tilde{Y}_{21}	\tilde{Y}_{22}	...	\tilde{Y}_{2r}
...
n	X_{n1}	X_{n2}	...	X_{np}	\tilde{Y}_{n1}	\tilde{Y}_{n2}	...	\tilde{Y}_{nr}

Fig. 19.1 A triangular fuzzy response $\tilde{Y}_{.r}$.

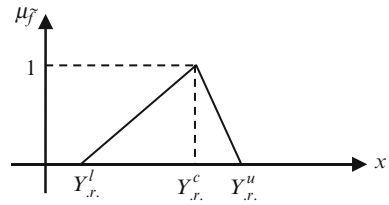


Figure 19.1 shows a triangular fuzzy response value. It is required to find a proper approximation for the true functional relationship between inputs and fuzzy response variables. The second order response surface model is used to model the unknown and perhaps very complicated response function in fuzzy setting.

The fitted second order fuzzy response function can be written in the form

$$\hat{Y} = \tilde{\beta}_0 + \sum_{i=1}^k \tilde{\beta}_i X_i + \sum_{i=1}^k \tilde{\beta}_{ii} X_i^2 + \sum_{i=1}^k \sum_{i < j}^k \tilde{\beta}_{ij} X_i X_j \tag{19.1}$$

in which $\tilde{\beta}_0$, $\tilde{\beta}_i$, $\tilde{\beta}_{ii}$, and $\tilde{\beta}_{ij}$ $i, j = 1, 2, \dots, p; i \leq j \dots$ are triangular fuzzy numbers, denoting $\tilde{\beta}_i = (\beta_i - \beta_i^{ls}, \beta_i, \beta_i + \beta_i^{rs})$, $\tilde{\beta}_{ii} = (\beta_{ii} - \beta_{ii}^{ls}, \beta_{ii}, \beta_{ii} + \beta_{ii}^{rs})$ and $\tilde{\beta}_{ij} = (\beta_{ij} - \beta_{ij}^{ls}, \beta_{ij}, \beta_{ij} + \beta_{ij}^{rs})$. Here, $\beta^{ls} = [\beta_0^{ls} \ \beta_i^{ls} \ \beta_{ii}^{ls} \ \beta_{ij}^{ls}]$ and $\beta^{rs} = [\beta_0^{rs} \ \beta_i^{rs} \ \beta_{ii}^{rs} \ \beta_{ij}^{rs}]$ show the left and right spread vectors, respectively. The fitted fuzzy response function given in Eq. 19.1 is obtained by using FLS method. It is notable that the fuzzy response model does not require any assumption regarding the form or degree of the estimated response function and each response may have different form and different set of input variables. In this work, it is assumed that the responses are uncorrelated. The triangular fuzzy model parameters are determined by using the following least squares problem with respect to Diamond's distance metric (Diamond 1988)

$$\min \phi(\hat{\beta}) = \sum_{k=1}^r d_D^2(\tilde{Y}_k, \hat{Y}_k) \tag{19.2}$$

in which each observed fuzzy response is denoted as $\tilde{Y}_k = (Y_k - Y_k^{ls}, Y_k, Y_k + Y_k^{rs})$, $k = 1, 2, \dots, r$ and $\tilde{\beta} = (\beta - \beta^{ls}, \beta, \beta + \beta^{rs})$. According to the linear operation properties of triangular fuzzy numbers and assuming that the $(X'X)$ is nonsingular the fuzzy parameter values are given in Türkşen and Apaydın (2012) as

$$\begin{aligned} \beta &= (X'X)^{-1}X'Y \\ \beta^{ls} &= (X'X)^{-1}X'Y^{ls} \\ \beta^{rs} &= (X'X)^{-1}X'Y^{rs}. \end{aligned} \tag{19.3}$$

19.3 Application

In this section, a numerical example is given from literature (Pignatiello 1993) to illustrate the proposed fuzzy modeling approach. In the example, there are two response variables (Y_1, Y_2) and three input variables (X_1, X_2, X_3) . It is assumed that the target values of responses are 103 and 73 and the specification limits are (97, 109), (70, 76) for (Y_1, Y_2) , respectively and the responses are uncorrelated. It was agreed that a simultaneous maximization of Y_1 and Y_2 would be desirable. The experiment was conducted in a full factorial design and each process point was replicated four times. The experimental data set is given in Table 19.3.

In order to obtain fuzzy responses, the mean and standard deviation of replicated measures of two responses are calculated as mentioned before. The fuzzy responses, represented as triangular fuzzy numbers, are indicated in Table 19.4.

Applying the proposed fuzzy modeling approach based on FLS, the obtained fuzzy response functions are given in below:

Table 19.3 The experimental data set (Bashiri and Hosseinezhad 2009)

No	Input levels			Responses							
	X_1	X_2	X_3	Y_1				Y_2			
				Rep.1	Rep.2	Rep.3	Rep.4	Rep.1	Rep.2	Rep.3	Rep.4
1	-1	-1	-1	109.895	109.759	110.704	109.773	67.697	67.237	67.962	66.927
2	1	-1	-1	100.192	99.634	100.269	100.600	67.026	66.178	66.576	67.943
3	-1	1	-1	106.078	105.642	105.670	105.393	72.935	72.851	72.577	72.375
4	1	1	-1	104.120	104.802	104.203	104.335	72.988	74.249	73.937	73.282
5	-1	-1	1	113.515	111.121	112.854	106.666	68.293	68.469	68.958	64.705
6	1	-1	1	98.732	99.357	102.842	94.235	67.096	63.611	68.647	62.419
7	-1	1	1	103.145	106.959	107.620	103.440	71.682	76.266	77.496	76.374
8	1	1	1	104.454	105.029	99.786	104.923	76.900	77.032	67.989	75.769

Table 19.4 The experimental data set with fuzzy responses

No	Input levels			\tilde{Y}_1	\tilde{Y}_2
	X_1	X_2	X_3		
1	-1	-1	-1	(109.5811, 110.0327, 110.4844)	(66.9932, 67.4558, 67.9183)
2	1	-1	-1	(99.7727, 100.1738, 100.5748)	(66.1722, 66.9308, 67.6893)
3	-1	1	-1	(105.4121, 105.6958, 105.9794)	(72.4277, 72.6845, 72.9413)
4	1	1	-1	(104.0605, 104.3650, 104.6695)	(73.0339, 73.6140, 74.1941)
5	-1	-1	1	(107.9538, 111.0390, 114.1242)	(65.6517, 67.6063, 69.5608)
6	1	-1	1	(95.2564, 98.7915, 102.3266)	(62.5278, 65.4432, 68.3587)
7	-1	1	1	(102.9645, 105.2910, 107.6175)	(72.8787, 75.4545, 78.0303)
8	1	1	1	(101.0276, 103.5480, 106.0684)	(70.0962, 74.4225, 78.7488)

Table 19.5 RMSE results for the fuzzy and classic regression models

	Fuzzy	Classic
Model 1 (Y_1)	1.0540	2.0485
Model 2 (Y_2)	0.4009	2.16

$$\begin{aligned} \hat{Y}_1(\mathbf{X}) &= (103.25, 104.87, 106.48) + (-3.22, -3.15, -3.07) X_1 \\ &\quad + (-0.14, -0.14, -0.14) X_2 + (-1.45, -0.20, 1.05) X_3 \\ &\quad + (2.38, 2.38, 2.38) X_1 X_2 \end{aligned}$$

$$\begin{aligned} \hat{Y}_2(\mathbf{X}) &= (68.72, 70.45, 72.18) + (-0.77, -0.35, 0.07) X_1 + (3.39, 3.59, 3.80) X_2 \\ &\quad + (-0.93, 0.28, 1.49) X_3 + (0.22, 0.32, 0.43) X_1 X_2 \end{aligned} \tag{19.4}$$

In the obtained fuzzy regression models, given in Eq. 19.4, the model error is not treated as a random term, but incorporated into the fuzzy regression coefficients. The classical regression analysis is applied to the data set given in Table 19.3 in the studies of Hejazi et al. (2012). When the classical regression analysis is used to model the unknown response surface, normality assumption on the random errors must be satisfied in order to make some statistical inferences. It is seen that the normality assumption is not satisfied for the models given in Hejazi et al. (2012). In addition, the modeling error metric RMSE (Root Mean Square Error) has lower value in fuzzy regression models rather than classical models. The RMSE comparison results are given in Table 19.5.

It is clear from the Table 19.5 that fuzzy regression models are more proper for modeling of the data set which is composed of replicated measures of responses. Representing the replicated measures as fuzzy numbers helps to incorporate the vagueness of the responses to the model. And also, there is no assumption for modeling phase with fuzzy approach.

19.4 Conclusion

In this study, a fuzzy modeling approach based on FLS is proposed for the multi-response experimental data set, composed of replicated measures of responses. The input variables are considered as crisp and replicated measures of responses are considered as triangular fuzzy numbers. It is seen that the fuzzy approach is more proper to model the uncertainty and complexity of the responses. In order to demonstrate the applicability of the presented fuzzy modeling approach, a real problem is employed on the case study. For future work, fuzzy modeling can be applied in the case of the responses are correlated.

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Chapter 20

Chaos, Complexity and Police Leadership

Ramazan Terkeşli

20.1 Introduction

We live in such a complicated world that we have never faced as humanity. The systems we have relied on so far do not work, retracing the solutions we have used so far drag us to a deeper complexity. It is not sufficient to patch to the parts of the system any more. It is required that the whole system be reconstructed again.

When we look at challenging and complicated problems like climate change, food crisis, wars inside, terrorism and destruction of the nature, we see that old familiar solutions do not work anymore; therefore we need to go beyond the approaches creating the problems. Many philosophers, activists, social entrepreneurs and academics search the answer of this question today.

Everyone trying to see and comprehend the great Picture through common-sense agrees upon one topic: the old system of the world that we already know and enjoy is ending. Social, economic and ecologic systems continue to erode. Instead of patching the old familiar solutions to this situation by panic and fear, visionary leaders and social innovators should see and take action by a perception that the world is chaotic, everything is linked with each other and it can't be circumvented. We should understand the dynamics that complicated systems, chaos and everything are linked with each other and educate ourselves on living in these conditions.

For all these reasons, leaders are more needed today much more than any time in such a complicated and chaotic atmosphere. It is not possible to solve problems of today and to cover the expectations of today without a successful organization. A successful organization is not possible without a successful leader either. An incapable leader may make the institutions sicker just like an incapable doctor and even kill them.

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The concept of leadership is vitally important for all institutions. There are various reasons that it is not clear who the good leader is and what the features of a good leader are. First, the leader himself/herself is a human being and there are many reasons affecting the human behaviour (Harold 2011). The same conditions may not result in the same behaviours. Also the same conditions may cause different behaviours in different persons. Therefore it becomes hard to describe the leader's leadership behaviours. Second, the followers of a leader are human beings too. The same problem exists for the followers too. The manifestation of innumerable factors affecting the behaviours of the followers under different time and conditions affect the leader's behaviours too (Alkın and Unsar 2007). It is not so easy for a leader to manipulate the persons whose values, expectations and perceptions are different from each other towards the same target (Tengilimoglu 2005). Third, leadership perception and expectations of followers on this topic change in time. Ideal leader behaviours and its features of 50 years before have lost its importance today. Who the good leader is and what the necessary features of a good leader are change in accordance with this change process. Fourth, the features of a leader change from society to society and culture to culture. This difference exists for the institutions too. The features of leadership in a public institution may not make any sense in a private sector institution or two different public institutions may require different features of leadership. To sum up, it can be stated that there is no unique definition of leadership and there are no definite features of leadership described. The features of ideal leader must be redetermined in accordance with the changing time and conditions, characteristics of his/her followers s/he guides, leader's society and institution.

Akis (2004, p. 63) has listed 21 indispensable features of impressive leaders by using different resources in leadership literature:

To have a vision/To be ambitious and self-sacrificing/To be faithful, determined and consistent/To be a good model/To trust and to be trustworthy/To motivate/To integrate the expectations with the vision/To inspire/To be focused on the development/To have the feeling of justice/To be modest/To be a good listener/To establish an open communication/To be sensitive towards persons/To be sensitive towards situations/To be innovator/To decide fast and efficiently/To be flexible/To use time efficiently/To be able to form a synergetic team/To have knowledge.

When we consider the Police Organization on the base of these general determinations, Turkish Police Organization performs an essential duty from the point of individual and public security. It is possible for Turkish Police Organization to run service providing individuals and society with satisfaction and support only by managing its all resources specifically human resources effectively. This can be achieved only by the good leaders in the Organization.

Police leaders are responsible for the execution of the charges loaded to the organization, productivity of his/her subordinates and their success. Each good police leader is also a trainer, teacher, planner, discipline keeper, advisor, listener, friend, communicator and performance evaluator. When considered the hard conditions of policing and the situation of workers tending to stress more, the burden of police leaders and the importance of the features they need to have increase twofold (Delice et al. 2010).

It is required that police leaders today have efficient and sufficient qualities and so a good leadership education in order to identify the problems correctly and solve them practically and effectively as the needs and expectations of the society get complicated gradually.

20.2 Police Leadership

Police Organization needs effective leaders to reach its goals and to be more successful as well as every institution. Police leaders are expected to inspire other employees, motivate them and achieve an effective performance in order to realize his/her institution's goals (Vito and Higgins 2010). Police leadership was firstly mentioned in the book, 'Police Administration' by Leonhard F. Fuld, published in 1909 (Ozguler 2002). Although the issue of police leadership has been dealt with in various studies as of this date, police leadership hasn't acquired the interest anticipated by 1980s. The importance of police leadership has been comprehended and researches on police leadership have been initiated after 1980 (Altuntas et al. 2012).

Police leaders perform duty on areas independent and different from each other. These areas may change even daily. Besides many factors may make working conditions of a police leader difficult due to the nature of policing. Haberfield (2006) defines the police leaders as individuals, able to control versatile and highly stressful events and make snap decisions together with the pressure of the society, media and the politicians. Another feature of police leadership is that each policeman at a rank is a chief and the leadership roles expected from these chiefs are very different from each other in accordance with the ranks. At the time of transitions from one rank to another, police leaders need to adapt their new roles and display the behaviours of their new positions. Police leaders are expected to prepare themselves for each step while stepping up one by one and to be qualified enough for these new steps.

The specific features related to policing oblige police leaders to be more careful, equipped and educated. Also changing conditions of today, changing perceptions of administration, new cultures and values, factors like expectations of citizens the police give service etc. require police leaders to be more equipped and to develop themselves continuously.

Despite the fact that the qualities of police leaders seem to be different from the leaders of other institutions, scientific researchers have indicated that the qualities that need to exist in police leaders are similar to the features anticipated to exist in other leaders. The autocratic leadership approach does not work and is not desired in police organizations either (Baker 2000). It is stated that police leaders who cannot adapt the change, do not support the change, abstain from taking risk, do not make time for the development of his/her followers can't be successful (Goldstein 1990). As is seen, the features of police leaders display a similarity with the leaders working for any other institution. The beneficial approaches on leadership in other institutions are beneficial in police organizations too (Altuntas et al. 2012).

Therefore modern leadership approaches and ideal leadership features described above can be applied for police organizations and police leaders too.

20.3 The Features That Need to Exist in Police Leaders

The researches carried out display that general leadership features are the same for the police leaders too. However some policing features have become more apparent for the reasons that police perform duty in a hierarchic structure and need to decide in urgency in the situations of crisis and chaos. These features are as follows:

To be Open to Change and Development: Police leaders must be open to innovations and innovative. Police leaders should be open to change and development, and develop themselves in a continuous dynamism.

Getting on With Technology: Police leaders must be able to raise awareness in the Police Organization in such a globalizing world where knowledge and communication systems provide added value to institutions and firms. Also, police leaders must be aware that technologic developments are adapted fast in Police Organization and this is an indispensable necessity in order to catch crime and criminals, make them ineffective and prevent crime before its occurrence.

Providing Motivation: Police leaders must be able to work their followers in a devoted, dedicated and fruitful way by providing motivation. Police leaders need to utilize the motivation means such as formation of an eligible working environment, prize, support, mentoring and guidance activities to motivate their personnel. Police leaders should primarily form the working environment and conditions in a way that the personnel feel themselves best and the goal here must be the highest productivity.

Having a Vision: Police leader must have a vision. Vision holder leaders are the ones who dream of and design the future of their societies and organizations (Ercetin 2000, p. 93). The past, today and future are the three essential timeframes affecting the behaviours of leaders. Future oriented behaviours keep great importance in visionary leadership behaviour. Visionary leadership is a horizon leadership and turns towards the future.

Communication Skill: Police leader must have communication skill to be effective and succesful. S/he must communicate and cooperate with other police units, other institutions and citizens by means of this skill.

Capacity of Representation: Police leaders must have the capacity of representation. They are before eyes like a model in the window shop and represent the organization. If the police leaders are successful on representation, the Police Organization will gain a reputation in the eye of both citizens and other institutions, and the cooperation and the communication with those will be easier.

Professional Knowledge, Skills and Capacity: Police leader must impress his/her followers and have sufficient knowledge, skill and capacity on their profession to be able to lead them for the goals of the institution. Police leaders will be able to impress their followers by his/her this feature and the followers will be able to trust on their leaders only by virtue of this feature.

Including his/her Followers in the Administration: Police leaders must include his/her followers in the administration. Police leaders must exchange ideas with their followers, value their ideas and transfer his/her powers to his/her subordinate leaders.

Being character-wise: The features of police leaders' personality have an important role for them to be effective and successful and, considered and respected by his/her followers. The way to be a good police leader bases upon being a good and model person.

Ensuring Qualified Employment and Coordination: Police leaders must be able to ensure a qualified employment and arrange coordination. Police leaders must be able to ensure a qualified employment and coordination inside the organization on the purpose of reaching institutional goals and ensuring the institutional productivity and quality.

20.4 Conclusion

Police leader must support his/her followers, encourage them, take their ideas and views, and include them in the process of administration by valuing them in order to become more successful in their both professions and roles. It will be easier to both prevent crimes and enlighten the crimes already penetrated by virtue of police leaders' good communication with citizens. Police leader must keep communication channels open, be open to meetings, negotiations, cocktails and different social activities which develop communication. Police leader should create flexibility and a social environment where they work by activating his/her friendly and funny features. S/he should form such social bonds among the employees based on respect, trust and caring each other. Police leader must be able to show the leadership behaviour and feature required by different situations by adapting different situations. Police leader must be ready to stand to the resistance possible to appear against change, and to persuade people in order to ensure the change of his/her followers even if himself/herself is ready for the change. Police leader must ensure that his/her communication with the organizations and institutions be carried out in kindness, respect and protocol rules, and by prioritising the interests of the institution. Police leader must develop his/her capacity on visionary leadership.

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Chapter 21

Ideas on Municipalities, Chaos Theory and Transformational Leadership

Recep Bozlağan

21.1 Introduction

The aim of this study is to identify ways of and deliver an opinion on how to take advantage of the strong mayor model in Turkey, chaos theory and transformational leadership approach in relation to the fact that municipalities affected by numerous internal and external factors shall achieve high performance. In this context, the first part of the study examined organic structure of municipality, relationship between municipal organs and status of mayor while transformational leadership approach was discussed in the second part and the third part focused on the chaos theory. At the end of the study, working environment for municipalities was evaluated within the framework of chaos theory and in this regard it was concluded that transformational leadership can be an appropriate model.

21.2 Organic Structure of Municipality, Relationship Among Municipal Organs and Status of Mayor

Municipality can be defined as an administrative unit of local government and is public corporate entity established in the statute of public legal entity having powers of self-government and autonomous both administratively and financially, in order to meet the common local needs of the inhabitants of specific geographical area and the decision making organ of which is elected by local electorates. Establishment of municipalities, their tasks, organs, financial structures, and relationship with the central government may vary by country and also amongst states in federal countries (Bozlağan 2009, p. 99).

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Municipalities in Turkey have been established and organized according to the articles 123 and 127 of the 1982 Turkish Constitution, Municipality Law No.5393 and Metropolitan Municipality Law No.5216. The term of “municipality” has been included in the Constitution and municipality has been recognized as one of the local government units with the status of public legal personality. The provisions regarding local government have been maintained in Article 127 of the Turkish Constitution. The Constitution on one hand guarantees to local government certain fields of responsibilities while on the other hand local government is subject to a strong administrative tutelage as well as various restrictions (T.C. 1982 Anayasası, md. 127).

Turkish municipal administrative system holds a threefold structure with a council, an executive committee and a mayor. Municipal council is defined by law as the only “decision-making body.” Which means in other words that it is only the municipal council that takes decisions about how municipality works and what kind of investments and activities are to be carried out. For this reason, municipal council is the competent authority where municipality’s strategic plan, performance program, investment program, budget, annual report and final account report are discussed and approved. Municipal council cannot delegate this authority to any other administrative organ (5393 sayılı Belediye Kanunu, md. 18). Municipal council is composed of members (councillors) directly elected by local electorates as well as of mayor of municipality.

Municipal executive committee, in consideration of its structure and authorities, is a specific body identified with Turkish administration system. Municipal executive committee consists of two halves; the first of which is formed by councillors elected by the municipal council among its members and the second one is composed of staffs appointed by mayor. Municipal executive committee carries and exercises the functions of consultation, coordination and execution. Municipal executive committee acts as the consultative body through propounding to municipal council in relation to the matters of strategic plan, performance program, investment program, budget, annual report and final account report for consideration and also expressing an opinion on issues referred by mayor of municipality (5393 sayılı Belediye Kanunu, md. 34). In addition, it also serves as a kind of platform where municipal bureaucrats and municipal councillors come together on a regular basis every week in order to discuss issues on the agenda. There are some cases where municipal executive committee functions as an organ of the executive power. Some of those mentioned functions, for instance, are that it takes decision of expropriation; works as tender commission in tender processes carried out in accordance with the Turkish legislation for Tendering Law No.2886 on Public Procurement; and performs the duties of “High Disciplinary Committee.” Municipal executive committee is not a decision-making body in that all decisions taken by municipal executive committee should be based on a decision of municipal council.

Mayor, as defined by the Municipality Law (through article 37), is the head of the municipal authority and represents its legal personality (5393 sayılı Belediye Kanunu, md. 37). Mayor is directly elected by local electorates. Mayor is the chief executive of the municipality and implement the decisions of both municipal council and municipal executive committee.

Municipal system in Turkey is based on “a strong presidency” model. In other words, council and executive committee – the other two organs that constitute the municipality – have relatively weak positions when compared to mayor. This is a result of the mayor’s competencies in the processes of both establishment and operation of these municipal organs as well as functioning of political parties and local electoral system. It is realised when considered in terms of the formation process of organs that mayor or mayoral candidate has a very strong influence on the formation of both municipal council and executive committee.

In order for mayor on the one hand to able to effectively implement party policies at the local level and on the other hand to put strategies into practice to comply with these policies, persons whom mayor trusts implicitly are nominated as councillorship candidates. In other words, mayor or mayoral candidate has a significant influence on the nomination process for candidates for councillorship by his/her political party through an internal process and in advance of councillorship elections.

Proportional representation electoral system used in the process of nomination of candidates for municipal councillorship also strengthens the position of mayor in comparison to council. This situation is due to “one tenth threshold and nomination in favour of the biggest party” method practiced in the system. The main purpose for the implementation of this method, however, is to create a majority in favor of the biggest party (the party that has the most seats on the council) in the municipal council. This method is the main reason behind the fact that the party to which mayor belongs generally has a majority on municipal council (Arikboğa 2008, pp. 192–194).

It is known that Political Parties Law No. 2820 impose a strict discipline on political parties in Turkey. As set-forth comprehensively in this law, disciplinary mechanism is used towards strengthening party members’ commitment to party policies. As for the local level, this mechanism has been established to ensure policies carried out by the mayor holding significant position in party organizations be supported by the municipal councillors from the same party of the mayor.

When considered in the sense of functioning of these organs, it is also examined that the mayor has a significant impact on the two organs. The mayor is the head of both municipal council and municipal executive committee preparing the agenda of those organs. Any subject proposed by municipal councillors is put on the agenda only if there is provided absolute majority of quorum for meetings. There is not even the possibility for executive committee to do this, thus no issue can be discussed unless mayor offers it in agenda.

Mayor has the right to reject a decision taken by the municipal council, then municipal council could insists on its decision only on the condition that the absolute majority of total number of members is ensured. In this case, mayor has also right to apply to the administrative jurisdiction. In the event that executive committee takes a decision which the mayor is unwilling to do so, mayor may raise the relevant issue on the meeting of municipal council and initiate a similar process to that of decision-making of municipal council.

In addition, the fact that mayor represents the majority of voters in the case of an equality of votes in municipal council as well as in executive committee is the another practice increasing the power of mayor. The number of members of

municipal councils (with the exception of metropolitan municipalities) ranges from 9 to 55. Given that the number of members is 55, the quorum for the meeting shall be at least 28 and the quorum for decisions shall be at least 15. This figure shows us how important even a single vote is. Moreover, there is no municipal council in Turkey which has 55 councillors. Rather, the number of councillors in all municipal councils varies between 9 and 45 and most of municipal councils have less than 15 councillors. The number of members of executive committee including mayor in metropolitan municipalities is 11 ([5216 sayılı Büyükşehir Belediyesi Kanunu](#), md. 16) while for other municipalities this number changes between 5 and 7 depending on the population of municipality.

Municipal council monitors the performance of mayor through a variety of ways such that municipal council once deemed mayor “unsuccessful”, then the course of proceeding for mayor’s being relieved of duty could only start by a three-fourths (3/4) majority of the total number of members. Even in this case municipal council is not the ultimate decision-making body and it is the decision of council of state that determines the process. Furthermore, in the case councillors and mayor belong to the same political party, it is almost impossible to initiate the process in which mayor be relieved of his duties.

On the other hand, the fact that municipal bureaucracy is directly dependent on mayor is another fact in strengthening the mayoral position. Notwithstanding that municipal council is the ultimate decision-making body with respect to municipality’s organizational structure and permanent staff, and since negotiations and debates are carried out on the basis of mayor’s proposals and also there is strong impact of mayor on municipal council, after all these it can be said that decision shaping phase takes place literally in the mayor’s shadow. Moreover, mayor is not obligated to receive council approval for his appointments in the municipal bureaucracy, displacements or dismissals; however, he is only required to inform council on appointments of department directors and senior managers.

It appears that mayor takes a stronger position in comparison to the other two bodies. As a consequence of this situation, municipality’s service performance can be said to become considerably dependent on the mayor’s performance. In other words, personality, character, experience and business culture of the mayor and also his organizational culture are of great significance directly affecting the performance of municipality. For this reason, leadership style that mayor need to demonstrate is a matter on which excessive emphasis should be put.

21.3 Transformational Leadership

Socio-economic developments at the national and global level led the organizations to have new and superiority provider leadership. The studies carried on this purpose have focused on the determination of the leadership approaches to respond the socio-economic transformation. Studies in the 1980s, highlighted the “transformational leadership” as a leadership style (Bozlağan [2005](#), p. 45).

Transformational leadership has based on the purpose of strengthening subordinates to make them the leader of their own fields through development of mutual trust and encouragement. Transformational leader does not hesitate in displaying attitudes and behaviours, which has symbolic importance, to achieve this goal when it is necessary (Boehnke 2003, pp. 5–6; Shamir 1999, p. 285).

Moral values and high ideals are main motivational tools of the transformational leadership. In achieving specific goals and objectives the leader keeps his subordinates focused on goals and objectives by changing their beliefs, values and thoughts rather than supporting material rewards to them. The basic strategy here was once “a dream” after a while, things appear to be “thinking”, “behaviour” and “habit” and ensure that the conversion is to take concrete steps towards the realization of the objectives of the organization. Key features of the transformational leadership are as follows; (Uyguç et al. 2000, p. 593; Tucker et al. 1999, p. 19; Higgs 2002, p. 276; Carless 1998, p. 354; Barling et al. 1996, p. 827; Coad and Berry 1998, p. 165; Boehnke 2003, p. 6; Howell and Avolio 1993, p. 891; Koene Bas et al. 2002, p. 194; Özaralli 2003, p. 335):

- i. **Charisma:** To offer a clear and concise vision; support and guidance in achieving the vision; to give confidence, invoke the respect, to encourage his followers to think about the future positively; enable them to see what is really important in their lives; inspire a sense of mission; to inspire optimism and to show his support for the followers at every opportunity.
- ii. **Intellectual stimulation:** To encourage the followers to ponder-think about things-; transfer of new ideas and perspectives; to provide them new perspectives for the problems; to encourage them to reach for the better; to be tolerant of different points of view; to improve intelligence, rationality and problem-solving ability; increase commitment to the organization; tempt to show higher performance; To contribute to the effective work of the followers, even under stress; encouraging them to be innovative and creative; to make the authority transfer; to give important tasks, to involve them in the decision making process more.
- iii. **Individualized consideration:** To trust and respect the followers as human beings; to build self-confidence, to be sensitive to their needs, to present opportunities for self-development; to contribute their personal development; emotions, to approach their desires and thoughts closer, to act fair and equitable.
- iv. **Inspirational motivation:** To be a model for the followers; to act to affect, motivate and inspire them; to define his own position and the position of the followers; to transfer the institutional-organizational vision them.

Transformational leadership requires understanding of “visionary”, “confident”, “analytical and creative thinking and advanced querying capability” and “wide horizon” leadership. This kind of leadership, leads to the emergence of a sense for the followers “to go beyond expectations”. Transformational leaders realize this praising organizational goals and objectives. To do so, if necessary, they use the self-interests and values of their followers in effective manner (Boehnke 2003, p. 5–6; Block 2003, p. 321; Shamir 1999, p. 285). Followers integrate their own personal

interests with organizational purposes and with the realization of the organizational goals and they assume that their goals are being realized too.

In the twenty-first century conditions, it can be said that the impact of the Weberian rationality has greatly reduced on organizations, whereas the emotional reality became more visible. With transformational leadership approach, institutional results, has ceased to be a benchmark in determining the effectiveness of the leader, but instead, the level of impact on the leader's followers were to the fore (Higgs 2002, p. 277).

Transformational leaders, use the current system to implement the vision or change it if necessary. However, they do not tend to accept the current system. Taking the initiative for change they are trying to show a high risk-taking and high creativity. They guide the followers to take greater responsibility to improve themselves. Followers have the tendency to see such leaders, as their "sample" (Howell ve Avolio 1993, pp. 891–892; Boehnke ve d. 2003, p. 6).

The concept of organizational leadership, in general, has been a topic discussed in the behavioural sciences and political science. It is hard to say that the importance given to organizational leadership at the public administration and at the decentralization which can be described as a sub-branch of and public administration.

The leadership in the behavioural sciences literature is the studies conducted mainly on private sector organizations and non-governmental organizations, and has its own specific circumstances. Therefore, it will not be eligible to consider that the results achieved at this kind of studies could be accepted as a "current" thing for decentralization. However, empirical data obtained in these studies, have contributed significantly to the establishment of the theoretical framework for the leadership approaches.

It would not be appropriate to accept that the political science findings could be current for decentralization science. In political science, it has been focused on the general political structures and systems generally. In the second half of the twentieth century, local and urban politics has been a topic discussed and worked on (Keleş 1994, pp. 88–109). For the municipalities as a local government institution, organizational leadership has been generally neglected as an area of scientific study. The organizational structure, administrative and financial autonomy of the municipalities, demonstrates the importance of the organizational leadership phenomenon of municipalities and local government in terms of science.

21.4 Chaos Theory

Chaos theory as a scientific approach previously developed at physical sciences and then has permeated the social and managerial sciences in this context. Today it became a paradigm of widely accepted in understanding the formation, development, structure and functioning of the human systems such as societies, communities, institutions and firms.

The lexical meaning of the concept of chaos means that as of turmoil and confusion. In theoretical sense, it refers to the uncertainty of events and reactions that may occur at any system against the effect which has been created. Chaos theory explains that; there are no exact limits of the events, the relationship between events is not linear, causes and the results are not proportional to each other and seemingly small and insignificant things could also lead to great results. In this context, natural or human systems are under the interaction of many variables and parameters and working conditions, continuously changing (Ertürk 2012, pp. 852–863).

In addition, the development process and the results of any event, are under the influence of the initial conditions and formation process of that event. Therefore, to be able to predict the outcome of an event, the initial conditions the entire process of formation should be known in detail. As this is not feasible, the only way to understand in what direction an event will develop and what kind of conclusions it will lead, is to estimate from the available data (Mutlu ve Sakıncı 2006, pp. 5–6).

The main objective of chaos theory can be said that is to reveal systems under the irregularly displayed order. Because, according to this approach, every irregularity has a function on the way to reach the order. Therefore, the theory, is not only related with “complexity” but also with the “order” (Baş 2003, p. 32).

Chaos theory, queries the linear trend of thinking. Although many state/event seems linear at macro-scale, it would be understood while descending to micro-level that is not linear and very small changes in the process of the realization of the events could lead to major unrest (Mutlu ve Sakıncı 2006, p. 6).

According to the chaos theory the organization is not the purely static structure which has a mechanical operation but is a dynamic structure which is considered to operate a chaotic process. For this reason, organizations should be considered like other living systems in the nature (Mutlu ve Sakıncı 2006, pp. 2–6). In other words, organizations are affected by internal and external factors, have the flexibility to be changed and transformed in a clear and specific structure. Within the chaotic situations analytical approach becomes poor and long-term planning gets difficult (Tüz 2001, p. 44).

In the chaotic organization, it is seen that static structures looking for changes and dynamic structures are seeking balance are in conflict. On the one hand the main service units which are in the continuous dynamics and on the other hand more static position situated in the nature support and help services. The conflict or relationship between them attracts the organizations in a chaotic environment.

Chaotic organizations include both linear and cyclic events and developments within their structures. While there are cases where the linearity exists in short-term situation, there is a cyclical situation in the long-term. In other words, in the current chaotic situation it may be complicated long-term planning and predictability while enabling the identification of the objectives of a general nature, the more detailed objectives in the short term makes it possible to be identified.

In the chaotic approach, differences are considered as a wealth, problems assessed as an opportunity and importance given on free thinking. The approach of the “self-organizing systems” with organizational learning, or “learning organizations” (self-organizing systems) has a specific importance at organizational size of

the chaos theory. Because, individual or organizational learning or re-organization of the system itself will contribute to institutional development and transformation sustainability. Devolution and flexible employment models and flattened and broad organization approaches are contained the organizational approach of the theory of chaos.

According to the approach of chaotic, organization to be reached the “chaos threshold” referred to as “equilibrium point”. This point is a critical threshold. The organization neither reached at exact balance (i.e., a static structure) nor fully dynamic (chaotic) state. In terms of strategic scale, the direction of the organization (vision and mission) is defined in the case of balance, but at the tactical and operational scale there is a constant dynamism, mobility, diversity and vitality. On this scale, putting forward alternative ideas, discussion and searching for the ideal solution is required. The purpose of the chaotic organization is to reach the brink of chaos. Chaotic organizations tend to reach this threshold. When this threshold is exceeded the dynamism disappears and a static structure will emerge. This situation prevents the development of the organisation and could take it to the decline and collapse.

The “butterfly effect” of the chaos theory, is observed in the societies or organizations from time to time. It should be noted that the smallest event or development, would lead to the developments of the results cannot be predicted. Because as the beating of a butterfly’s wings, would be sufficient to mobilize accumulated energy in the nature, an accident in the community or organization, a suicide or a protest action could expand in a short time and turn into social and even violent mass demonstrations and may cause revolutions. Tunisia, Egypt, and Syria should be taken into consideration as samples. Butterfly effect should not be considered only as a mobilizing factor of the existing potential. At the same time, it can be considered as a starting point of the formation of the potential process.

21.5 Conclusion: Transformational Leadership in Municipalities Within the Frame of Chaos Theory

The rapid development in information and communication technology has changed relatively the meaning and importance of time and space. The importance of time and space has weakened in terms of some activities while it strengthened for some other activities. Time and space are, on one hand, gaining extraordinary importance for companies bringing service to customers and offering on-time manufacturing and service delivery processes with a competitive advantage provided, while, on the other hand, time and space lose their meaning and importance to a large extent for companies offering services on the internet as they are everywhere and provide instant solutions.

This change does not only influence companies operating in the private sector but in the same time civil society organizations and public institutions are also

touched by this change. Local authorities particularly take the lead in being the most affected public institutions. The concept of globalization on the one hand adds new economic, political and cultural roles to cities and on the other hand has accelerated competition between cities.

Globalization, as summarized, can be taken to refer to the process arising from quick production, distribution, share, consumption and re-production and re-distribution of information in the cycle. Globalization, on the one hand, conceals cross-cultural differences through allowing free movement of skilled labor force, capital, goods and cultural elements worldwide, and on the other hand it strengthens local culture and identities by opening the way for submission of different ones to global markets and thus introduces new areas where differentiation can occur.

Increasing competition between cities, have led to conceptualizations such as “global city”, “world city”, “international city” and resulted in the development of indexes in order to classify cities. Through taking into account tens of parameters and variables, many international or global companies or civil society organizations score cities and city administrations in political, social, economic and financial dimensions and thus cities have been ranked based on this scoring system. Score-cards developed for almost every city are closely followed by investors, tourists, organizers and financiers. Cities and municipalities have been trying to meet criteria in the aforementioned indices as they wish to obtain a strong position in national, international or global level if and whenever possible.

What dimension inter-city competition reflects on local community is assigned a priority among the issues with which local politicians and city administrators in local government need careful follow-up. Socio-economic implications caused by capital and investments in the city over local community are the main factors affecting local politics and consequently political future of local administrators.

In addition, the central-local government relations, relationship of mayor and competitors with party, developments in civil society organizations, professional organizations and private sector as well as environmental change are some of the factors that affect the process. From this perspective, municipality as a city government entity, appears to interact with many external factors. Internal factors of municipality can be grouped as not only organs, but also they are listed as institutional goals and objectives, institutional structure, institutional culture, financial structure, human resources, business processes, physical conditions and technical equipment. Internal factors are just as effective as on the performance of municipality to the extent on which external factors are.

Influenced by numerous parameters and variables, city governments can reap more the benefits of chaos theory and transformational leadership paradigm in order to be successful in the local, regional, national and global competition. “Self-organizing systems” and “learning organizations” approaches found in chaos theory show parallelism with the components of transformational leadership: “intellectual stimulus”, “paying personal attention to followers” and “giving inspiration.”

When considered that Turkish municipal system has been constructed according to the strong mayor model, it can be said that owing to his position, mayor seems to have some advantages in terms of using transformational leadership. Mayor,

in line with the powers granted to him, has the opportunity to build a good team within the municipality as well as the ability to convert partially or largely current employees and the system. When similarities between chaos theory and transformational leadership approach are also considered, mayor can be said to increase the possibility of developing more effective solutions to local problems by developing a new management paradigm.

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Chapter 22

IDEAS The Modelling Technique Based on Neuro-Fuzzy Structure for Chaotic Rossler System

Remzi Tuntaş

22.1 Introduction

Recently, chaotic systems and related research has rapidly increased. In recent year, modelling, control and synchronization of chaotic systems have been received more attention (Moaddy et al. 2011; Wu et al. 2012; Wang and Liu 2006). Various chaotic systems have been introduced until now. For example, the nonlinear Chua circuit and nonlinear Duffing oscillators are experimentally investigated (Fotsin and Wofo 2005; Fotsin et al. 2005). One of these chaotic systems is the Chen system, which was first found by Chen and Ueta (Chen and Ueta 1999). Rossler found out another chaotic system (Rossler 1979). Lü and Chen found out a new system representing the transition between the Lorenz and Chen attractors (Lü and Chen 2002).

Artificial neural networks (ANN) and fuzzy logic (FL) is used increasingly in various fields of engineering. There are simple rules of fuzzy systems and are useful for simplifying the learning process (Takagi and Sugeno 1985). The neuro-fuzzy architectures developed with the combination of ANN and FL (Jang and Sun 1995). Hayati et al. have applied modelling and simulation of combinational CMOS logic circuits by ANFIS (Hayati et al. 2010). An expert system for air flow control of HVAC system based on ANFIS is presented (Soyguder and Alli 2009). Modelling and simulation of transistors and circuits used the ANN (Andrejevic and Litovski 2003; Djeflal and Chahdi 2007). A fuzzy dynamic characteristic modelling and adaptive control method is proposed by Li et al. (2011).

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22.2 The Chaotic Rossler Systems

The Rossler system (Yu 1997) is defined by the set of ordinary differential equations

$$\begin{cases} \dot{x} = -y - z \\ \dot{y} = x + ay \\ \dot{z} = xz - cz + b \end{cases} \quad (22.1)$$

where x, y, z are the state variables of system (22.1), and a, b and c are the positive parameters of system. When $a = 0.2, b = 0.2$ and $c = 5.7$, system (22.1) shows a chaotic behaviour. Fourth-order Runge–Kutta method is used to solve the systems of differential equations (22.1) with time step size equal 0:001 in all numerical simulations. We select numerical values for the parameters in (22.1) as $a = 0.2, b = 0.2$ and $c = 5.7$ to insure the chaotic behaviour of Rossler system. The initial values of the system are $x(0) = 0.5, y(0) = 1, z(0) = 1.5$.

22.3 ANFIS Architecture

ANFIS is an adaptive network which allows the use of fuzzy logic together with neural network (Turkmen and Guney 2005; Culliere et al. 1995). ANFIS uses the learning capacity of ANN to determine the input–output relationship and build the fuzzy rules by defining the inputs structure. The five-layered characteristic ANFIS structure have m inputs (x_1, \dots, x_m) each with n membership functions (MFs), R rules and one output (f). If we suppose that fuzzy inference system has two inputs (x, y) and one output (f), a first order Sugeno model can be described with two rules as follows:

Rule 1: If x is A_1 and y is B_1 , then $f_1 = p_1x + q_1y + r_1$,

Rule 2: If x is A_2 and y is B_2 , then $f_2 = p_2x + q_2y + r_2$.

The individual layers of this ANFIS structure are summarized as follows:

Layer 1: Every node i in this layer is adaptive with a node function.

Layer 2: Every node in this layer is a fixed node that calculates the firing strength w_i of a rule. The output of each node is the product of all the incoming signals to it.

Layer 3: Each node in this layer is a fixed node. Every i th node calculates the ratio of the i th rule's firing strength to the sum of firing strengths of all the rules. The output from the i th node is the normalized firing strength.

Layer 4: Every node in this layer is an adaptive node with a node function.

Layer 5: This layer contains of only one fixed node that calculates the overall output as the summation of all incoming signals.

Terms of the proposed ANFIS structure the values of premise parameters are given. the final output can be phrased as a linear combination of the consequent

parameters. Result parameters are identified by the least squares estimate, in the forward pass of the learning algorithm. In the backward pass, the error signals are propagated backward from the output layer to the input layer. In this backward pass, the premise parameters are updated by the gradient descent algorithm (Qian 1999; Shoorehdeli et al. 2009).

22.4 Modelling Result

In this study, the model structures carried out have one inputs and one output. Models were trained separately for each state variable. Inputs were determined as the state variables of the chaotic Rossler system, and outputs were determined as the next state of this state variables. With using structure of proposed model structures, obtained the chaotic Rossler system modelling was tested and the performance of this model was presented graphically.

In this study, 1,000 simulated signals of the chaotic Rossler system were generated by using the numerical solve of differential equation systems (22.1) in MATLAB Toolbox. 700 of these 1,000 signals were used for training phase and others 300 signals were used for testing phase of the expert system. For each input, it was used five membership function. The proposed ANFIS models were trained separately for 100 epochs using different MFs. And their performances were compared in terms of the RMSE and R² values for the training and testing data sets of the proposed ANFIS model in Table 22.1.

The best performance was obtained by using Gaussian curve membership function. The RMSE value is 0.000118 and the R² value is 0.999999 for ANFIS model. Then, MATLAB were used as a general simulator for comparing and testing the ability of the simulation method belong to proposed ANFIS model. Four various data sets that were shown in Table 22.2 were used for testing the simulation speed of ANFIS model and MATLAB.

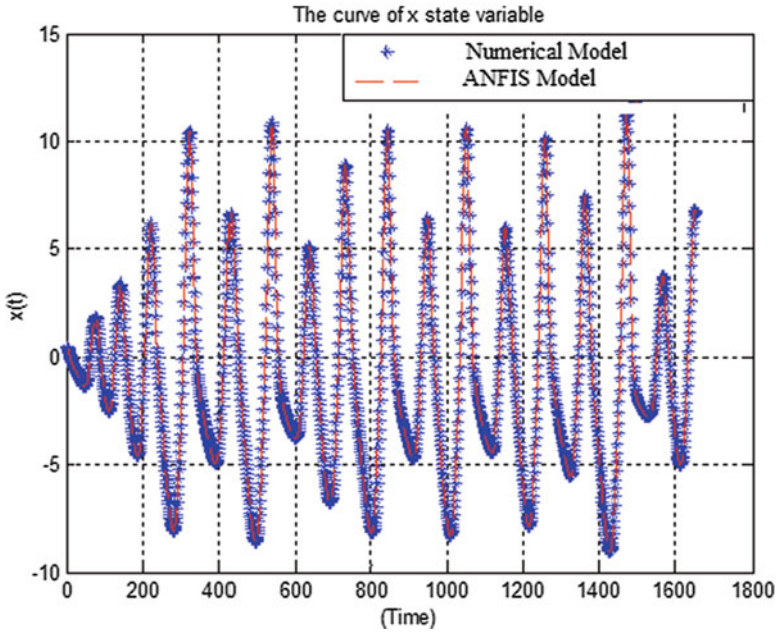
Obtained Results show that the proposed method is much faster than MATLAB simulation. The better and faster results are obtained with increasing number of data as shown in Table 22.2. To show the performance of this metod, in the testing stage, the proposed ANFIS models values with the numeric values of the state variables were shown by comparing on the same curve as shown in Fig. 22.1.

Table 22.1 Performance comparison of proposed ANFIS model for different MFs and the x state variable signal of the chaotic Rossler system

Membership functions	For the training data sets		For the testing data sets	
	RMS	R2	RMS	R2
Gaussmf	6.1062e-005	0.999999	0.000125	0.999999
Gauss2mf	7.2401e-005	0.999999	0.003352	0.999983
Pimf	3.5824e-005	0.999999	0.000864	0.999994
Trimf	5.4869e-005	0.999999	0.000176	0.999997
Gbellmf	4.1176e-005	0.999999	0.000349	0.999992

Table 22.2 The comparison between MATLAB and ANFIS model simulation time for ALU

Number of data	Simulation time (s)		Speed improvement
	MATLAB	ANFIS model	
200	16	0.92	17.4 times
500	43	1.74	24.7 times
700	57	1.83	31.2 times
1,000	78	2.26	34.5 times

**Fig. 22.1** The nonlinear waveforms of the numerical and ANFIS models of the chaotic Rossler system

22.5 Conclusion

In this paper, an ANFIS approach for the modelling of Rossler system was presented. For this purpose a computer program was developed by using MATLAB programming language. The numerical data were obtained by using the numerical solve of differential equation of Rossler system to train the ANFIS models. The input–output data sets of this circuit were first stored and then these data sets were used to obtain its model based on ANFIS. The ANFIS models were trained and tested for different MFs. Then, the best ANFIS models were obtained by comparing the performances of MFs. Efficiency of the developed neuro-fuzzy modelling

technique was tested and a mean 99.999 % recognition success was obtained. Then, the proposed ANFIS models were compared with MATLAB simulation. Obtained results showed that the ANFIS model simulation is much faster than, MATLAB simulation. This study showed that this model can be used in any other nonlinear dynamic systems analysis and chaos studies.

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Chapter 23

Leading Diversified Workforce to Improve Organizational Network Effectiveness

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23.1 The Concept of Diversity and Diversity Management

Diversity can be briefly defined as the management of individuals from different cultures sharing a broad range of common traits (Carrell et al. 2000, p. 55). These traits can be expanded in terms of certain different dimensions such as race, gender, national origin, age, religion, physical abilities and regional origin (Carrell and Mann 1993; Uma 2011). The need to manage diversity had become a practical necessity because of the demographic shifts in the composition of transnational workforce population and the further globalization of world markets (Warren 1997). Today, workplace diversity is a global workplace and marketplace topic. Any business that intends to be successful must have a borderless view and an unyielding commitment to ensure that workforce diversity is part of its day to day business conduct (Childs 2005).

Cox and Blake (1991) offer ways that cultural diversity can offer competitive advantage and many organizations have taken efforts to increase their race, gender and age heterogeneity to reap these benefits. Visible diversity may contribute to increased marketability, increased creativity, increased problem solving ability and more flexibility (Richard et al. 2002). More specifically, as suggested by Cox and Blake (1991), if coordinated successfully to comply with organization's wider

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purpose and strategies, diversity supports competitiveness in terms of cost advantages, resource advantages, marketing effectiveness, creativity, problem solving skills and system flexibility.

Diversity management is increasingly promoted as a strategic people management technique that will enhance organizational competitiveness. The formula for obtaining competitive advantage has changed several times beginning with Michael Porter's analysis on firm's market position in respect of a five forces model and continued with total quality management, benchmarking, re-engineering, empowerment, the network organization and the learning organization. Finally "diversity" has taken the focus point in Harriot and Pemberton's (1994) competitiveness formulation. A diverse work force can give the organization the leading edge and make successful innovations only if diverse individuals work together in teams in a context where they can learn from the outcomes (Warren 1997). In this sense managing diversity can be defined as a comprehensive managerial process for developing an environment that works for all employees (Thomas 1991, p. 10). Managing and leading diversity may assist to gain a competitive advantage and improve a firm's innovative capabilities and overall performance. Despite the potential advantages of diversity management, little attention has been given on organizational leaders and how they respond to environmental and economic pressures that encourage the implementation of diversity management practices. It is argued that although institutional and environmental factors may pressure firms into managing diversity, organizational leaders ultimately exercise strategic choice on whether and how to manage diversity. According to the strategic choice perspective, organizational leaders make decisions that influence organizational outcomes and performance. Organizational structures and responses are fashioned after the people in power and organizational leaders possess the discretion to act on their own free-will, making key strategic decisions that shape the organization. The implementation of diversity management practices provides an example of this form of strategic choice (Ng and Sears 2011).

The objective of diversity management is to increase awareness of cultural differences; develop the ability to recognize, accept, and value diversity through organizational intervention to minimize patterns of inequality experienced by those not in the mainstream; and modify organizational culture and leadership practices so that "members of all socio-cultural backgrounds can contribute and achieve their full potential" (Cox 1993, p. 225). One of the most important factors that influence the adoption of diversity management policy and initiatives are the personal background and attitude of the CEO and management toward diversity management (Cooke and Saini 2010). At the strategic level, top management is required to have a philosophy and foster organizational culture that recognizes diversity, and commits resources and leadership so as to implement diversity policies (Shen et al. 2010).

23.2 The Role of Organizational Networks in Managing Diversity

Individual employees' creativity is affected by social networks as well as the nature of jobs, rewards, goals and deadlines, feedback and evaluations, leadership and supervisory behaviors, coworker behaviors and role models such as creativity oriented managers (Zhou and Su 2010). One of the most important functions in this managerial process is the coordination of organizational (social) networks. In general, a network is defined as "a set of nodes and the set of ties representing some relationship, or lack of relationship, between the nodes" (Brass et al. 2004). In other words; a network is a set of connected relationships with people inside and outside your organization upon whom you depend to accomplish your work (Grayson and Baldwin 2007). A company's network can be further classified into inter-organizational and intra-organizational networks. Inter-organizational networks form relations with shareholder, supplier, customer, competitors and any other possible stakeholder as for instance regulatory authorities while intra-organizational networks refer the relationships between employees (Sydow 2006). In this study the focus point will be intra-organizational networks. Due to the fact that these relationships and people working together are influential on creating ideas, information and decisions, interaction is considered as a basic process for the development and maintenance of organizational goals. These interactions are termed as social networks (Henttonen 2010).

One of the advantages that a network confers is access to a diverse array of skill sets. While expertise has become more specialized during the past 15 years, organizational, product, and marketing issues have become more interdisciplinary, which means that individual success is tied to the ability to transcend natural skill limitations through others. Highly diverse network ties, therefore, can help you develop more complete, creative, and unbiased views of issues. And when you trade information or skills with people whose experiences differ from your own, you provide one another with unique, exceptionally valuable resources (Uzzi and Dunlap 2005). Also "trust" is crucial for any kind of knowledge sharing in networks. Consequently, the value of your private information to others-and the value of others' private information to you depends on how much trust exists in the network of relationships (Eckenhofner and Ershova 2011). Coordination of networks focuses on the alignment of people, tasks and processes within the organization. To enhance the degree of alignment among these variables, organizational structure provides a major framework representing formal and informal communication channels. The effects of social networks lie in the economies of scale (synergy effects) as well as in the economies of scope, which are more focused on quality and innovation and therefore primary target of many companies. Another advantage of social network

lies in the transaction-cost theory, which says that the costs for coordination and transaction can be reduced due to social networks. Transaction costs such as costs for search and information, bargaining, policing and enforcement, can be limited with the help of social networks due to trust, proximity, reciprocity and social responsibility (Eckenhöfer and Ershova 2011).

According to organizational network research, building and managing the networks in which people and groups are involved and interact with each other have crucial consequences for organizational outcomes (Ibarra et al. 2005). Therefore, it is obvious that, to unveil the impact of integrating and utilizing a diversified workforce and to understand the related dynamics within this framework is crucial to maintain organizational network efficiency.

Through such successful coordination mechanisms, there will be enhanced opportunities for innovation and less resistance to change in the organization. From an individual point of view, building networks of relationships within the organization enhances career prospects, regardless of whether a mentor is present. Actually, network resources are able to serve as an alternative to traditional mentoring relationships. From an organizational viewpoint, organizational designs and human resource systems that promote the development of informal relationship ties foster those aspects of commitment that have positive consequences and inhibit those that have negative consequences (Bozionelos 2008).

23.3 Leading Diversity and the Role of Leadership in Managing Diversity

Diversity is also becoming a key factor in helping to define leadership in today's marketplace. Leaders must help all people involved with their business understand that workforce diversity can be a bridge between workplace and marketplace. The most important quality for a diversity leader is the ability to motivate others to be part of the leadership on this subject, and see it as part of their personal day-to-day performance. A diversity leader must be able to draw others into the debate and be the catalyst that can convince others that helping to change the content and character of the workplace makes the team stronger and a better performer in the marketplace (Childs 2005). In this sense leader is the key factor in benefiting of workplace diversity. Leadership networks are essential to collaborative partnering, in which team members draw on their own areas of expertise and share their

specific knowledge within the organization to strengthen the business process continuously through enhanced communication (Giovagnoli and Stover 2004). If leaders comprehend the social network relationships not just among organizational employees, but also between employees and those outside the organization, then leaders can build the social capital of the organization by putting individuals' personal social networks to work for the organization's benefit (Balkundi and Kilduff 2005).

In conclusion, the primary aim of contemporary leader-manager turns out to be coordinating the diversified workforce and thus to be able to value and exploit the unique attributes brought by individual differences. Brief literature review on relationship among diversity, organizational context and social network is shown in Table A.1.

23.4 Conclusion

Since the discovery of human side in organizations, social dimension, in addition to technical dimension, has become focus of interest in studies. Regarding this social dimension, relationships among organizational units lead to the emergence of a more dynamic organizational structure. This dynamic structure is affected by various organizational context related factors including both team based and task based ones. Additional to these organizational factors, another influential factor is the diversified nature of contemporary workforce. Stemming from this nature, demographic, structural, and functional aspects of diversity emerge as interacting variables with the consequential impacts of social network dynamics. Leadership intervenes with these processes via the crucial coordination and vision setting function it provides. Coordination of social networks focuses on the alignment of people, tasks and processes within the organization; therefore, in order to enhance the degree of alignment among these variables, organizational structure provides a major framework representing formal and informal communication channels. Thus effective leadership should focus on both the technical and social aspects of this structure and understand certain moderating and mediating social network related variables to manage diversity in a way to maximize the positive spillover effects of contextual factors.

A.1 Appendix

Table A.1 Brief literature review on relationship among diversity, organizational context and social network

Author(s)/ Year	Type of diversity	Organizational effectiveness criteria	Social network related moderating/ mediating variables	Type of study/data	Sector(s)	Major findings
Ayoko and Konrad (2012)	Racioethnic divers	Performance morale	Group-team processes/ task conflict/ relationship conflict	Empirical (quantitative)	Public service	Mitigating effects of leader emotion management and leader transformational behaviors on conflict's negative effects
Curseu et al. (2012)	Educational	Group effectiveness	Internal network density/external network range	Empirical (qualitative)	-	Internal network density and external network range mediate the relationship between educational diversity and group effectiveness
Ehimare and Ogaga- Oghene (2011)	Gender/ ethnicity/ tenure/age	Growth strategy (asset growth)/ performance outcomes	Workgroup size/org. size/tenure/ workgroup context competition oriented workgroup culture	Empirical (quantitative)	Finance (bank)	Gender and ethnicity are negatively related to employee productivity and performance bonus./combined effect of diversity on organizational effectiveness is positive
Drach- Zahavy (2011)	Informational diversity	Team effectiveness	Boundary spanning/scouting/ ambassado- rial/coordinating/ empowering	Empirical (quantitative and qualitative	Health sector	Scouting, ambassadorial, and coordinating are positively associated with team effectiveness, whereas empowering is not

Zoogaha et al. (2011)	Nationality/ gender/ functional background	Team performance/ satisfaction/ goal achievement	Team coordination	Empirical (quantitative)	Strategic alliances in various sectors	Positive rel. of gender diversity, negative rel. of functional diversity to perf. satisf./effects of coordination on nationally homogeneous and heterogeneous teams
Kearney and Gebert (2009)	Age/nationality/ educational background	Team performance	Elaboration of task-related information/collective team identification	Empirical (quantitative)	Pharma	The moderating effect of transforming leadership/the mediating effect of task-relevant info
Joshi (2006)	Structural and demographic comp.	External networking behavior	Centrality in network/homophily of external networks	Conceptual	-	-
Cummings (2004)	Structural diversity	Performance	Ext. knowledge sharing/type of structural diversity	Empirical (quantitative)	Telecommunications	Intra-group and ext. knowledge sharing are important for performance in work groups/Ext. knowledge sharing is rel.'ed to perf. in structurally diverse teams
Kuo (2004)	Age/gender/ seniority/ education level	Team effectiveness	Team social capital	Conceptual	-	-
Kochan et al. (2003)	Race/gender	Performance sat./turnover	Training and development func./competitive context among teams/org.-context/group-team processes	Empirical (qualitative and quantitative)	Retail/IT/ finance	Racial and gender diversity do not necessarily have positive effect on organizational performance/Mitigating effect of training on racial diversity's negative impact

(continued)

Table A.1 (continued)

Author(s)/ Year	Type of diversity	Organizational effectiveness criteria	Social network related moderating/ mediating variables	Type of study/data	Sector(s)	Major findings
Schippers et al. (2003)	Gender/age/educ./ tenure on the team	Satisfaction/ commitment/ Perf./ reflexivity	Team process/group longevity/outcome interdependence	Empirical (quantitative)	IT/insurance/ banking/ government/ chemicals	Moderating effects of outcome interdependence and group longevity
Bunderson and Sutcliffe (2002)	Functional (background/ assignment, etc.)	Team performance/ team effectiveness	Information sharing	Empirical (quantitative)	Consumer products	Mediating role of info. sharing between intrapersonal functional diversity and unit performance/Dominant function diversity is negatively associated with information sharing
Harrison et al. (2002)	Race/ethnicity/sex/ age/marital status	Task performance	Collaboration/team social integration/team reward contin- gency/perceived surface diversity	Empirical (quantitative)	University students	Relationship between perceptions of diversity and lower social integration, team reward contingency and collaboration, social integration and task Perf.
Dreatchlina et al. (2000)	Race/ethnicity	Communication eff.	Different perspec- tives/alternate realities/social isolation/selective percep- tion/stereotyping	Empirical (qualitative)	Healthcare	The leader's impact as a unifying force/diversity leadership serves as the mitigating factor in the relationship between race and the self-perceived communication effectiveness of nursing care teams

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Chapter 24

Charismatic Leadership, Ethics and Effectiveness in Political Science

Zakir Gül

24.1 Introduction

Living in today's world is not as simple as it used to be, as "Complexity and change characterize the modern world" (House et al. 1991, p. 391). Especially the political life and its components are full of paradoxes and complexities (Stone 1997). Making decisions and policies in such complex and uncertain environment is not an easy task for the people. Therefore, some more attributed ones are needed to do the right thing, give the best decision, guide the correct direction, and above all, save the lives in crisis and chaotic situations. These people are called leaders. Leaders, however, are only one part of the leadership dynamics (Fiedler 1967; Hollander 1978; Hughes et al. 2006; Nahavandi 1997). There are also followers and the situation that should be taken into consideration.

Leadership in general, charismatic leadership in particular is presented with their definitions, roles and components. Then, ethics and effectiveness in charismatic leadership is explained. Finally, a discussion and conclusion will be presented. Some research questions are as follows: Is charisma important in leadership? What conditions generate charismatic leaders? How should the leaders be judged? Should they be evaluated just with their effectiveness, no matter what their ethical behaviors are, or should they be assessed by their ethical decisions as well as their effectiveness?

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24.2 Leadership

Leadership is almost an issue of every discipline. Political science is one of them. Despite its great importance and discussion, it does not have a standard definition. It is asserted that there are as many leadership definitions as the number of people who defined it (Stogdill 1963). Hughes et al. (2006) argue that each person or theory looks at the leadership issue from different angles and sees its different sides as it is a complex phenomenon that has three dynamics: The leader, follower, and the situation. Therefore, although there are numerous definitions of leadership, there is no one single definition and theory that explains and covers every issue.

It is claimed that leadership is a process (rather than a position) to motivate the followers in the organizational achievement of goals (Hughes et al. 2006). To Fiedler (1967), leadership is directing and coordinating the members (followers). Nahavandi (1997) sees the leadership as setting goals and dealing mostly with change. Ginnett (1996) presents the leadership as creating an environment for the followers to be successful. And yet, Bass (1985) asserts that a leadership is about transforming the followers and showing them how to attain goals.

Modern theories see the leadership more holistic, consisting of the components of leader, follower, and situation (Nahavandi 1997; Van Wart 2005; Hughes et al. 2006) rather than focusing only the leader's traits and skills. It is claimed and assumed that leaders can be trained, educated and improved (Cox 1974; House 1977; House et al. 1991). Contrary to the great man thesis, which claims that leaders are born not made, it is argued that leaders are made not born (Rooke and Torbert 2005; Hughes et al. 2006).

24.3 Charismatic Leadership

Charismatic leadership is discussed and studied depending on the three dynamics of leadership in the literature. First group focused mainly on leader's characteristics, whereas the second school centered on follower's perception, recognition, and acceptance, and yet the final group of scholars focused on the situational factors in defining and generating charismatic leadership.

Charismatic leadership is considered significantly different than other types of leadership. House (1977) asserts that charismatic leaders are distinguished from others because of their high tendency to influence and dominance over others. Moreover, they have a strong conviction to their own beliefs and values. They also have a strong emotional relationship with their followers, and can motivate as well as make them get confidence.

During the nineteenth century and until early twentieth century the great man thesis was known and influential among leadership theories (Van Wart 2005). According to these theories, the leader is the main factor, who has some innate attributes. They were seen as having supernatural and heroic characteristics. The

concept of charisma was created by the German sociologist Weber (1947). He claimed that the charismatic person is distinguishable from the ordinary people (because of his/her extraordinary attributes).

From a different perspective, “charisma” is not something that the leaders attribute themselves, but a concept that the followers have attributed to the leaders (Conger and Kanungo 1988). In other words, it is the followers’ perception and belief about these leaders. The followers also expect to see some other attributes, as well.

Another important dynamic is the situational factors that lead to emergence of the charismatic leader. Conger and Kanungo say that there are some preconditions such as crisis and emergency that are necessary for them to emerge. Similarly, Hughes et al. (2006) state that the most important situational factor for a charismatic leader to appear is the crisis situation. In that regard, the chaotic and complex issues and affairs are best conditions to generate, and best tests that separate the charismatic leaders (from the others). House and his colleagues (1991, p. 391) claim that, “charismatic leadership seems most likely to emerge under conditions of crisis”. In the same vein, charismatic leaders show up during crisis, turbulence, threat and stress (Conger 1999; Hunt et al. 1999; Mumford 2006; Shamir and Howell 1999; Vessey et al. 2011).

The charismatic leaders were believed to have great impact on many issues in the history. They can overcome the uncertain and complex situations, crisis and chaotic conditions such as natural disasters and wars, and reestablish the equilibrium after it is punctuated (Baumgartner and Jones 1993).

24.4 Ethics and Effectiveness

It is claimed that being charismatic is the most important characteristic for a leader to be effective (House et al. 1991), especially in a world where there are extremely quick changes, varying nation states, huge enterprises, complex issues, chaotic problems, and numerous unpredictable events. The effectiveness of charismatic leadership is defined as “the degree of its influence on followers’ self-concepts, values, and motivations” (Shamir and Howell 1999, p. 259).

The charismatic leaders can influence and motivate the followers. However, charisma may have some drawbacks and risky sides, as well. Since charismatic leaders are also humans, they may have weaknesses as well as temptations, and strong desires and dreams to make them happen. The charismatic leaders may have over-confidence that may lead them to despotic positions. They may use their “charisma power” to pursue their own egoistic passions and ambitions. And thus, they may motivate and misuse the potential of his/her followers, accordingly. Therefore, the charisma has both good and evil sides (DuBrin 2010; Tucker 1968).

Charismatic leaders can create a nice and productive environment for the followers and set several goals and may create paths for the followers (House 1971). However, they may not like to empower and delegate the issues and decision-making

to any people in the organization, as they may desire everything dependent on them, and have everything under their control.

Charismatic leaders can use power “for good and ill, and the leader’s personal values may be one of the most important determinants of how power is exercised or constrained” (Hughes et al. 2006, p. 132; see also Tucker 1968). Therefore, the possession of power leads to “ethical questions about how that power should and should not be used” (p. 132). It is a kind of control mechanism and/or a frame that shows the limits of power.

Then, how should the leaders be judged? Should they be evaluated just with their effectiveness, no matter what their ethical behaviors are, or should they be assessed by their ethical decisions as well as their effectiveness? Gardner (1990) argues that both attributes are important whereas Burns (1978) states those who do not behave in an ethical way are not considered true leaders. And yet, another question comes front: “What does it mean for a person to do something the right way?” (Ciulla 2005, p. 333). Probably, ethics and effectiveness turns around this question.

24.5 Discussion

There is not a precise and perfect way to assess when a leader is effective (Nahavandi 1997). Ciulla (2005) breaks leadership into three categories in terms of moral assessment of leadership: “1. The ethics of leaders themselves – the intentions of leaders and the personal ethics of leaders; 2. the ethics of how a leader leads (or the process of leadership); and 3. the ethics of what a leader does – the ends of leadership” (p. 332). She finds the ethics and effectiveness concept in a dilemma, and wonders how an effective leader is related to being ethics, and how the ethics is related to being effective.

It is obvious that values are important in leadership as they help leaders choose right from wrong, and between ethical and unethical behavior (Hughes, et al. 2006). The ethical content focuses on values that highlight the ethical behavior criteria (Bass and Steidlmeier 1999). These values are may change according to the individuals and organizations. The value system is shaped and formed by the individual’s family, friends, education, religion, media technology and geography (Massey 1979).

Ethics is related to culture, and for transformational leadership to be ‘authentic’, “it must incorporate a central core of moral values. Yet the practices of such values are highly culturally relative. Further, even when a set of core values, such as friendship or honesty, may be found in all cultures their ordering and relative importance may also vary by culture” (Bass and Steidlmeier 1999, p. 210). Therefore, what is right and what is wrong may vary depending on the culture. Cultures “refer to those learned behaviors characterizing the total way of life of members within any given society. Cultures differ from one another just as individuals differ from one another” (Hughes, et al. 2006, p. 151). Therefore, while evaluating and issue or a leader, in terms of ethics and/or effectiveness it is important

to know the culture. In that regard, there is no “one fits all” type of explanation to this concept. Nahavandi (1997, p. 7) summarizes the point as in the following quote:

Leadership is a social and cultural phenomenon. A leader considered to be effective in Singapore may seem too authoritarian in Sweden. The charisma of an Egyptian political leader has no effect on the French or the Germans. Understanding leadership requires understanding the cultural context in which it takes place.

However it should also be realized that leaders may be vulnerable to make mistakes, as they are human beings. As stated, temptations to deviate from altruistic values can be very strong for leaders (Ludwig and Longenecker 1993). A final point to consider that “History often judges leaders by results and not the means or process of getting to them. In the present, a leader’s intent and the means that he or she uses to get things done are morally important for earning the trust and cooperation of followers” (Ciulla 2005, p. 332).

24.6 Conclusion

Leadership, especially charismatic leadership is presented in this study. Further, the values and dilemmas of ethics and effectiveness of charismatic leaders are discussed. The study was a synthesis of the literature rather than an empirical one. Therefore, more empirical research is needed to see whether there is any difference between an ethical and unethical leader in terms of effectiveness. The ethics in the literature is not new, nor is the leadership. It is obvious that ethics and values differ depending on the culture of the nation and country. A comprehensive cross-national longitudinal research is needed. Finally, the globalization might have various effects on the world. The question of whether it has any impact on ethical and moral values of the nations in terms of evaluating charismatic leadership, needs to be explored. In conclusion, it looks like the dilemma of being ethical and effective in the frame of charisma will continue. One thing, however, seems to be constant: Chaos, complexity, or crisis situations are good distinguishers and generators of charismatic leaders.

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Chapter 25

GARCH Type Volatility Models Augmented with News Intensity Data

Sergei P. Sidorov, Paresh Date, and Vladimir Balash

25.1 Introduction

Recent studies on the volatility of stock returns have been dominated by time series models of conditional heteroscedasticity and have found strong support for ARCH-GARCH-type effects. However, ARCH-GARCH-type models do not provide a theoretical explanation of volatility or what, if any, the exact contributions of information flows are in the volatility-generating process. One of the possible theoretical explanation is the mixture of distribution hypothesis (MDH) developed by (Clark 1973). The MDH relies on the following assumptions:

- Returns and corresponding trade volumes are jointly independently distributed with finite variance (Harris 1987);
- The number of events occurring each day is stochastic.

As a consequence, the variance of returns at a given interval is expected to be proportional to the rate of information arrival at the market. The development of MDH can be found in the papers (Epps and Epps 1976; Tauchen and Pitts 1983; Lamoureux and Lastrapes 1991).

Trading volume is one of the most favored proxies for news arrivals. It can be explained by the following way: the more specific news arrives about a given stock (or company), the more investors will interpret the effects of that news differently, and thus the more investors will have an incentive to trade as their expectations

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about future returns diverge. There are well-known empirical studies of the positive contemporaneous correlation between trading volume and price volatility (see, e.g. Karpoff 1987 and references therein).

Some of empirical studies, including a pioneer work for the US stock market by Lamoureux and Lastrapes (1990), have found evidence that the inclusion of trading volumes in GARCH models for returns results in a decrease of the estimated persistence, or even causes it to disappear. However, the results from other research indicated that trading volume contributes some information to the returns process, while their results also show persistence in volatility even after incorporate volume effects. These research include work on the futures market reported in Najand and Yung (1991).

Different measures of information arrivals were employed in variety of empirical studies in order to test the impact of the rate of information on the market volatility:

- Macroeconomic news, (Ederington and Lee 1993);
- The number of daily newspaper headlines and earnings announcements, (Berry and Howe 1993);
- The number of specific stock market announcements, (Mitchell and Mulherin 1994).

It is worth mentioning the paper (Andersen 1996) in which it was shown that different types of news have a different impact on the conditional stock volatility.

The work presented here tries to evaluate the impact of news on stock volatility through a small empirical study on augmented GARCH models. While news analytics tools became more popular among investors as indicated in Mitra and Mitra (2001), there are not so much research works studying quantitative impact of news on stock volatility. It is worth to be mentioned the pioneering works (Kalev et al. 2004; Janssen 2004). In the paper of Kalev et al. (2004) firm-specific announcements were used as a proxy for information flows. It was shown that there exists a positive and significant impact of the arrival rate of the selected news variable on the conditional variance of stock returns on the Australian Stock Exchange in a GARCH framework. They split all their press releases into different categories according to their subject. In the second of the papers the author examines impact of news releases on *index* volatility, while in our work we analyze the impact on *stock* volatility following study of Kalev et al. (2004). However, we restrict our choice by some of the FTSE100 companies, while Kalev et al. (2004) considered some French companies. Our emphasis is on assessing the added value of using news intensity in improving the explanatory power of the GARCH model.

25.2 Augmented GARCH Models

Let X_t be the log return of a particular stock or the market portfolio from time $t - 1$ to time t . Let I_{t-1} denotes the past information set containing the realized values of all relevant variables up to time $t - 1$.

Suppose investors know the information in I_{t-1} when they make their investment decision at time $t-1$. Then the relevant expected return μ_t to the investors is the conditional expected value of X_t , given I_{t-1} , i.e. $\mu_t = E(X_t|I_{t-1})$. The relevant expected volatility σ_t^2 to the investors is conditional variance of X_t , given I_{t-1} , i.e. $\sigma_t^2 = \text{Var}(X_t|I_{t-1})$. Then $\varepsilon_t = X_t - \mu_t$ is the unexpected return at time t .

We recall Bollerslev (1986) that a process (ε_t) is said to be the generalized autoregressive conditionally heteroscedastic or GARCH(1,1) process if $\varepsilon_t = \sigma_t u_t$, $t \in \mathbb{Z}$, where (σ_t) is a nonnegative process such that

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2. \quad (25.1)$$

In the model, α reflects the influence of random deviations in the previous period on σ_t , whereas β measures the part of the realized variance in the previous period that is carried over into the current period. The sizes of the parameters α and β determine the short-run dynamics of the resulting volatility time series, i.e. the sum $\alpha + \beta$ of these parameters reflects the degree of persistence. Large ARCH error coefficients α mean that volatility reacts intensely to market movements, while large GARCH lag coefficients β indicate that shocks to volatility persist over time.

Following the paper (Kalev et al. 2004) we will use news intensity as a proxy for information flows. (The number of news about a company at the day t is called *the news intensity* at the day t .)

We will examine two alternative GARCH models:

1. *GARCH model augmented with news intensity.* We will consider a process (ε_t) such that

$$\varepsilon_t = \sigma_t u_t, t \in \mathbb{Z}, \quad (25.2)$$

where (σ_t) is a nonnegative process such that

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \gamma n_t, \quad (25.3)$$

where n_t is the number of all relevant news for the company released at the day t , $\omega > 0$, $\alpha, \beta \geq 0$, $\alpha + \beta < 1$, γ are parameters of the model.

2. *GARCH model augmented with lagged news intensity.* We will consider a process (ε_t) such that

$$\varepsilon_t = \sigma_t u_t, t \in \mathbb{Z}, \quad (25.4)$$

where (σ_t) is a nonnegative process such that

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \gamma n_{t-1}, \quad (25.5)$$

where n_{t-1} is the number of all relevant news for the company released at the day $t-1$, $\omega > 0$, $\alpha, \beta \geq 0$, $\alpha + \beta < 1$, $\gamma > 0$ are parameters of the model.

For brevity of notation, the augmented models are referred to as GARCH-news and GARCH-news-L respectively (L is for lagged model).

We will use a GARCH model of order 1 since it has been shown to provide a abstemious representation of the conditional variance. Hansen and Lunde (2001) ‘found no evidence that a GARCH(1,1) is outperformed by more sophisticated models’ for prediction of variance of stock returns.

To calibrate the models we have used the Maximum Likelihood Estimation (MLE) under the assumption of Gaussian innovations, which corresponds to the Quasi Maximum Likelihood Estimation (QMLE) method (see e.g. Francq and Zakoan 2010).

25.3 Empirical Study

Our sample covers a period ranging from July 1, 2005 to July 1, 2008 (i.e. 750 trading days). Our sample is composed of the 92 UK stocks that were part of the FTSE100 index in the beginning of 2005 and which survived through the period of 6 years. We have deleted 8 stocks that have not survived. In this work we will present empirical results of only ten company from the FTSE100 for brevity. In particular, we focus our attention only on ten companies traded on London Stock Exchange: Aviva, Barclays, BP, Brit Amer Tobacco, BT Group, Carnival, Centrica, Compass Group, Capita, CRH Plc.

Daily stock closing prices (the last daily transaction price of the security) are obtained from Yahoo Finance database. Results similar to one’s presented in the paper have been verified for all FTSE100 companies.

The Box-Ljung Q -statistic shows that there is no autocorrelation of log returns. Using this fact, we do not include autoregressive and moving average terms in mean equation. We will assume $\mu = E(X_t)$.

Consistent with the findings in Lamoureux and Lastrapes (1990), we find that the p -values of Shapiro-Wilk statistic of log returns for all five companies are close to zero. We may conclude that all series are non-normal.

The GARCH model of Bollerslev (1986) provides a flexible and parsimonious approximation to conditional variance dynamics. Maximum likelihood estimates of the GARCH(1,1) model defined by Eq. 25.1 for log returns of closing daily prices are presented in Table 25.1. Using GARCH estimates, Table 25.1 shows that volatility persistence, i.e. $\alpha + \beta$, is more than 0.9. It provides clear evidence of GARCH effect. The coefficients of the model are significant with levels of 5 %.

All news analytics data were given by Raven Pack News Analytics (RPNA). RPNA is a news sentiment analysis service that provides a look into the sentiment of more than 28,000 publicly traded companies worldwide. Each score is a weighed balance of sentiment in articles published by professional newswires (such as Dow Jones and Reuters) and hundreds of financial sites, online newspapers and even blogs.

Table 25.1 Maximum likelihood estimates of the GARCH(1,1) model

Company	α	β	$\alpha + \beta$	LLF_1
Aviva	0.0721	0.8960	0.9681	2,345.51
Barclays	0.1492	0.8519	1.0011	2,301.50
BP	0.0162	0.9733	0.9895	2,420.70
Brit Amer Tobacco	0.0214	0.9741	0.9955	2,367.68
BT Group	0.1044	0.6386	0.7430	2,223.44
Carnival	0.0645	0.8363	0.9008	2,096.49
Centrica	0.1027	0.7931	0.8957	2,190.40
Compass Group	0.1263	0.7997	0.9260	2,141.91
Capita	0.3956	0.0000	0.3956	2,323.72
CRH Plc	0.1007	0.8846	0.9853	2,167.92

For each news wire, we have got the following fields: time stamp, company name, company id, relevance of the news, event category, event sentiment, novelty of the news, novelty id, composite sentiment score of the news, word/phrase level score, projections by company, editorials and commentary, reports corp actions, news impact projection, story ID. Company, relevance score and composite sentiment score are the main fields of interest. One piece of news can of course concern several companies, industries and subjects. We restrict the sample to news released with high relevance score (more or equal to 90). We do not eliminate all news releases with the same headlines and lead paragraphs, since we suppose that the number of the same news published by different news agencies reflects the importance of the news.

There is no clear trend of the total daily number of news wires for FTSE100 companies. It could indicate that the news time-series is stationary and reduce the risk of dummy results due to a possible simultaneous increase over time of the stock volatility. Some periods have rate of news intensity below the average (e.g. holidays, Christmas time). On the other hand, one can witness the increase of the rate at the periods of the quarterly reports and releases of the intermediate figures and earnings of companies.

There is a clear presence of weekly seasonality in the data (the average number of a company's news announcements released during the week-end is much lower than the one of the other weekdays). The same picture is held for all FTSE100 companies indeed. Since that we exclude all weekend news from our analysis.

The estimates of GARCH model with contemporaneous news intensity defined by Eqs. 25.2 and 25.3 are presented in Table 25.2.

The results show us that daily news intensity has some explanatory power regarding the conditional volatility of daily log return. Once news intensity n_t is included as an explanatory variable in the equation, the sum of $\alpha + \beta$ is less than corresponding results in Table 25.1.

To estimate the impact of lagged news intensity on volatility persistence in GARCH model, we consider the model defined by Eqs. 25.4 and 25.5. The results presented in Table 25.3 show that there are no evidence of vanishing ARCH and GARCH effects. Moreover, estimates of parameters α , β are close to corresponding ones in Table 25.1. The coefficients of the model are significant with levels of 5 %.

Table 25.2 Maximum likelihood estimates of the GARCH-news model

Company	α	β	γ	$\alpha + \beta$	LLF_2
Aviva	0.1258 (0.0285)	0.7867 (0.0495)	2.8E-06 (9.9E-07)	0.9125	2,354.54
Barclays	0.1579 (0.0401)	0.8232 (0.0420)	1.1E-06 (4.4E-07)	0.9811	2,310.09
BP	0.0703 (0.0194)	0.1149 (0.1526)	2.0E-06 (5.4E-07)	0.1852	2,431.87
Brit Amer Tobacco	0.0203 (0.0120)	0.9771 (0.0117)	2.8E-07 (2.8E-07)	0.9973	2,368.45
BT Group	0.0805 (0.0222)	0.4074 (0.1253)	9.8E-06 (2.4E-06)	0.4879	2,271.55
Carnival	0.1203 (0.0648)	0.4363 (0.1356)	3.8E-05 (1.1E-05)	0.5566	2,147.81
Centrica	0.1118 (0.0290)	0.2166 (0.1611)	1.6E-05 (5.2E-06)	0.3284	2,219.23
Compass Group	0.1565 (0.0284)	0.1501 (0.0833)	5.3E-05 (1.1E-05)	0.3067	2,247.18
Capita	0.1457 (0.0621)	0.0000 (0.0000)	3.7E-05 (9.5E-06)	0.1457	2,365.79
CRH Plc	0.1078 (0.0372)	0.8745 (0.0518)	9.7E-07 (1.9E-06)	0.9823	2,168.19

Table 25.3 Maximum likelihood estimates of the GARCH-news-L model

Company	α	β	γ	$\alpha + \beta$	LLF_3
Aviva	0.0721	0.8960	7.35E-08	0.9681	2,345.53
Barclays	0.1492	0.8519	3.54E-08	1.0011	2,301.52
BP	0.0162	0.9733	6.85E-09	0.9895	2,420.72
Brit Amer Tobacco	0.0214	0.9741	4.22E-09	0.9955	2,367.68
BT Group	0.1044	0.6386	1.19E-07	0.7430	2,223.45
Carnival	0.0645	0.8363	9.88E-05	0.9008	2,105.60
Centrica	0.1027	0.7931	5.67E-07	0.8957	2,190.49
Compass Group	0.1263	0.7997	5.13E-07	0.9260	2,141.92
Capita	0.3956	0.0000	7.30E-08	0.3956	2,323.74
Crh Plc	0.1007	0.8846	7.15E-08	0.9853	2,167.92

25.4 Monte Carlo Simulation for Likelihood Ratio Statistic

Note that the GARCH(1,1) model (the null model) is a special case of the GARCH-news model (the alternative model). Therefore, to compare the fit of two models it can be used a likelihood ratio test (see e.g. Cox and Hinkley 1974). It is the most common approach to testing problem. This test has been discussed in the papers (Lee and Brorsen 1997; Kim et al. 1998). In this subsection we use this approach to test the GARCH-news model against GARCH model (as well as the GARCH-

news-L model against GARCH model). Let H_0 denote the GARCH(1,1) model and H_1 denote the GARCH-news model. Let ε_t be a random variable that has a mean and a variance conditionally on the information set I_{t-1} .

Denote the corresponding log likelihood functions by $LLF_{H_0}(\varepsilon; \theta_0)$ and $LLF_{H_1}(\varepsilon; \theta_1)$, respectively.

We will consider the test statistic defined by

$$LR = 2 \left(LLF_{H_1}(\varepsilon; \hat{\theta}_1) - LLF_{H_0}(\varepsilon; \hat{\theta}_0) \right). \quad (25.6)$$

While the asymptotic null distribution of Eq. 25.6 is unknown, it can be approximated by Monte Carlo simulation.

We can assume that the GARCH-news model is the alternative model and that $\hat{\theta}_1$ is the true parameter. Using Monte Carlo approach we will generate N realizations of T observations $\varepsilon^{(i)} = (\varepsilon_t^{(i)})_{t=1}^T$, $i = 1, \dots, N$, from this model. Then we will estimate both models and calculates the value of Eq. 25.6 using each realization $\varepsilon^{(i)}$.

Ranking the N values gives an empirical distribution with which one compares the original value of Eq. 25.6. The true value of $\hat{\theta}_1$ is unknown, but the approximation error due to the use of $\hat{\theta}_1$ as a replacement vanishes asymptotically as $T \rightarrow \infty$.

If the value of Eq. 25.6 is more or equal to the $100(1-\alpha)\%$ quantile of the empirical distribution, the null model is rejected at significance level α . As it was mentioned in Lee and Brorsen (1997) the models under comparison need not have the same number of parameters, and the value of the statistic can also be negative. Reversing the roles of the models, it can be possible to test GARCH models against GARCH-news model.

The data-generating model is defined by Eqs. 25.2 and 25.3 given before. Notice that the error term in the mean equation is drawn from a normal distribution with mean zero and variance that changes over time according to Eq. 25.3.

Finally, we have set the number of trials N in each Monte Carlo experiment to 500.

Results of likelihood ratio test for GARCH model (null model) and GARCH-news model (alternative model) one can find in Table 25.4. For eight of ten companies the alternative model is preferable with confidence level of 1 %. Results of likelihood ratio test for the GARCH(1,1) model (null model) and the GARCH-news-L model (alternative model) one can find in Table 25.4. Only for one of ten companies the null model is rejected with confidence level of 1 %.

25.5 Conclusions and Present Research

We have studied different GARCH models augmented with news analytics data to examine the impact of news intensity on stock volatility. Based on empirical evidences for some of FTSE100 companies it has been shown that the GARCH(1,1)

Table 25.4 Results of the likelihood ratio test for the GARCH(1,1) model and the GARCH-news model, for the GARCH(1,1) model and the GARCH-news-L model

Company	GARCH/GARCH-news	GARCH/GARCH-news-L
Aviva	Rejected	Accepted
Barclays	Rejected	Accepted
BP	Rejected	Accepted
Brit Amer Tobacco	Accepted	Accepted
BT Group	Rejected	Accepted
Carnival	Rejected	Rejected
Centrica	Rejected	Accepted
Compass Group	Rejected	Accepted
Capita	Rejected	Accepted
CRH Plc	Accepted	Accepted

model augmented with news intensity does remove GARCH and ARCH effects for some of the FTSE100 companies. Moreover, the likelihood ratio test has shown that the GARCH(1,1) model augmented with the news intensity performs better than the ‘pure’ GARCH model. We have used RavenPack news analytics data.

The work may be considered as a preliminary work on the problem of evaluation of impact of news on stock volatility. Based on the research it can be suggested some directions of future work.

- The first problem is to develop a GARCH-type model with news analytic data for prediction VaR with better performance than the “pure” GARCH model.
- It is worth considering the problem of mutual dependence of volatility and news intensity.
- The problem of calibration of augmented models (e.g. GARCH-Jumps models) is difficult due to its non convexity and noisiness. We can try to use different solvers for global optimization or to develop new algorithms.

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Chapter 26

A General Outlook to the Transformational Leadership Practices of School Administrators in Turkey in the Light of Present Research Findings

Tuğba Turabik

Just as in the rest of the world, in our country too there are efforts to adapt to changes in order to improve the quality of education. One of such efforts is to bring the leadership styles of school administrators in accordance with the present day. Therefore, school administrators in Turkey too are expected to exhibit leadership behaviors which are in accordance with the requirements of the present day. The situation of transformational leadership in Turkey, which has been frequently referred in the last 20 years will be examined in this study. Researches conducted in this topic in Turkey will be examined, practices of Transformational Leadership in Turkey and effects on the motivational levels of administrators and opinions of related individuals will be analyzed and a general framework will be set out.

Recently, there have been dramatic changes in almost all fields of our lives, just as in administration of organizations. In the past, administrators were regarded as rulers of an organization and were held responsible only to secure the organizations' regular functioning.

It was inevitable to see changes in administrator traits as there had been a progress from Classical Approach in administration of organizations towards Neoclassical Approach and later on towards contemporary approaches like Systems Approach and Contingency Approach. Changing conditions created a necessity for leaders who are not solely administrators but can motivate the group members, can enhance their organizational commitments and willingness to work in groups, can assist them in adapting changing conditions, appreciate their opinions, innovative, following scientific, technological, political, social, geographical and humanitarian etc. developments and humanitarian.

In the present case then, what are the discrepancies between a leader and an administrator and what makes leaders more expedient? An administrator is

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portrayed by Koçel (2010) as a person who ensures the organizations to achieve its pre-defined goals by making use of their own experiences in administration and by collaborating with others.

Leadership on the other hand bears various definitions and Erçetin (2000) narrates some of these as;

- Leadership is the art of influencing people mentally, physically and emotionally by persuasion (Copeland cited by Erçetin 2000).
- Leadership is the process of influencing the activities of an organized group towards goal setting and goal achievement (Stogdill cited by Erçetin 2000).
- Leadership is influencing people to succeed in a common goal (Koontz and O'Donnel cited by Erçetin 2000).
- Leadership is the ability to influence people by exhibiting active, crucial and intercorrelated behaviors like expertise or empathy (Pagonis cited by Erçetin 2000).
- Leadership is making the interactions between members of an organization meaningful within a context and reshaping them (Ogawa and Bossert cited by Erçetin 2000).

In addition to these definitions, leadership is defined as;

- Leadership is a process of influencing and shaping activities of others under certain circumstances aiming to achieve certain personal or group objectives (Koçel 2010).
- Leadership is the ability of administering individuals in a desired manner (Moore cited by Kaya 1998).
- Leadership is basically the qualification of guiding and is related with the ability of coordinating and encouraging individuals or groups with intention of achieving certain objectives (Kaya 1996).

Regarding all the definitions above, coordination, influencing, authority and power stand out as common concepts in leadership.

Power: Is the ability to lead actions of others in a desired way (Koçel 2010).

Influencing: Is the capacity to have an effect on the character, development, or behaviour of someone or something, or the effect itself (<http://oxforddictionaries.com>).

Coordination: Is the act of making all the people involved in a plan or activity work together in an organized way (<http://dictionary.cambridge.org>).

Authority: According to Weber, authority is obedience of members of an organization to directions of their superiors willingly and unconditionally. Fayol defined authority as the power of giving orders and making others to obey. Barnard proposed a theory called 'acceptance theory of authority'. According to his theory, Barnard argued that authority arises only when the orders gets obedience form subordinates and authority flows to manager through acceptance of his orders by the subordinates (Koçel 2010).

Who is a leader then? Morphet and his colleagues gave some tips to identify one as a leader or not:

1. If assisting members of a group in realizing duties, objectives and goals,
2. If assisting members of a group with providing duties, objectives and goals,
3. If assisting a group in providing necessities and assuring the determinedness,

The person possessing the traits above can be entitled a ‘leader’ (Kaya 1996).

As things stand, it can be seen that administration and leadership are quite a different concepts and organizations of modern days are in need of leaders. In order to comprehend this necessity better, difference between administratorship and leadership should be further investigated (Koçel 2010).

- Administration is implementation of a profession, whereas leadership is the work of influencing others.
- While administration requires a formal construct, leadership does not.
- Administration makes sure the best outcome of a certain operation; leadership determines which tasks to be achieved.
- While administrators use sanctions and authorizations to influence people, leaders use their personal traits.
- There is a job definition for an administrator but not for a leader.
- Administration is more scientific while leadership is more artistic.
- An administrator does things right, a leader does what is right.

People require various services in various fields in our modern world. Correspondingly, various organizations established providing service for different requirements. Every organization has its own structures and they must be led with a leadership approach in accordance with their present reason of occurrence and time being. Some of these approaches are; Visionary Leadership, Quantum Leadership, Cultural Leadership and Transformational Leadership. In this study, transformational leadership manners of school administrators in Turkey will be investigated in the light of findings of some former studies.

Educational institutions are among the most susceptible towards changes. Thence, a school administrator must be a person who can lead teachers, personnel, students and their parents in acclimatization to changes. Accordingly, possessing transformational leadership traits is an important requirement for school administrators. We shall look further into details of transformational leadership and the traits of transformational school leaders.

26.1 Transformational Leadership and Educational Institutions

Transformational leadership is a human and change oriented approach aspiring to create a change in people and hence in organizations and accommodate to new conditions (Celep 2004).

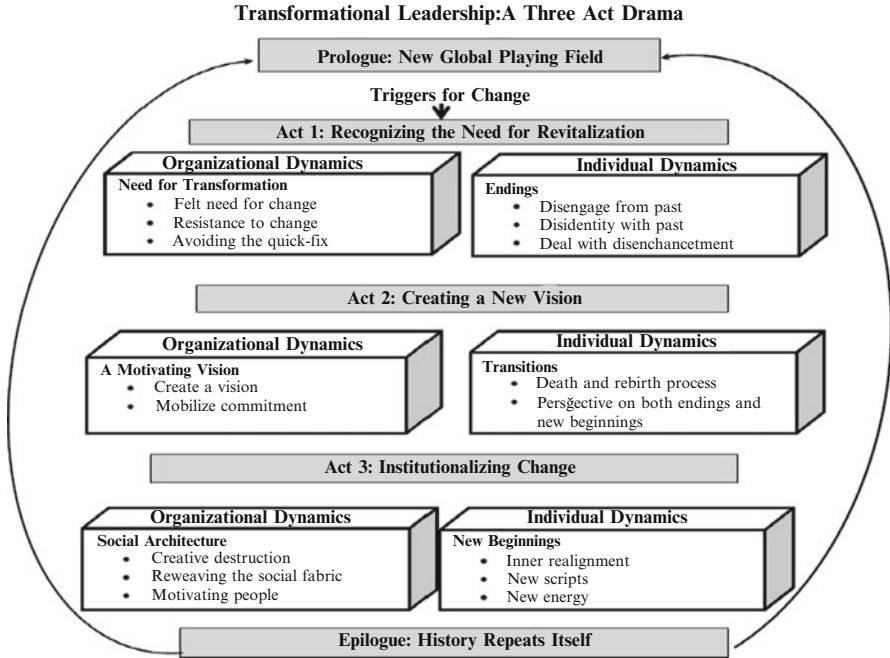


Fig. 26.1 Transformational leadership: a three act drama (Source: Tichy and Devanna 1986)

Competitive pressures are forcing companies to reassess the explicit and implicit employment contract they have struck with employees over the last three decades. The opinions and feeling is voiced by middle managers and others caught up in organizational change are part of a growing chorus of anger, confusion and dismay. The change they are being asked to make is not marginal; it is fundamental. It demands the commitment of the many not the few. Its nature is revolutionary not evolutionary. It cries for leaders not managers, to effect the transformations required by most organizations (Tichy and ve Devanna 1986).

According to Tichy and Devanna (1986), transformation occurs as a three act drama as can be seen in the figure (Fig. 26.1):

Considering educational organizations, they are obviously susceptible to even little changes in both physical and mental variables, be it political, scientific, technological or philosophical. Any minor change in these fields will force educational institutions to change accordingly which is expectedly uneasy. At this very point though, school administrators with transformational leadership traits could play a vital role and could survive the storm without any major harm done to the organization, namely the school. Wherever a change is, there will be a resistance to it. During the course of change, school administrators with transformational leadership traits will inform, convince and make teachers, students and their parents willing to the process by explaining why the change is necessary to the institution,

what are the possible consequences of failure in change, how is the institution and the shareholders (students and their parents) will be effected by the change, how is the institution will be improved by the change, which opportunities will be taken and what are the possible effects on the shareholders. From this aspect, roles of school administrators with transformational leadership traits are vital. So what is the situation with transformational leadership traits of school administrators in Turkey? There are various studies performed to come up with answers to this query. This study is on the situation of transformational leadership traits of school administrators in Turkey.

26.2 Noticeable Findings of Studies Performed on Transformational Leadership Practices of School Administrators in Turkey

26.2.1 Study 1

First study examined was Töremen and Yasan (2010)'s study named 'Primary School Administrator's Transformational Leadership Features (Example on the City of Malatya)'.

This research was performed to determine the extent of the school managers' transformational leadership practices by consulting teachers' opinions. To do so, researchers conducted 'multifactor leadership questionnaire' on 251 teachers working in Malatya province during the 2005–2006 academic year. The questionnaire is made up of four dimensions (idealized influence, individualized consideration, intellectual stimulation, inspirational motivation) and 39 items. The questionnaire is a 5 point Likert scale and the answers to questions in the questionnaire are grouped and assessed as; (1) point for 'never', (2) points for 'rarely', (3) points for 'sometimes', (4) points for 'often' and (5) points for 'always'.

It is concluded by the analysis of the findings that according to teachers, school administrators highly demonstrate the traits of transformational leadership. There is an inequality observed between male and female teachers' opinions for the intellectual stimulation and individualized consideration dimensions of the scale. For these dimensions, male teachers found to hold more affirmative views than female teachers.

With respect to subject area of the teachers, which was taken as the second variable, there was no significant difference between teachers' opinions.

With respect to educational levels (college or university degree) of teachers too, there was no significant difference between opinions.

With respect to seniority of the teachers, only for inspirational motivation, teachers with 1–10 years of experience and teachers with 21 years or more experience found to hold more affirmative views than teachers with 11–20 years of experience.

Finally, minor differences found between teachers' opinions with respect to educational region of the teachers. Although there are minor differences between opinions of teachers according to the findings of the research, it is concluded that school administrators highly display transformational leadership traits.

26.2.2 Study 2

Taş and Çetiner (2011)'s study called 'The Perspective of the Teachers Towards the Secondary School Directors' Performing the Transformational Leadership Behaviors' is aimed to determine teachers' views of secondary education school principals' transformational leadership practices.

Within the framework of this general purpose, they aimed three sub-objectives;

1. Determination of the extent of transformational leadership practices of the secondary school directors,
2. Determination of the differentiation in transformational leadership practices of secondary school directors with respect to teacher opinions regarding; gender, field of study, seniority and length of working with the director,
3. Determination of the relationships between dimensions of the transformational leadership.

For this purpose, data obtained with transformational leadership scale which was applied to 170 teachers working in public secondary schools in Burdur city during the 2007–2008 academic year were analyzed. The scale was consisted of two parts. In the first part of the scale, there were questions about personal details of the administrators and in the second part, there were questions about the transformational leadership practices of the administrators. This second part of the scale included six dimensions; identifying and developing a vision, facilitating individual support, intellectual stimulation, strengthening acceptance of group aims, forming a behavior model, and expectation of high performance. The scale had 5-scale Likert type items allowing to score: 1 (Totally Disagree) to 5 (Totally agree).

According to the research findings, it was discovered that teachers' perceptions on frequency of exhibiting transformational leadership practices of school administrators was 'intermediate' level.

The second sub goal of the research was to find out whether teachers' opinions differentiate or not on school administrators' transformational leadership practices with respect to their gender, field of study, seniority and period of working with the administrator. Findings were as follows.

- There is a significant difference between the opinions with respect to gender. Female teachers' opinions were affirmative.
- No significant difference found with respect to seniority of the teachers
- With respect to length of working with the administrator, there was a difference only in 'identifying and developing a vision' dimension of the scale. Teachers

working with the administrator for up to 5 years expressed their opinions to be ‘sometimes’, whereas teachers working with the administrator for more than 11 years expressed ‘seldom’.

Finally, researchers attended the relationships between the sub dimensions of transformational leadership and high levels of positive relationships were found among all the dimensions of leadership. Overall, transformational leadership practices of school administrators at secondary schools were insufficient according to teachers’ opinions.

26.2.3 Study 3

The master’s thesis study of Keleş (2009) called ‘Teachers’ Perceptions About Transformational Leadership Practices of Principals in Primary Schools (Muğla Sample)’ is aimed at investigating elementary school teachers’ perceptions about transformational leadership practices of school principals in Muğla province. For this purpose, 304 elementary school teachers in Muğla were given the transformational leadership scale in 2008–2009 academic year. The scale had four dimensions; inspirational motivation, idealized influence, individual consideration and intellectual stimulation. These four dimensions were explained by Avolio and Bass as follows (cited by Baloğlu et al. 2009).

Inspirational motivation: Leaders with this characteristic are always optimistic for the future, enthusiastic about the goal, inspires followers to see the attractive future state, well expresses the challenges of a vision and gives confidence in achieving the goals.

Idealized influence: Leaders with idealized influence emphasize the most prized values and motives of the followers, highlight the significance of purposefulness, interpret the moral and ethical outcomes of the decisions, put emphasis on the importance of building up a sense of common task, make others be proud to stand with him/herself, go beyond his/her self-interests for the sake of the team, act responsible and give sense of confidence.

Individual consideration: Treat every individual as the one, rather than a member of the group, spend time on teaching and coaching, help others to be strong, respect particular needs and skills.

Intellectual stimulation: Consider every possible way of solutions, seek for different perspectives, encourage members of the group to seek for new ways of solutions, enable followers to develop distinctive perspectives.

According to the responses of teachers, rate of answering ‘often’ and ‘all the time’ are of high incidence. Grand average of all of the dimensions was ‘often’ with the value of 4.19. The findings concluded that elementary school administrators well practice transformational leadership.

Researchers analyzed the results with respect to the gender, seniority, field of study and length of teachers' service in the school. With respect to these variables, no significant difference was found between teachers' opinions other than the seniority of the teachers and the intellectual stimulation sub-dimension. With respect to the 'seniority' variable, teachers with 6–10 years of experience found the practice of school administrators' intellectual stimulation more than the teachers with 16–20 years of experience.

Considering the research as a whole, it can be concluded that elementary school administrators do practice transformational leadership.

26.2.4 Study 4

The master's thesis study of Bilir (2007) called 'The examination of the relationship of teacher's job satisfaction and primary school administrator's transformational leadership properties according to teacher's perception' is aimed at determining the transformational leadership behaviors of school administrators and the relationship between transformational leadership of school administrators and job satisfaction of teachers at primary schools.

For this purpose, 500 teachers working in Konya province were given 'background information form', 'Transformational Leadership Questionnaire' and 'Job Satisfaction Questionnaire' in 2005–2006 academic year.

According to the findings of the research, teachers' opinions on transformational leadership practices of school administrators were positive yet they did not find it sufficient. Job satisfaction of teachers was found to be at medium levels. Finally, researchers investigated the relationship between the job satisfaction of teachers and transformational leadership practices of school administrators and they found a positive and strong relationship between the two.

26.2.5 Study 5

The master's thesis study of Zeren (2007) called 'Investigation of the relationship between transformational leadership characteristics of elementary school principals and the organizational commitments of these school teachers' is aimed at investigating the transformational leadership characteristics and the relationship between transformational leadership characteristics of elementary school principals and the organizational commitments of teachers.

For this purpose, 600 teachers in Şanlıurfa province were given the 'Transformational Leadership Questionnaire' and the 'Organizational Commitment Scale'. Sub dimensions of the transformational leadership scale were idealized influence, intellectual stimulation, inspirational motivation, individual consideration and the sub dimensions of the organizational commitment scale were compliance, identification and internalization.

According to the findings of the research, teachers stated that school administrators ‘mostly’ exhibit idealized influence and intellectual stimulation dimensions of transformational leadership and ‘sometimes’ exhibit individual consideration and inspirational motivation sub dimensions of transformational leadership. According to the findings of the research, it can be concluded that school administrators do practice transformational leadership.

In addition to these findings, a positive and a medium level relationship was found between the transformational leadership characteristics of the school administrators and job satisfactions of teachers. Significant relationships were identified between the idealized influence and the intellectual stimulation sub dimensions of transformational leadership and the organizational commitment. No significant relationships were observed between other dimensions of transformational leadership and organizational commitment itself.

26.3 Conclusion and Recommendations

Although not sufficient, school administrators in Turkey can be concluded to exhibit transformational leadership behaviors. Job satisfactions of teachers as well as organizational commitments appear to increase with transformational leadership practices of school administrators.

Considering rapid changes in the national education policies in Turkey, requirement for a leader is obvious who can lead teachers, students and all other stakeholders in adapting to such changes so that schools can keep up. The leader of these characteristics is a transformational leader. For this reason, insufficient transformational leadership practices, as concluded in the studies must be improved by in-service trainings or by instructing the administrators on transformational leadership prior to service.

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Chapter 27

Avoidance Behaviors of School Managers in Uncertain and Chaotic Environments

Nilay Neyiřci and Nihan Potas

27.1 Introduction

Uncertainty as a part of the nature is a phenomenon occupying our individual and organizational lives. Today many organizations are trying to survive in chaotic, complex and uncertain environments and these environments create more obscure for individual and/or organization. While the state of certainty disappears with the increasing rate of change, uncertainty spread like a storm to our experiences. One of the basic assumptions of traditional theories of intellectual and experimental environments is having a full knowledge. Real life, however, is full of uncertainties and risks. Individuals, groups, organizations and even societies in the public and intellectual sphere have to take these uncertainties and risks in the decision making process into consideration. Certainly, we can state that avoidance from uncomfortable situations is a natural human instinct, our cultural perceptions and expectations that we use to avoid from these situations determine the strength of our avoidance requires. A situation that is not compromising with your perception of “normal” presents us actually the level of intrinsic uncertainty.

Can the experienced uncertainties be one of the determinants of our behaviors? In order to perceive uncertainty, a distinction between the characteristics of intrinsic and perceived environments is considered as significant. Since our perceptions are changing according to our positions in the organization. Beside the position in the organizational structure, we can perceive the environment and existing uncertainty

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variant according to formal and informal education, characteristics of social and organizational culture and hierarchical structure of the organization. As these individual and organizational differences change the level of perceived uncertainty, it also distinguishes attitudes and behaviors in situations of potential uncertainty (Özcan 2003, pp. 29–30).

27.2 Organizational Implications of Individual-Level Uncertainty Avoidance

Organizations' adapting themselves to uncertain conditions and behaving effectively under these circumstances may differ in accordance with their capabilities. Individuals in organizations with low level of uncertainty avoidance attach great importance to knowledge and their level of sharing knowledge increase. Managers within such organizations behave more flexible under uncertain and knowledge lacking conditions. Flexibility in the organization, enabled through changes and uncertainties becomes of vital importance for its survivability. Entrepreneur behaviors exhibited by the managers with low uncertainty avoidance affect the subordinates positively and give employees the opportunity to take risks easily (Weaver 1998, p. 118).

In situations involving uncertainty and unpredictability, individuals' perception of complexity and characteristics of coping with chaotic and change-adaptable conditions may differ. Whetten and Cameron (1995, p. 76) divided individuals into two categories according to the uncertainty avoidance level: individuals with low level of uncertainty avoidance and individuals with high level of uncertainty avoidance. Individuals with low level of uncertainty avoidance are more successful in providing and transmitting information and have greater level of flexibility and adaptation to work than individuals with high level of uncertainty avoidance. Managers with low level of uncertainty avoidance have more entrepreneur features and prefer semi-structured tasks (Çakici 2003, p. 23).

As another classification, according to Hofstede (1984), it can be assumed that there will be differences between organizations as well where there are differences between countries from certain aspects including culture and apprehension. Hofstede (2001) describes the term uncertainty avoidance as the extent to which members of a society feel comfortable in unknown and unstructured circumstances and as a societies' attempt to control the uncontrollable situations. Hofstede (2001, p. 161) states that "stress and uncertainty may cause reduction of perceived alternatives in decision making and the use of negative rather than positive cues". In organizations with high level of uncertainty avoidance individuals' characteristics are active, aggressive, emotional, intolerant and in need of safety (Hofstede 2001, p. 153). Organizations with high level of uncertainty avoidance desire strongly group control and they are not satisfied with their situation and alienation; furthermore they are against personal responsibility and personal decision-making and prone to intolerance and aggression. Cooperation and interpersonal relations are important to them, because they do not want to take responsibility when

facing with a problem and they seek to be together individuals with similar ideas. For this reason, they create strong belief systems with strict rules and do not allow corrupting these rules (Hofstede 2001, p. 154). Sargut (1994, p. 120) who implemented Hofstede's measurement tool to students and managers indicates that individuals in Turkish culture tend to significantly avoid uncertainty. The results of this research seem to contribute Hofstede's findings about Turkey. Rogovsky and Shuler (1997, p. 63), who describe uncertainty avoidance behavior as the level of uncertainty that would not be tolerated in a society or organization, indicate that individuals in organizations with high levels prefer structured and riskless situations, and otherwise they feel uncomfortable.

27.3 School Principal as a Leader in Uncertain and Chaotic Environments

Leadership is an important issue in terms of management and involves many different values and qualities. Human, considered as the most valuable element of organizations, has the necessity of organizing in order to achieve his/her goals; in addition, together with developments in the global dimension, organizations are required to find new forms of leadership. If we consider recent past and today, the term leadership now includes parts of organizational culture and terms like empathy, interaction and identity (Erçetin 2000, pp. 4–11). There is a dramatic change in the leadership understanding of today's educational managers. Educational managers undertake new roles with globalization, information technologies, scientific attitudes and behaviors, organizational learning and total quality management. School managers are expected to determine the mission and vision of the school and besides to plan how to act to reach these aims, to create school culture accordingly. To shorten, today's educational managers need to have the ability of carrying on the spirit of "learning organizations" in their schools to continuously improve the current situation.

In almost every area the leaders are expected in the chaotic environments created by risk and uncertainty to act more consciously and consistently than others and manage the process as possible with confidence.

Educational managers as also being a leader should have the sense of change and should keep followers' motivation high in case of unexpected things happen. Besides, this will lead to the efficiency in organizational communication. He should also make use of this opportunity to remind his followers of the possibility of experiencing chaotic events and contingencies at any time. Motivating his followers and taking risks may lessen negative effects of the probable consequences which might be caused by those risks. This also becomes an important issue on promoting the quality of educational organization from the aspects of giving effective education and developing himself in terms of creativity and progressiveness (Erçetin 2000, p. 45).

First of all, how individual school administrators perceive uncertainty is important to manage the uncertainty as leaders. Yet sometimes it can be vital as safely landing of airplane by the pilot despite damaged displays and stormy weather. How school administrators perceive uncertainty? How they differ in perceiving these situations? In this study, 58 school administrators participated voluntarily to the process of the determination of what individual level uncertainty behaviors are and which sub-categories (gender, age and education level) affect these perceptions. And based on the study results we discussed the effect of enhancing the school principals' level of coping with uncertainty on constitution of learning together, sharing, cooperation and team spirit.

27.4 Method

In our descriptive survey modeled study, in regard of the purpose of the study and scope of the researchers, a study group of voluntarily participated administrators from secondary education schools is selected. 58 administrators from 29 vocational and technical educational institutions that are determined by purposive sampling method are voluntarily involved to our study. As developing the "Individual Level Uncertainty Avoidance Behaviors of the Administrators Questionnaire" followed steps are given below:

- Considering the research problem in order to reveal current conditions, a literature review was conducted,
- According to the literature review, items regarding determination of uncertainty avoidance behaviors were composed,
- Among the items the most appropriate behaviors are selected based on the expert opinions,
- The questionnaire had the final form after performing corrections based on expert opinions.

Since determining administrators' level of exhibiting uncertainty avoiding behaviors is the main purpose of this study, items were formed in Likert type and it was also tried to be ascertained to what extent the principals agreed on each item. Content validity of the data collection tool was ensured based on expert opinion and it was configured with necessary amendments regarding the content, expression and spelling in the direction of the received feedbacks.

Multiple correspondence analysis used in this study. The basic aim of correspondence analysis is to reveal the structure of a complex data matrix by replacing the raw data with a more simple data matrix without losing essential information. Correspondence analysis is a method especially applicable for analyses of large contingency tables. The technique is a tool to analyze the association between two or more categorical variables by representing the categories of the variables as points in a low-dimensional space (Clausen 1998, pp. 1–2). Over the contingency tables like $R \times C$ the investigations about simple correspondence analysis can be

done. Multiple correspondence analyses is the way of revealing the relation and the togetherness at the sub-categories of variables that take place in nested different crossed contingency tables like RxCxK (Özdamar 2004, p. 490).

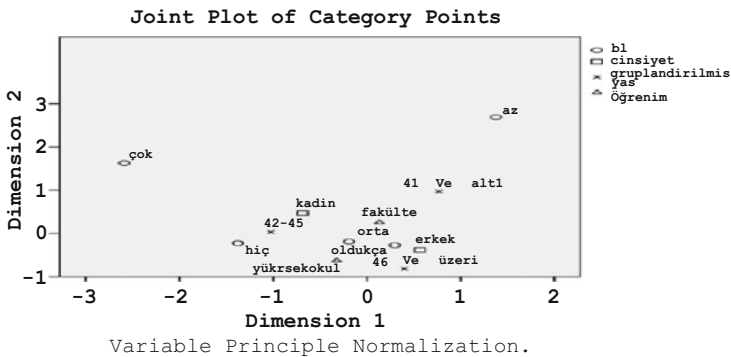
27.5 Findings

According to the results of the multiple correspondence analysis of the data obtained uncertainty behaviors of school administrators at the individual level are discussed in six items (1, 6, 13, 15, 16, 19 item numbers). Interpretations of correspondence analysis for each item are given below (Table 27.1).

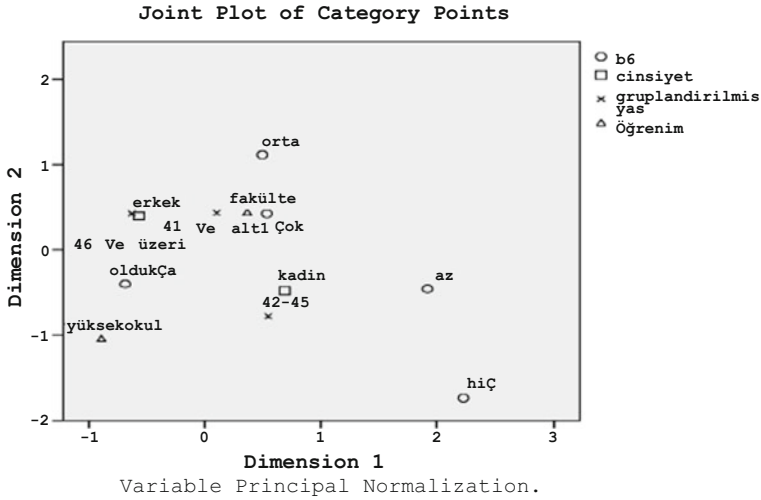
Male school administrators who are 46 years old and over and graduated from academy are found out to have higher levels of preference to work at the same school in long durations (Graph 27.1). According to the age category this shows that the tendency of individual-level uncertainty avoidance behaviors presents differentiation between groups. It is possible that school administrators in upper age categories tend to avoid from potential developments arising from uncertain and risky situations because of the internalization of organizational culture and bureaucratic culture over the years and probability to prefer the employment continuously at the same institution.

Table 27.1 Discussed items

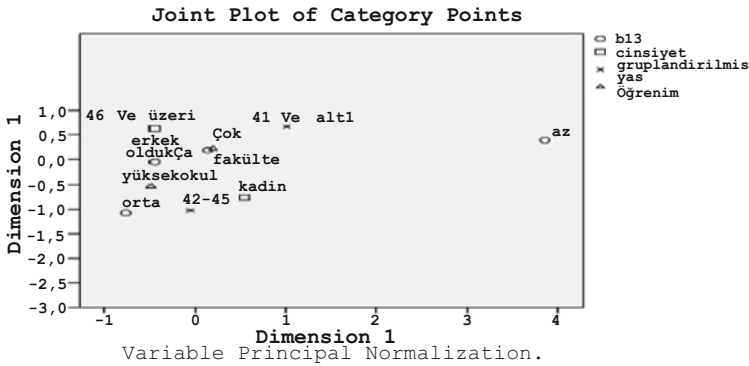
1	I prefer to work in the same school as long as possible
6	I plan on future as possible
13	I prefer planned situations to unplanned situations
15	I would be worried if I do not have information about a situation arisen as a result of an incident
16	I would be stressed if I cannot foresee the potential consequences
19	I feel uncomfortable in ambiguous situations



Graph 27.1 Multiple correspondence analysis of item I



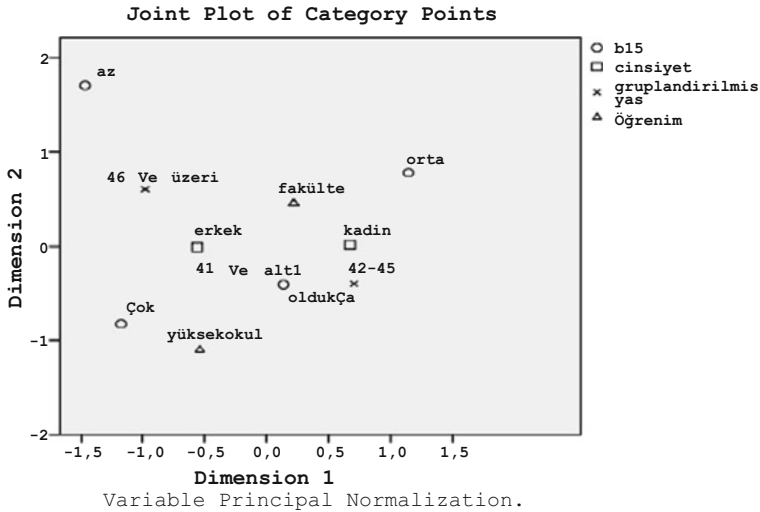
Graph 27.2 Multiple correspondence analysis of item 6



Graph 27.3 Multiple correspondence analysis of item 13

Male school administrators who are 41 years old and under and have a bachelor’s degree considered as participating item six at high levels which is about planning on future as possible (Graph 27.2). In addition, administrators in the age category of 46 years and older agreed on this item at very high levels. This finding can be explained by the positive perceptions of school administrators in all age categories about planning and by their awareness of managing uncertain and risky situations more easily. Although school administrators present attitudes towards avoiding ambiguous situations, it can be say that they develop methods by planning for dealing with such situations.

Male school administrators who are 46 years old and over and graduated from university are found out to prefer the planned situations at very high levels to unplanned situations (Graph 27.3). Whereas, female school administrators at the



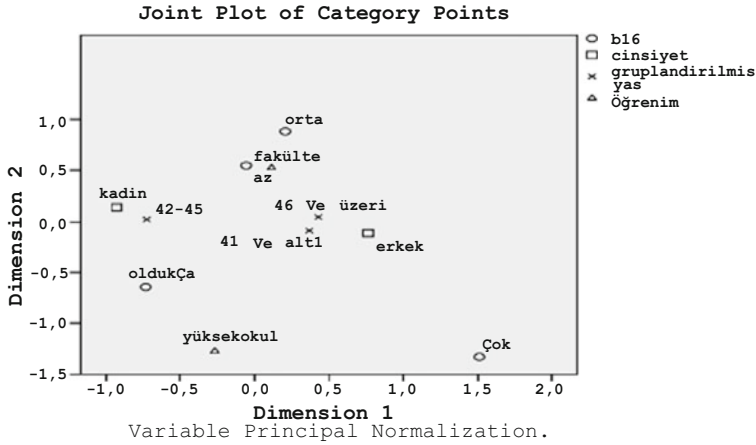
Graph 27.4 Multiple correspondence analysis of item 15

age group 42–45 are participated moderately to this item. According to the gender category this shows that the tendency of individual-level uncertainty avoidance behaviors presents a slight differentiation between groups. It can be stated that female managers feel less inconvenient about uncertainty then male managers; consequently they can manage more easily with unplanned situations.

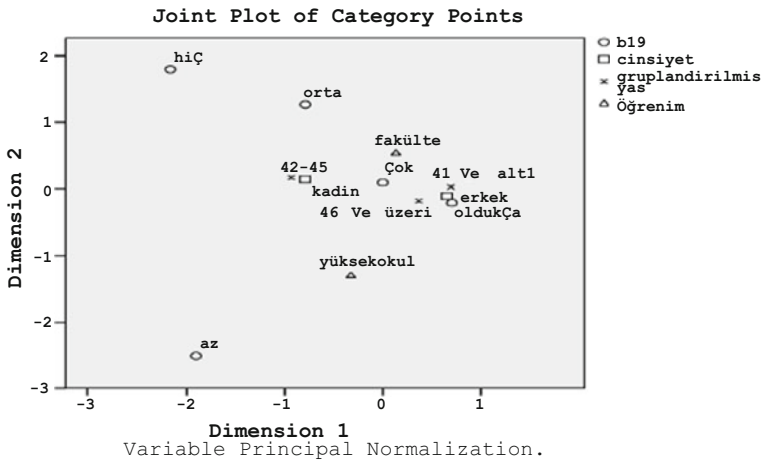
Male school administrators who are 41 years old and under and have a bachelor's degree showed high participation to “I would be worried if I do not have information about a situation arisen as a result of an incident” (Graph 27.4). This finding could be explained with the younger managers' tendency on taking more risks in their first years on job and bringing their professional mission on the work, but with their being less affected by organizational culture and less job experience leading more demand for information.

Male school administrators at the age group 46 and over and graduated from university participated low level on “I would be stressed if I cannot foresee the potential consequences” (Graph 27.5). Likewise female administrators aged between 42 and 45 years were participated low level on this item. This could be ascribed as general skills of both female and male managers on coping with stress. According to the self perceptions of managers, in the uncertain situations they can handle with the unpredicted consequences by appropriate leadership skills and stress management.

University-graduated male school administrators at the age group 41 and under and 46 and over appear to be high level uncomfortable with the uncertain situations (Graph 27.6). This indicates that according to the gender variable male administrators are not comfortable and competent on uncertainty avoidance behaviors.



Graph 27.5 Multiple correspondence analysis of item 16



Graph 27.6 Multiple correspondence analysis of item 19

27.6 Conclusion and Discussion

School administrators' uncertainty avoidance behaviors differ according to the age, gender and level of education categories. This difference emerges significantly between the managers in the beginning of the career and older managers. In this circumstance uncertainty avoidance behaviors can be correlated with individual factors such as career, tendency towards risk taking, employment demand, and degree of appropriation organizational culture, job satisfaction, coping with tension, moral issues and leadership skills.

The relation of uncertainty avoidance behaviors with the individual factors makes us to think about the need of different skills and competencies in the assignment of educational managers who are selected to work in the National Education System. Thus managers' development can be achieved in terms of taking risks, providing flexibility in appropriate conditions about structure and rules, not believing in one truth and easier adaptation to changes.

Cultures, structures and processes of schools in the National Education System should be supported to improve so that authorized individuals and/or educational managers can experience or let be experienced flexibility in the risky and uncertain situations and improve their leadership skills in harmony with changes and developments in the organization.

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Chapter 28

New Leadership Paradigms in the Complexity Science

Nilay Neyiřci and Nihan Potas

Leadership is a term that has long attracted interest. The word ‘leader’ evokes images of influential and dynamic individuals who achieve superiority. Leadership reminds many questions: Why and how do certain leaders inspire such commitment? Why and how do certain leaders achieve such attention? And why do certain successful leaders then just fall out of favour? Such questions surrounding leadership have long been a topic of speculation.

Hunt (1999) states that existing leadership theory neglects the complexities of the leadership role because most definitions reflect the assumption that it is a process whereby intentional influence is exerted by one person over another (Yukl 2006).

Besides new models of leadership continue to develop, including a model of leadership for the new organizational form, where leadership relies less upon managerial authority and a new set of ideas that transcends the physical, biological, and social sciences, referred to as Complexity Theory (Schneider 2002).

Organizations are dynamic and so should their leaders be. Dynamic leaders are behaviorally complex, so effective leaders apply appropriate behavior to the demands of the situation. In order to cope with the problems of reductionism and determinism, Marion and Uhl-Bien (2001) recommend exploring leadership from the perspective of Complexity Theory. Complexity Theory is the study of complex and chaotic systems and how order, pattern, and structure can arise from them (Marion and Uhl-Bien 2001). In the natural sciences Complexity Theory has

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evolved for many years but has only recently realized as a metaphor for studying leadership and organizations within the social sciences. This research investigates empirically leadership and organizations through the lens of Complexity Theory by exploring the complex and chaotic contextual factors that leaders experience. This research contributes to the evolving process of the study of Complexity in the arena of leadership by contextualizing the literature.

The study of leadership from the perspective of Complexity Theory is about adaptation in response to uncertainty. Lawrence et al. (2009) maintain leaders with a large behavioral repertoire are more adaptable than those with a limited repertoire of behavior. Behavioral Complexity is operationalised using Lawrence et al. (2009) Competing Values Framework. The Competing Values Framework is a measure that captures the extent to which leaders demonstrate four behaviors on four quadrants: Control, Compete, Collaborate and Create, which are argued to be critical to all types of organizational leadership. Leadership effectiveness is defined in terms a leader's level of "Overall Performance", their "Ability to Lead Change" and their capability to "Influence".

Schneider and Somers (2006) contribute to the linkage of Complexity Theory (CT) and leadership by suggesting how leadership within a Complex Adaptive System (CAS), one type of dynamic system under CT, might influence or shape the CAS. They attempt to fill a critical step in developing linkage of the existing literature on Complexity Theory and leadership with the ambitious objective of development and testing of a CT-based leadership model. This effort is aligned with the broader quest to move from generalizations about dynamic systems to tools and processes for understanding these systems (Sterman 2000).

28.1 General Systems Theory

In the General Systems Theory, some systems phenomena were thought to be of universal significance for all disciplines (Boulding 1956). These phenomena involve populations of individuals in interdependent relationships and the interaction of these individuals with their environment, governed by the principle of equilibrium or homeostasis. Systems were categorized into a hierarchy based upon their complexity. Greater levels of complexity were thought to be regulated by the principle of self-maintenance. Social organizations were considered to be complex (Boulding 1956). Katz and Kahn (1978) captured GST's application to organization theory in describing its emphasis on relationships, structure, and inter-dependence, and delineated ten characteristics of Open Systems (Table 28.1) (Schneider and Somers 2006).

General Systems Theory has had a large influence on leadership research, creating a lens of systems thinking with a framework, such as Hunt's (1991) theory of leadership, Jaques' (1976) general theory of bureaucratic organizations, and Fiedler's (1967) Contingency Model (Schneider 2002).

Table 28.1 Comparison of properties of open and complex systems

Properties of open systems	Properties of complex systems
(1) Importation of energy	Energy is imported from the environment
(2) Throughput	Inputs are converted through the use of energy
(3) Output	Produced output is exported into the environment
(4) Cyclicity	System events are structured by cycles
(5) Negative entropy	The transformation cycle is a cycle of entropy, leading to disorganization or death. To survive, negative entropy is acquired by storing energy from the environment
(6) Information input, negative feedback, and the coding process	Inputs consist of information and signals about the environment and system functioning, as well as materials that are transformed. Negative feedback allows for necessary correction. Information must be coded appropriately to be meaningful
(7) Steady-state and dynamic homeostasis	The basic principle is the preservation of the character of the system. In countering entropy, systems move toward growth and expansion, as they tend to import more energy than is necessary
(8) Differentiation	There is movement toward greater differentiation, specialization, and elaboration
(9) Integration and coordination	Greater integration and coordination are necessary to counter the tendency toward greater differentiation
(10) Equifinality	The same final state can be reached from differing conditions and a variety of paths

Schneider and Somers (2006), adapted from Katz and Kahn (1978)

28.2 Chaos and Complexity Theories: New Factors in Leadership Discourse

Complexity brings new principles into existence about a type of system, named as Complex Adaptive Systems. Having ideas deep in historical roots, the theory gained ground in the 1980s with formation of the Santa Fe Institute (Schneider and Somers 2006). This new theory is named as a paradigm shift from previous science (Wheatley 1994) and moreover some explained that it is a new paradigm by associating previous science with Modernism and Complexity Theory with Post-Modernism (Schneider and Somers 2006). Organizational complexity had been defined as the number of activities or sub-systems within an organization, with the dimensions of vertical or number of levels; horizontal or number of units, departments or divisions; and spatial, the number of geographic locations (Daft 1992). Schneider and Somers (2006) explain Complexity Theory as that there are three inter-related building blocks of Complexity Theory – non-linear dynamics, chaos theory, and adaptation and evolution. Complex systems are non-linear, meaning events within complex systems do not follow direct sequences. Neither are the effects proportionate to the cause; big effects can have small consequences and small effects can have big consequences, this phenomenon is referred to as the butterfly effect. Chaotic systems and complex systems are different, for complex ones are less mechanical and more stable and predictable, Chaos Theory does inform Complexity Theory, as both concern non-linearity (Marion 1999). Chaos is critical to the process of adaptation and evolution. Not all systems have equal capacity to evolve; this capacity reflects the system's mix of chaos and anti-chaos, or order (Kauffman 1995).

While Complexity Theory has promoted a re-examination of leadership, it has been suggested that leadership may be crucial to the process of self-organization (Knowles 2001) and leaders might serve as context setters and designers of learning experiences (Schneider and Somers 2006). In complexity theory the leadership process is different, for in complex systems leadership does not rely on formal authority structures, moreover it is contrary to the authority structure as it may well influence the process of emergence or self-organization. The difference in process implies that the leader is also qualitatively different. Leaders influence other persons and processes (Marion and Uhl-Bien 2001). They do not rely on authority and might consciously initiate their leadership role, or might accept the role that has been given at them.

28.3 Conclusion

Complex systems perspective introduces new leadership logic to leadership theory by explaining leadership in terms of an emergent event rather than a person. It suggests a form of distributed leadership in an interactive dynamic, within which

any particular person will participate as leader or a follower at different times and for different purposes (Lichtenstein et al. 2006). It is not limited to a formal managerial role, but rather emerges in the systemic interactions between heterogeneous agents (Marion and Uhl-Bien 2001).

Leadership emerging endogenously within interactions, leaders is not assumed to be directing collective action. There is no linear cause-effect relationship to discover. Indeed, leadership might a term that is descriptive of certain social forces among actors, which may include a formal leader. Complexity leadership theory also reflects a new approach to understanding dynamic organizational capabilities, including innovation (Lichtenstein et al. 2006).

To conclude, leadership is the emergent result of interacting individuals such that behavior and resource elements of the organization come together in useful ways. We can state a frame that can be formalized in terms of dynamic organizational capabilities and routines. Adopting complexity thinking does not throw away existing practices, but it does change our attitude to their likely success. Complexity thinking addresses the balance between assuming predictability and stability, and handling uncertainty, novelty and change. As such, it reflects the complexity of the real world, increases the relevance of our leadership theories, and provides new insights for students, researchers, and managers in the complex world of leadership.

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Chapter 29

Chaotic Conditions That Postgraduate Students Came Across and Solution Suggestions

Nedim Özdemir, Selçuk Turan, and Ahmet Yirmibeş

29.1 Introduction

‘Static, consistent, compatible... this has been our conception of the universe for over 300 centuries. Comfortable, simple and safe.’ (Erçetin 2001, p. 24). The classical physics theory introduced by Newton has directed the science as dominant paradigm for three centuries. The classical physics justifies that everything processes in a regular system, and every impact causes predictable responses. The immediate raise of science led people to realize more complex, multidimensional systems, social Networks and bigger forms related to the universe. Finally this quest showed that many systems which we think regular consisted complex forms and this had deep patterns which could not be explained by only classical physics.

Flapping of a butterfly’s wings in Amazon Forests may result in the breaking of the storm in the United States. In other words, *flapping of a butterfly’s wings* can cause a hurricane which can able to walk halfway around the world. Concepts of “precise adherence to its initial state” or “butterfly effect” (Bradley 2010) that Lorenz uses to describe the situation described in this example seems to be an ideal phenomenon to describe the chaos theory which owes its popularity to him. Unlike the name it refers, chaos theory refers to a pattern of irregularity (Shoup and Studer 2010, p. 4). In contrast to mechanistic approach which says; we have nothing important left to be discovered in the nature (Coles 2006, p. 115), chaos theory emphasizes the fact that we are at the beginning of the discovery.

Words, insufficient to explain the concepts of the new world like “impulse response law”, “absolute accuracy”, “measurability” that classical physics advocated are replaced by more ambitious and analytical discourses like “uncertainty”, “complexity” and “chaos”. Of course, in everyday language, these concepts can be

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seen as risky and negative concepts which are completely different (Banerjee 2013, p. 185). The interest to chaos theory that arise after the half of the past century and the findings related to this raise the chaotic situations within an interdisciplinary approach in education.

As well as in other disciplines, many of the concepts described by chaos theory have become apparent in the field of education. As stated by the reputation Ertürk (2012, p. 861), environmental changes trigger the organizational changes as well. Therefore, with changing conjuncture educational institutions should also be in a reconstruction, classical management should be replaced by a more flexible structure which can consider chaotic situation as an opportunity not a risk assess and can create synergy. As Trygestad (1997, p. 10) stated, the pattern of human interaction cannot be understood via linear static and sequential Newtonian mentality. Education, from its most basic system of schools to the highest echelons where policies are produced can be defined as a chaotic structure. There is a common denominator intended from policy-makers to school administrators, teachers and even students; "success". As Ertürk (2012, p. 861) mentioned before, there is not an absolute, certain method for success. At this point, the cause-effect relationship that reveals the success cannot be determined precisely.

In a multidisciplinary field such as education the effects of chaos theory and the chaotic conditions it revealed can be observed at post graduate level as well as all levels of education. Many individuals who can be defined as adults continue master's or doctoral programs. Most of them are married and have their jobs. And in this process most of them face chaotic conditions. The research, conducted with a limited group of post-graduate people, tries to identify the chaotic situations that post-graduate students encountered and tries to produce solutions to them.

29.2 Method

This research which aims to resolve the chaotic situations that graduate students come up with is a descriptive survey model as it targets to describe the existing. In this study, qualitative research was used. The reason of using this method is due to the observation of that qualitative researches, unlike the quantitative methods used for many years, have been used in social sciences researches recently both in Turkey and the world. Accordingly, a study group was composed which consisted of graduate/postgraduate students of universities located in the city of Ankara in this study. While composing the study group, the criteria related to the students' graduate/postgraduate education experience period, their employment status or their marital status were considered. In this direction, 36 students in total from Hacettepe University, Ankara University, Middle East Technical University and Gazi University were included in the study group.

In the process of collecting research data, semi-structured interview form which was prepared by taking the opinions of field experts with the focus group method was addressed. The person who was interviewed was informed about the goal of

the study, the content and duration of the interview at the beginning. The persons who were asked their ideas expressed their thoughts, views and perceptions about the topic intimately with starting the first question. The interview ran on a free conversation atmosphere since the order of questions in the interview form was not followed accurately during the meeting. Besides this, the researcher was able to ask new questions circumstantially apart from the ones in the interview form during the interview.

Except for one of 36 students in the study group of research, the others were interviewed. The interviews made with the students in the study group were recorded with a voice recording device. During each interview made with involved persons, coding was used to keep the identities of those secret. Therefore, the universities that involved people enrolled were coded as U1, U2 . . . ; and the students were coded as S1, S2

The data which was obtained during the interview was evaluated by using descriptive data analysis which is one of the qualitative data analysis techniques. In this study, the data obtained with the semi-structured interview forms as a result of the interviews was initially described systematically and clearly considering the research questions, afterwards it was tried to come to some conclusion by interpreting these descriptive definitions.

29.3 Findings and Discussions

In semi-structured interviews held with 35 students in the study group, it's been obvious that the chaotic situations due to 'time deficiency', 'crossing roles', 'the lack of physical and equipment of universities', 'problems about the lecturers', 'bureaucratic problems', 'colleagues' attitudes', 'family problems' and 'the lack of the ability of distinguishing scientific data' have been revealed.

S1, who is married and works for state sector, defines these problems as 'sometimes irresolvable situations'. On the other hand, it is observed from the appeals of students that the related problems have some 'unpredictable effects' on graduate/post-graduate education.

Students, who are married and also work in public or private sector, told the chaotic situation they faced as follow:

As a teacher and a graduate student at the same time I think that 24 hours of a day are not enough for me. This situation requires a planning process. Everything becomes more unresolvable when the role of fatherhood is added to this as well. Chaotic condition is experienced necessarily. I can also add many cases such as the problems that school administration creates while taking the lessons, the lack of physical equipment of the university. Actually, chaotic conditions are too many . . ." (U1, S3)

I do not understand clearly what the university teachers want from us May-be, this situation is chaos itself. In addition, physical conditions of the school are inadequate. Especially while preparing for a presentation my hands wander on my feet in case a possibility of a breakdown of a device. For this reason I take my personal lap –top to the class . . ." (U4, S14).

It is understood from the interviews with married and occupied students that the time matter has a primary position amongst problems they come across while having graduate/post graduate education. Besides, it can be said that unlike time and family problems, bureaucratic ones are relatively encountered more often when married and occupied students are considered. Underlining the related item of law, some of the interviewed students express that 'it is possible that a teacher who is having a graduate education can be given 2½ days off provided that they don't neglect their occupation'. But nonetheless they say that they encounter with school administration in practice.

Involved students voice the conditions they meet in this way:

According to the 41st article of Permit Directive of Ministry of National Education, it is stated that a teacher who is having a graduate education can be given two half days off provided that they don't neglect their occupation. The schedules of teachers are planned as giving the opportunity to go on their graduate/post graduate education. Eventually, this is a situation which is determined with legal texts. Education must be considered as a personal right. Whereas, they threaten us whether to implement what the article exactly says or to leave the job. This is the problem that we get disturbed most, meanly the difference between the directive and the practice. (U1, S23)

Chaotic situation is particularly the issue of getting permission from the directors. At the beginning of each term, it is necessary to make an arrangement between my own school schedule and the schedule of university. Sometimes I may have to drop out the lessons. So it doesn't go as we plan..." (U3, S6)

First of all, I say bureaucratic barriers, meanly the situations caused by the directors, district administration of education, the city education directorate. Secondly, the problem that school emerges since they don't want to arrange my schedule according to the schedule of university. (U3, S12)

In accordance with the views of students stated above, it is understood that the problems graduate/postgraduate students come across are initially related to time and bureaucratic problems. As this issue is considered from the point of marital status of students, it can be said that married ones face the problems which emerge from lack of time in a more 'bitter' and 'intense' way. The related issues and their contents are respectively discussed below.

In any chaotic situation, it is observed that the students get a little support from their spouses, colleagues, school directors or lecturers. On the other hand it is seen these supports are not much well-rounded. They are only temporary and instant ones. S9 and S12 say that their spouses help them but they manage the process themselves.

29.4 Conclusion

Research findings reveal that the students who participated the re-search face chaotic conditions such as: lack of time, role conflicts, physical structures of the universities, and lack of equipment, problems related to faculty members, bureaucratic problems, the attitude of colleagues, family problems and undistinguished scientific

knowledge. In addition, it is seen that students in any chaotic case as a strategy for coping with, more or less they take support of their spouses, colleagues, school administrators or faculty members.

Based on this result:

1. In the name of minimizing the legal, administrative regulations to implement full text that chaotic situations M.S./Ph.D. students encountered,
2. To take support from the person concerned to be able to cope with situations in excess of the individual forces and facilitating access to these support mechanisms can be suggested.

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Chapter 30

Survival of the Fittest: Intelligent Organizations as Intelligent Complex Adaptive Systems

Esen Arzu Kayman and Şefika Şule Erçetin

30.1 Introduction

In a complex, uncertain environment, for an organization there is no way but to be intelligent. There are the qualities of the intelligent organization. The need for an organization to be intelligent occurs in the environment we live in. The system we live in requires effective measure both in practicing and consuming. As we accept the organizations complex and adaptive, it is time to argue the qualities of an intelligent organization in order to point out the survival of the intelligent organizations in a complex adaptive system.

If the organizations taken as living, learning, developing and growing living organisms, they can make decisions on ordinary regular events as well as unexpected conditions of dynamic global environment. If the organizations have the mentioned capabilities and potentials, that is the intelligence, if we use these potential, we call the organizations “intelligent”.

The velocity of the change as a must requires lots of conditions and has to do lists. First of all, it will be helpful to clarify the factors for an up-to-date change.

1. Change has no end; it is eternal,
2. It is easier to reach the information than in the past,
3. Knowledge is not the aim but the resource to use, the vast amount of the knowledge makes it difficult to realize the important and the real knowledge,

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4. Technology has a great effect on the service of the work and the relations of the workers; as it keeps everyone linked to everywhere in the world, it can make the people lonely and away from each other (Porter-O'Grady and Malloch 2011).

Chaos and complexity theory offers that influencing the change is possible but controlling the change is impossible. In order to predict the variables in a forecasting model, a strategic planning can notify short term decision making. The process can be defined as having the data to predict variables, with the help of the surveys or documentations; it is probable to forecast the emergence of the chaos (Houry 2011).

In an effective, a safe and healthy system design, it is important to have an uncertainty management. Both coping with the uncertainties and minimizing them are essential for a system design but keeping the balance either while coping with or minimizing the uncertainties is of great importance. Keeping the balance depends on the role of the human factor and the technology in the organization. In addition to this, rules management and complementary system design are of great importance, either (Grote 2004).

In this complexity and chaotic world, not only the private firms but also the public organizations or all kinds of non-profit organizations confront such challenges. The researchers or practitioners of management in such organizations have been successful in conception, finding solutions, modeling and creating new methods to accelerate the surviving rate. The key is to learn organizationally and create knowledge to survive (Schwaninger 2011).

In a complex adaptive system, the agents are connected to each other. Namely, there are common criteria for them to make decisions and to share a purpose. Strategic planning is a great act to reconstruct relationships and construct possibilities among the internal and external groups of people in the organization. Looking for the changes that has happened or could happen through meetings of both internal staff and external stakeholders is a way of SWOT analysis rather than using the traditional organizational and environmental one in a complex adaptive system (Vogelsan).

In a complex and chaotic system, the organizations have to be adaptable, fast to act and react, in short, intelligent. The organizations must have intelligence to cope with the unknown, uncertain or chaotic.

Organizational intelligence is for an organization, to have a brainpower, then to mobilize its brainpower and to concentrate the brainpower achieves the mission of the organization. Dumb organizations are said to be to waste the brainpower, energy and intelligence of the human factor while the smart organizations are said to be successful to use and increase the intelligence of their people in the organization. Organization's level of intelligence can be described in seven dimensions, (1) The way they are going; vision, (2) The same boat the people are in, shared fate, (3) Challenging the unexpected, change, (4) Having the same spirit or energy for success, heart, (5) Enough rules and tools for success, alignment, (6) Information, knowledge and wisdom sharing, knowledge, (7) Getting the things resolved in the organization, performance (Albrecht 2002).

It is no doubt the intelligent organizations would survive in such a rapidly changing world; the efficient the organization uses its potential in the best way, the successful the organization would be in fulfilling the aims with its intelligence (Erçetin et al. 2011).

In the intelligent complex adaptive systems model, the organizational intelligence concept is defined as the ability of the organization to comprehend, interpret and respond to the environment it is in. While doing so, it will fulfill the organizational goals with a satisfaction of the employees, customers, investors, the community and the environment. It can be described by the exhibition of indication of the measure of organization's intelligence (Bennet and Bennet 2004).

To Bennet and Bennet (2004), the qualities of intelligent complex adaptive systems meet the qualities of an intelligent organization using

1. *Unity and Shared Purpose*; the ability of ICAS organization to coordinate and unify the resources of the organization to have the maximum effective understanding, knowledge flowing and possessing the power to act and react, taking the threats and the opportunities the organization would meet into consideration.
2. *Optimum complexity*; the ability of the ICAS organization to recognize the number of opportunities or states to make a difference for the organization. In other words, choosing the information, material or energy that is meaningful order for the organization to reduce confusion and encourage decision making, being focused and powerful.
3. *Selectivity*; the ability of the ICAS organization to filter the broad information into specific knowledge that the organization needs, interpret the out coming signals for the organization.
4. *Knowledge Centricity*; the ability of the ICAS organization to be aware of knowledge flow and allow people to retrieve information to find solutions to problems, make decisions rapidly about the problems.
5. *Knowledge Flow*; the ability of the ICAS organization to resume unity and coherence to organizational intelligence through horizontally and vertically flow of data between the people in-across-out of the organization and the decision makers.
6. *Permeable Boundaries*; the ability of the ICAS organization to differentiate itself from a classic bureaucracy organization. The classic understanding of relationships collapse in intelligent organizations as the boundaries of the organization is hard to define. The ideas exchanged cannot be followed in a complex, permanently changing environment.
7. *Multi-dimensionality*; the ability of the ICAS organization to have qualified workers in the organization; they have the vision of viewing the environment from various perspectives; carry out a wide range of thinking styles and intelligent solutions to the issues and problems. They evaluate the opportunities and threats in a wide range of possibilities to pursue organizational identity and unity.

As the qualities of the ICAS organizations are discussed, it is time to discuss about the qualities of the intelligent organizations and how their qualities meet the qualities of the system in complexity.

There are some skills that enable the organizations survive and be fit in a complex system. The fitter the organization, the more intelligent it is. The intelligent organizations have some definite skills to

1. Act and react,
2. Adapt,
3. Be flexible,
4. Be intuitive and prescient,
5. Be open to new ideas,
6. Make use of imaginative,
7. Be able to renew itself (Erçetin 2001, 2009).

It is aimed to present how the qualities meet and correspond to each other. The skills of the intelligent organizations will be discussed to make it clear.

Intelligent organizations are equipped enough to act and react rapidly in a rapidly changing environment. Through unity, shared purpose and optimum complexity, they can act and react rapidly. The skill is related to the organization's skill to perceive, understand and describe the internal and external factors immediately and decide what to do while reducing the bureaucratic formalities (Erçetin et al. 2009).

The intelligent leader of the intelligent organization should know that leadership is shared and requires collaboration. The leader should put the people work together effectively, economically. In a cooperative way of working together, intelligent organizations can develop new models for leadership which supports people solve economic, political, technological, social, ecological and spiritual problems. They can only achieve it with optimum complexity, unity and shared purpose (Sydänmaanlakka 2008).

Adapting to changing situations is one of the intelligent organization skills. The organizations sustain balance in changing and erratic conditions, filter the complexities in both internal and external environment of the organization. The intelligent organizations create and implement policies and strategies to take actions or reactions to adapt the rapidly changing conditions (Erçetin et al. 2009).

This skill enhances organizational learning as well. We don't recognize but it is initiated by problems and opportunities (Hunt and Sanders 1989).

The intelligent organization has flexibility and comfort in operation, that is it is flexible and comfortable in choosing actions or reducing the bureaucratic formalities. That means that making mistakes is something usual in the organization (Erçetin et al. 2009).

Flexibility and the speed of response are the advantages of a technology based firms or ICAS organizations. To sustain the organizational growth, to face with the changes in market, technology, product and other environmental changes, intelligent, flexible system has been installed or set to increase decision making quality high, to communicate insight (Savioz et al. 2003).

Being intuitive and prescient are the other skills of the intelligent organizations. It is defined as the emotional intelligence at the organizational level, that is to say, investigating the past makes predicting the present and the future in a complex adaptive system is of great importance (Erçetin et al. 2009). Selecting the events that can help us foresee the possibilities will help the intelligent organizations survive better.

Contrary to the classic organizational view, the organizations are intelligent and multidimensional, getting powerful with the help of relations and there is a shared vision with shared and flowing knowledge, a shared vision that enables people to form boundaries and decision making within a dynamic change (Hall).

Being open to new ideas shows that there is a great tolerance for every offer and idea in the organization. It means that there is such a good climate of tolerance in the organization that everyone can share their ideas and feel secure (Erçetin et al. 2009).

In such a tolerant environment that everyone can tell what s/he really thinks makes the people think critically and express themselves well. In a research by Erçetin, it was seen that open-minded schools are accepted easily and supported by its environment. If the people are not open to new ideas, it was seen that no other skills could be seen (Erçetin 2004).

Making use of imagination means improving individual creativity makes the organizational creativity improve. The use of the imagination should be thought as a whole. If there's the imagination, there is the flexibility; there is the possibility to develop actions and reactions (Erçetin et al. 2009).

Using the imagination can be thought as future foresight. Intelligence and a good sense of network would produce a great deal of data. Turning that data to opportunities with the imagination makes the organization more advantageous than the other ones. That can be a powerful strategy and a competitive device to survive (Goldbrunner et al. 2005).

Being able to renew itself is a demand in the ISCAS. That is to say that transferring and using the new information and technology guarantees the renewing and surviving in complexity (Erçetin et al. 2009).

30.2 Conclusion

The renewal can be achieved when the organization behaves multi-dimensionally. Different perspectives, thinking styles create imaginative, surviving solutions to problems and accelerate the change and the adaptation for the complex adaptive intelligent system in today. In intelligent self-adaptive systems, intelligent organizations can survive as they can adapt, renew themselves, forget and learn easily and rapidly.

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Chapter 31

How to Be a Quantum Leader in an Intelligent Organization?

Şefika Şule Erçetin and Esen Arzu Kayman

31.1 Introduction

The complexity in financial, social and spiritual environments pushes the organizations into an uncertain world. The solutions and the answers cannot be found easily by the up-to-date leadership behaviors and traditionally structured with the internal commanding and controlling (Hall).

People are overloaded with the work, the pace of the change overwhelms them and they have time limits on the work and life, the reality is that there is no end for the technological advances (Bennet and Bennet 2003).

Those conditions require leaders coping with the rapid changes of the present. A leader has to be equipped with qualities that the six characteristics of his century require. The characteristics of the millennium are technology, globalization, competition, change, speed and complexity and paradox (Tetenbaum 1998).

The change throughout the organization is perceived as a kind of survival. Change brings high costs of human and physical resources, insecurity of the stakeholders, dissatisfied customers and flow of cash. However, change sometimes fails to be achieved. There is no doubt that only the people in the organization can achieve making the change reality by changing their behaviors and the ways they relate to each other (Mowat 2002).

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Change meets resistance, rapid change meets more but the leader has to get the change adopted as soon as possible, in other words, he/she has to get the followers get used to change rapidly in a rapidly changing environment.

It is obvious that there has to be a transformation from the classical organizational values to neo-classical, chaotic and uncertain organizational values. That is the shifting paradigm; from Newtonian world to Quantum world in a rapidly changing environment.

Coping with uncertainty has a great role in leading as a quantum leader. First of all, the quantum leader has to know what kind of uncertainties there are in an organization, how managers deal with and act with the uncertainty and what the deductions of the uncertainty are (Watson 2004a).

It is better to manage the uncertainty, in order of minimizing or ignoring it. It is great importance of designing a system safe and efficient for both the organization and the human factor in it. In addition, the balance should be put into equilibrium; the amount of the openness for different solutions and participation by the stakeholders indicate a design management which can achieve managing a project with minimizing the risks and acknowledging the potential uncertainties to reach an innovation (Grote 2004).

The quantum leader should foresee and struggle with the uncertainty as one of the usual management affairs. There are foreseen, unforeseen uncertainty and the chaos. For both the foreseen and unforeseen, the strategies that are reducing, acknowledging, suppressing or avoiding uncertainty are possible (Watson 2004b).

The quantum leader should have a strong interaction with the followers. The quantum leader is the one who tries to delay and decentralize the power. The quantum leader should organize the work throughout the teamwork or project groups so that he/she will make sure that the groupings are flexible to get constituted, changed and dissolved (Tetenbaum 1998).

The relationship and commitment between the leader and the followers forms the effect of the leader and the interaction. It is not the use of force but the power of interaction, the dialogue between the quantum leader and the followers. A management of forcing or pressurizing can continue to a certain point as the quantum physics offers and that point is formed by the need, acquired trust, respect and commitment (Erçetin 1999).

Quantum leadership paradigm offers that leadership itself is considered as an uncertain and unpredictable reality due to the uncertainty principle of quantum physics. In the complex, uncertain and dynamic world, the leader has to take risks in the unknown and unpredictable environment but intelligent organizations. The quantum leader should think globally, be understanding to the others, used to the technology, able to share the leadership throughout the organization within the followers. This act shows that the quantum leaders can act according to the uncertainties and the probabilities. Finally, this manner will reduce the uncertainty but let the possibilities and choices arise (Erçetin 1999).

The more complex approach to leadership requires a more enabling leader rather than a heroic one (Nixon 2003). Getting the skills to cope with the uncertainties

comes the next. The quantum leader gets skilled with the uncertainties, probabilities and complexity.

Discontinuity in the quantum leadership can be defined that the leadership can emerge spontaneously at different times according to the interaction between the leader and the followers. Discontinuously occurring events form and strengthen the quantum leadership; the disagreement or the separation between the leader and the followers are approved because leadership can be interpreted by different people at different times (Erçetin and Kamacı 2008).

Quantum leaders create significant opportunities for people to work together and perform synergically. The synergy and the relationships created help the opportunities come true (Papatya and ve Dulupçu 2000).

The quantum leader knows the impact of the leadership s/he performs strengthens or weakens the interaction between the quantum leader and the followers.

The power of the interaction and the leadership cannot be effective by the relationship between the leader and the followers. The interaction cannot be sustainable with the former management styles like forcing, ordering or disregarding the human needs of the followers. That type of management continues to a certain point and it stops. It is the interaction that makes the scene clear (Kayman and Erçetin 2011).

As the qualities of the environment and the quantum leader were debated, it is time to let the qualities of the intelligent organizations meet the qualities of the environment and the leaders. The qualities of the intelligent organizations that are expected to meet with the qualities of a quantum leader are as follows (Erçetin 2000).

The intelligent organization has to be flexible to cope with the rapid change with a conscious and aware leader about the uncertainties and probabilities. The organization should be taken as an organism that is designed and constructed flexible in order to transform its intelligence to its constituents (Erçetin 2004).

Intelligence of the organization makes the organization's life span longer. It is possible with the use of those skills. The skills are as follows;

1. Flexible in process,
2. Visionary and intuitive,
3. Open-minded just because of uncertainty,
4. Rapid to act and react,
5. Adaptive to the continuous changing conditions,
6. Able to renew and sustain itself
7. Imaginary, (Erçetin 2000, 2001).

The intelligence of the human factor in the intelligent organizations is expected to interact with each other supported with information and communication technologies (Marjani 2012). A quantum leader who has a strong interaction with the followers is flexible at all to deal with a rapidly changing environment and situations by the help of the information and communication technologies.

There can be lots of factors bound to the situations which affect the interaction process between the leader and the followers. The factors can be job demands,

time and etc. and those situations require different types of leading styles. The followers can have strength in competing, committing, having responsibility and being independence (Sydänmaanlakka 2008).

Intelligent organizations are visionary and intuitive. This quality matches with the property of the quantum leader's being aware of the uncertainty and probabilities. For a leader and an organization, creation of future has two ways; first, the leader has to have purposes, values, a vision, direction and a culture, second, the leader has to activate the organization in order for response, adaptation, creation, re-creation, replacement of itself as a living, adapting system (Nixon 2003).

Intelligent organizations are open-minded just because of uncertainty. Organizational intelligence can make the individuals develop their cognitive intelligence and define other people's emotions more easily and control their emotions, make decisions easily and increase their motivation. When the things mentioned achieved, organizational intelligence does not need to influence the performance of the followers (Albrecht 2002).

Keeping uncertainty in mind helps the quantum leader and the individuals be open-minded to struggle with the uncertainty and adapt the changes today. The quantum leader knows the discontinuity of his/her leadership.

One of the qualities of an intelligent organization is to be rapid to the continuous changing conditions and the other is to be able to renew and sustain itself. Taking speed and scope into account, the changes in every field make us think about the speed and the change in action and reaction and they make it a prerequisite for maintaining the existence of itself (Erçetin 2004).

The intelligence of an organization is a concept that gives the organization power to adapt its environment, to learn, innovate itself and right choices to select (Altunbaş 2008).

Quantum organizations are like the intelligent organizations which create a self sustaining environment and turn the edge of the chaos into an opportunity. The more imaginary the organization, the more successful it is. The quantum leader tries to imagine the conditions and the solutions. The quantum leader knows the impact of his/her leadership depends on the interaction between the followers and the environment.

31.2 Conclusion

The key point is to see the organizations as getting adaptive to complex systems by decentralizing and diffusing the intelligence. To sum up, organizational intelligence is to have a capacity to behave suddenly, flexible and creatively. They achieve this by making sense of, thinking, explaining at not an individual but organizational level (Erçetin and Kamacı 2008). A quantum leader fulfills the intelligent organization requirements when the qualities of the leadership are taken into consideration. In a complex, adaptive system, the true leadership can be the quantum leading.

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Chapter 32

Forming Educational Leadership Standards in Turkey and Educational Leadership Policy Standards: ISLLC 2008

Tuncay Akçadağ and Melek Kaymaz Mert

32.1 Introduction

Competence is to have the required knowledge and skills for the expected behaviors from human beings (Başaran 1996). It is possible to arrange school administrator's competences into three titles: Technical, humanist and conceptual competences (Töremen and Kolay 2003). The recent studies both concentrate on the insight of acquiring these competences, protecting them and how the schools will be directed in a more effective way. Starratt (1995) reports that the administrators should wear two hats representing management and leadership. However, Hameck (1970, p. 132) indicates that very few leaders can be good managers, and very few managers can be good leaders. To give the administrator the quality of being chosen and influential, he must get rid of his superiority (Bursalıoğlu 1994, p. 208). In modern organizations, to be successful in administration, administration and leadership which do not have the same meanings, must be considered together (Ercetin 1998). The standards aimed at school administrators in Turkey are determined by the Ministry of Education with the regulations of administrators regarding assignment, assessment, promotion and transferal. According to these regulations, the main principles are:

- (a) To provide administration information, loyalty, job satisfaction and high motivation with institutive activism and staff performance.
- (b) To pursue the suitability to job description in assignment, promotion, transferal, career, merit, record, vocational retraining and priority.
- (c) To provide and improve job opportunities in administration.

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- (d) To give prevocational training
- (e) To assess the staff considering the principles of the principles of objectivity, dependability, validity and clarity (MoNE, TD 1998)

Another study that is being carried out by The Ministry of Education in Turkey is Primary Education Institutions Standards (PEIS). The aim of this study is to state the available cases by giving primary schools the opportunity for self evaluation and by this way to do the necessary things to make the schools reach the necessary standards (MoNE 2010). The fundamental aim of the study is to receive the opinions of the students, parents, teachers, and administrators to set the place of the institution in the stated standards and form strategic plans for these standards (MoNE 2010). Within this scope, PEIS are not for improving the management and leadership skills of school administrators.

The point in question is that school administrators must find correct solutions for school problems by improving their management and leadership skills. From this point of view, if the necessary qualities of a school administrator are extended, the solutions and the running of the system will be more steady (Arslan and Beytekin 2004).

School administrators are accepted according to the results of the study with the average of 4.50 for academicians, 4.41 for primary school supervisors, 4.58 for the Ministry of Education administrators and 4.53 for teachers. It is stated that the standards improved in the USA are valid for Turkish education leaders, as well (Güngör 2001).

32.2 The Educational Leadership Policy Standards: ISLLC 2008

It is known that initially in the USA and in some countries considered developed; the studies are done aimed leadership or standards of school administrators. One of these studies, ISLLC 2008, Educational leadership policy standards is determined by the US National Policy Board for Educational Administration (NPBEA). These standards are published by The Council of Chief State School Officers (CCSSO). In the text published, it is stated that up-to date information is reflected related to leadership in education at the stage of creation of this study. Furthermore, it is emphasized that at the stage of improving the aforementioned standards, as a result of ISLLC 1996 standards, the improvements and the opinions of educators in the field are taken into consideration.

Considering these explanations, ISLLC 2008 Educational Leadership Policy Standards and the duties under each Standard are expressed below:

Standard 1: An education leader promotes the success of every student by facilitating the development, articulation, implementation, and stewardship of a vision of learning that is shared and supported by all stakeholders.

Functions: (1) Collaboratively develop and implement a shared vision and mission, (2) Collect and use data to identify goals, assess organizational effec-

tiveness, and promote organizational learning, (3) Create and implement plans to achieve goals, (4) Promote continuous and sustainable improvement, (5) Monitor and evaluate progress and revise plans.

Standard 2: An education leader promotes the success of every student by advocating, nurturing, and sustaining a school culture and instructional program conducive to student learning and staff professional growth.

Functions: (1) Nurture and sustain a culture of collaboration, trust, learning, and high expectations, (2) Create a comprehensive, rigorous, and coherent curricular program, (3) Create a personalized and motivating learning environment for students, (4) Supervise instruction, (5) Develop assessment and accountability systems to monitor student progress, (6) Develop the instructional and leadership capacity of staff, (7) Maximize time spent on quality instruction, (8) Promote the use of the most effective and appropriate technologies to support teaching and learning, (9) Monitor and evaluate the impact of the instructional program.

Standard 3: An education leader promotes the success of every student by ensuring management of the organization, operation, and resources for a safe, efficient, and effective learning environment.

Functions: (1) Monitor and evaluate the management and operational systems, (2) Obtain, allocate, align, and efficiently utilize human, fiscal, and technological resources, (3) Promote and protect the welfare and safety of students and staff, (4) Develop the capacity for distributed leadership, (5) Ensure teacher and organizational time is focused to support quality instruction and student learning.

Standard 4: An education leader promotes the success of every student by collaborating with faculty and community members, responding to diverse community interests and needs, and mobilizing Community resources.

Functions: (1) Collect and analyze data and information pertinent to the educational environment, (2) Promote understanding, appreciation, and use of the community's diverse cultural, social, and intellectual resources, (3) Build and sustain positive relationships with families and caregivers, (4) Build and sustain productive relationships with community partners

Standard 5: An education leader promotes the success of every student by acting with integrity, fairness, and in an ethical manner.

Functions: (1) Ensure a system of accountability for every student's academic and social success, (2) Model principles of self-awareness, reflective practice, transparency, and ethical behavior, (3) Safeguard the values of democracy, equity, and diversity, (4) Consider and evaluate the potential moral and legal consequences of decision-making, (5) Promote social justice and ensure that individual student needs inform all aspects of schooling.

Standard 6: An education leader promotes the success of every student by understanding, responding to, and influencing the political, social, economic, legal, and cultural context.

Functions: (1) Advocate for children, families, and caregivers, (2) Act to influence local, district, state, and national decisions affecting student learning, (3) Assess, analyze, and anticipate emerging trends and initiatives in order to adapt leadership strategies.

32.3 Conclusion

It can be said that the standards above are related to visionary, educational, organizational, social, ethical and political leadership fields. In schools, the visionary leader is the one who leads the students to success by forming a vision shared by the school society and being the closest follower and implementer (Celik 2001). To improve the instruction, developing strategies and materials, being a source, engaging in activities regarding correction and improvement are the things that must be done by the leaders (Celik 2001). Organizational leadership is a type of leadership that includes finance management, staff management, time and source management with the roles of strategic and functional planning. Modern school administrators are supposed to be informed about the outer and inner components. The other things that expected are to analyze the effects of these components on decisions and to be ready for communication and interaction with them. This situation is related to school administrator's ability of showing his social leadership (Açıkalın 1996). As a moral leader, the things that are expected from him: Justice, equality, honesty, righteousness, objectivity, responsibility, human rights, humanism, loyalty, superiority of law, sympathy, toleration, secularism, respect, prudence democracy, positive relationships with human, clarity, fundamental rights and freedoms, doing labor's justice, resistance against illegal commands (Pehlivan 1998). From another aspect, the control of the local units effecting the education has been replaced by local organizations. Also, many people and groups have become effective in education enterprise. Furthermore, non-governmental organizations have become more important in education. Because of all of these reasons, the efforts of school administrators in political leadership are vital (Gümüşeli 2001).

The questions like "How can all these be achieved and pursued? How can leadership fields be taken into account in the process of choosing school administrators and educating them? What will Turkish educational leadership standards be when these studies are taken into consideration?" These are all questions still waiting to be answered.

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Chapter 33

The Importance of School Administrators' Cultural Leadership in Chaos Atmosphere

Mehmet Teyfur and Esin Acar

33.1 Chaos

It is known that chaos is used in Greek meaning abyss, endless abyss. The Turkish Language Association defines chaos as the formless and disordered state of matter before the creation of the cosmos. According to Kendirli (2006) chaos concept, different from daily language usage with a scientific perspective, is used as an order in disorder. Öge (2005) defined chaos as the science of the whole rather than separate parts of dynamic systems. Chaos theory, like in the real life, indicates that in certain scientific phenomenon small deviations include milestones that may cause big changes and these milestones are everywhere.

33.2 Chaos and Management

Management is reconstruction process in which corrupted balances in changed situations in a different way (Açıklalın 1995). Also management can be considered as a discovery which enables you to develop new values under new circumstances and apply them. Management is defined as coordination process of the activities of an organization to apply the defined policies (Erdoğan 2000). It is seen that we are going through a process where the importance of living with environment in harmony increased when organizations main aims are thought as living and

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developing. In this case, it is thought that when the organization encounter a chaotic situation it is necessary that the administration should develop a cultural management understanding focusing on emergent problems.

In a study conducted by Yıldırım in 2007 it was found out that administrators competence in finding logical solutions to unexpected situations and being aware of chaotic situations was low, that was explained by not having had an education about management of chaos. According to Kamacı (2010) among the reason to lead educational organizations to change a change in management and leadership understanding and attitudes of the employees towards management can be given. Today for educational organizations following leadership types are discussed; instructional leadership, cultural leadership, transformational leadership, moral leadership, learner leader, visionary leader, and all types of leadership make paradigmatic and structural changes compulsory.

33.3 Leadership

Although, there are over 350 definitions for leadership (Bennis and Nanus 1985), it is seen that certain concepts come to the forefront. It can be said that these concepts are like perception, desire, power, focus and enthusiasm. In addition to them, at the present time leadership is considered as a change instrument. It can be said that this case brings especially cultural leadership dimension of leadership in to the forefront. Symbols, means, formed norms, and uniting values that are used to affect others are considered as administrators' cultural leadership roles.

Leader is a member of a group who can create more positive effect on other members of the group than the other members have on him (Başaran 1992). In this regard it can be argued that the interaction between the leader and the group is important to understand the nature of leadership (Bush and Glover 2003). Accordingly, leadership is formed with emerging new concepts without depending on definite features.

At the present time, it is seen that the discussions on leadership concept are still going on. Harris (2005) stated that there was no consensus on the concept of leadership or the role of the leader and its organizational weight. Birnbaum (1992) claimed that some of the writers had suggested that leader should be "changeable". The structure, culture, history of the organization, and the environment of the institution have affected this feature. Keçecioglu (2003) has considered the concept of leadership is a process composed of four dimensions. The first dimension is the leader himself. Second dimension is the people, teams, groups or organization against leader. In a sense, receiver-and sender atmosphere is provided. Third dimension is the conditions inside and outside the organization. These are our clients in the organization, our culture values and climate outside the organization stakeholders and their temporal reflections.

33.4 Leadership and Management

The power of an administrator comes from formal structures like laws, rules and regulations while the leader's power to lead his follower to work comes from his personal features and current conditions.

Leadership is a complex study field where the success is generally attributed to one individual (Kirkpatrick and Locke 1991). However, leadership is not something that can be defined with a simple formula or lists of successful principles. Leadership of a principal is a critical part of a successful school. For successful principals independent from their own context there are some common features (Day and Leithwood 2007). Among these features forming a strong community, making school as a center for learning and teaching, making environment earn new values, and make learners to learn the artificiality of the borders in the world can be counted.

33.5 Cultural Leadership

Cultural leadership can be defined as a process to operationalize employees around an aim by means of common thought, belief, symbol, acceptance, traditions and norms that form an organizational culture (Yıldırım 2001). Acceptance of cultural values and intellectual enterprise creates a place for consensus on education quality, tolerance, objectivity, and aims of the school and to discuss them. This situation paves the way for identifying real values that were anticipated.

A leader cultural administrator acts like a trainer facilitating organizational operations. Leaders get their authority not from a hierarchical identification but from professional expertise. Authorities based on hierarchy trust in the position they occupy in the office rely on the symbols of the position. On the other hand, professional authority is a result of rivalry feature of the leader, his experience in developing organizational culture and pedagogic field.

33.6 Model to Manage Chaos

In the literature review about a model to manage chaos, transformational leadership, transactional leadership, cultural leadership, charismatic leadership visionary leadership, servant leadership, super leadership, strategic leadership and learner leadership are the behaviors displayed in this model. Among these leadership models cultural leadership is on the center stage in managing change/transformation about the chaos and forms a learning organization and maintains its continuity (Table 33.1).

Table 33.1 Leadership types in managing change and transformation dimension

Create	Change
Attract audience, integration with them	Weaken old culture and create new culture
Using personal features	Using personal features
Using integration methods	Weakening old culture and effect of its elements

Developed by Trice and Beyer (1991)

33.7 Cultural Leadership in Managing Change

Change has taken place in every period of human history. There is periodicity and differentiation in its core. According to Erdoğan (2004) change is a differentiation in anything in a certain period of time. It is seen that change is in every area. Among these areas there are structures unique to organizations. It is thought that this structure is both an obstacle in front of the organization and has characteristics to ask for change.

Organizational change refer to all changes whether planned or unplanned that may occur in various subsystems and their elements in the organization and relationship system among them (Yeniçeri 2002). The future of the organizations depends on their skills to adapt changing conditions. That can be achieved by a management which supports the flow of information (Altıntaş 2001). It is thought that the possibility of losing their actual aims and disappearance is very high for organization structures which cannot manage change well against internal and external threats.

It is thought that organizational culture should not have features that would resist change to adapt to the change process. It is known that in school principals' adaptation to the pace of change, the cultural role of administrator is important. One of the most important functions of the educational institutions is to lead spreading culture.

Cultural environment makes leadership meaningful so naturally leaders add new meanings to the environment. When cultural leadership is handled in a conceptual framework it can be studied in two dimensions; (1) maintaining and preservation of the present culture and (2) creating a new culture (Erçetin 2001). Cultural leader's behavior is affected by not only the culture of the organization he leads but also by the culture of society he lives in. Because schools are the first institutions that enables cultural change (Tuhaoğlu and Gedikoğlu 2009). Because of these reasons, in today's conditions it is seen that there is a need for cultural leaders who can lead institutions to accomplish those duties and adapt him to the pace of change and innovation.

Successful cultural leader should take into account ideas and suggestions of related people and sides about the future of the school and looking for solutions to some problems (Değirmenci 2006). It is thought that this situation would help administrators to achieve change in chaotic situations. School administrators should have a vision and be able to analyze the effects of environmental changes in order

to understand and manage the change. Because it is thought that demands coming from the environment force organizational cultures to change and cause them to create new values.

In a new school it is difficult to set certain traditions, rules and values as the history of the school is so new. In newly opened schools teachers and students should not be expected to accept the school culture immediately. School principal can create a school culture with new values, norms and traditions he would add to school (Çelik 2000). This situation creates chaos not only for newly opened institutions but also for deep rooted educational institutions. It is thought that school administrators' cultural leadership roles are important in creating a strong organizational culture and configuring a positive climate.

33.8 Cultural Leadership in Forming Learning Organization and Maintaining Its Continuity

Organizational learning refers to a process which starts from learning individually then learning as a team/group and finally learning as the whole organization (Probst and Büchel 1997). Learning organizations facilitate learning and have features to update themselves. It is thought that cultural leaders' roles are important in facilitating learning. There is a great interest in leadership and administration in education. General perception of undeniable effects of leadership on successful education and beneficial effects has been supported with proofs (Hallinger 2003; Leithwood et al. 2006). It is thought that when it is evaluated within the context of learning organization and leadership process, features that are necessary for the presence and continuity of learning organizations are related with the process of leadership process. Cultural leadership theory finds the approach in which leader make inferiors to accept the values and norms that are key element of an organizational culture wrong. The effectiveness of a cultural leader depends on creating a strong organizational culture, flexibility of organizational culture and managing it democratically (Çelik 2000).

Leaders should improve all the cultural roles that would manage the change and transformation occurring in every dimension of the organization in creation of a learning environment. It is thought that when the school principals fail to manage this process there will be chaos.

Learning organizations have strong cultural characteristic unique to themselves. Cultural characteristics that form a learning organization are not independent from one another and there are multi-dimensional reciprocal relationships among them. It is thought that in learning organizations the people who achieve these relations are administrators who carry out the cultural leadership roles.

School administrators have to show their personal vision and belief systems to the people they work with verbally and with activities. They must be successful in adapting both employees and students to schools' own vision with symbolic signs

and activities. Managers should be consistent in their activities and behave straightforward, they became a model by this way and can achieve the schools aims to form a learning organization and prevent chaos. Administrators are optimistic about undiscovered potential of people to grow and develop in a learning organization and they can achieve their cultural roles by having this belief.

33.9 Discussion

Discussions about leadership have been going on since the concept entered the literature. It is known that some of these discussions are leadership concepts that came up recently. One of the concepts whose importance for organization and management has been emphasized and has been studied in recent years is cultural leadership. Cultural leadership affects employees by conceptually emphasizing mutual thought, belief, symbol, acceptance, traditions and norms. Here, leaders who value leadership's symbolic and cultural dimension concentrate on using various symbols to attract people and focus on subjects like human consciousness, creating and sharing meanings and integration (Sergiovanni 1984; Şişman 2002). It is thought that if the living space which is thought to be important for cultural leadership roles cannot be created, organization and leadership will be in chaotic atmosphere.

It is thought that in order to cope with unprecedented change ratio in the twenty-first century in schools radical and alternative approaches for school development and school leadership is necessary. If schools would be the real learning places, that could not be achieved by change and development based on individual leadership activities. It is necessary for the administrators to get a comprehensive message, values, and norms and form an organizational culture based on reward system. It is thought that by providing best opportunities to employees and students to learn and succeed, creating a vision even in the most difficult conditions, sharing vision and persuading them that it is worth to follow this vision cultural leadership roles can save the organization and management from chaos in change process.

In this subject a study conducted by Sönmez (2008) it was observed that female teachers level of perception and evaluation tendency was higher than males in the following points; administrators advocate the change, they make adequate preparations before the change, pioneered activities related with the change and make employees to trust the administrator and participate change activities actively, they displayed behaviors that indicates they regard mutual values forming school culture important. In another study conducted by Tahaoğlu and Gedikoğlu (2009), according to teacher perceptions school principals carry out their visionary leadership roles the most and cultural leadership roles the least.

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Chapter 34

Is Arab Spring a Complex Utopia?

K. Gediz Akdeniz

34.1 Introduction

Today we are under the shelling of simulations which are operated by internet, media, cinema, etc. and thus human life is becoming more and more complex. In the both utopia and dystopias there is deconstruction between ideal (reality) and imager (hyper-reality-simulacra) and the modern mechanisms (progress, optimism, rationality, absolute knowledge, mono-stable) are starting to lose power (Sargent 2010). It means that the utopia-dystopia duality is already under the disorder process.

Recently, the “Disorder-Sensitive Human Behaviors (DSHB)” simulation theory (Akdeniz 2007, 2009) has been proposed to complete Baudrillard’s theory (Baudrillard 1995) via an additional principle (the chaotic awareness) to “Principle of Reality” in simulation world. The “Chaotic Awareness Principle” is the collection of the disorder dynamics which are neglected as non-social cultural anthropological forms by modernity. Because of that, the emergence of simulation of this principle is different than simulacra. For this reason we call this emergence as *zuhur* (Arabic *Zahara*) (Akdeniz 2007, 2009). The most character of *Zuhur*, as an uncertain state, is not to be valid identity in modern societies (Akdeniz 2010a, 2012). It could be an initial to provoke non-modern societies or to reconstruct modern conception of reality principles in modern societies.

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34.2 Complex Utopia

The complex utopia (Akdeniz 2010a, 2012) is not far to common composition given in the complexity science (Waldrop 1992 and Johnson 2007). As an agent-based complex social system (both in Modern societies and non-Modern societies) it is also open to self organization with the no limitation of modern reality principle. But it is close to stability, prediction and the border of complex utopia which can be drawn by its environment without central-control (close to idealization). In the complex utopia interacting objects (agents) are characterized by simulacra (with modernity reality principle) and zuhur (with chaotic awareness principle). They are interacting each other not only by long correlation (globally simulated by international operated organizations, internet access, by international tv channels, cinema with big budget and serial films, etc.), they are interacting also short range correlation (locally simulated by government operated organizations, censored local tv programs, limited cinema with tradition and, etc.). The structural point of view, one must note that the complex utopia is a reconstruction of utopia-dystopia duality rather than an alternative utopia. For that it might be considered as a critic theory.

More recently the identity deconstruction in scientific communities has been studied as a good example for the complex utopia (Akdeniz 2010a, b). According to this complex utopia the conflicts between simulacra (cyborg scientist) and zuhur (post-physicist) (Akdeniz 2007, 2009, 2010b) will play the central role in “clash of civilization”. The most important geography for such conflicts is the Middle East (North Africa, Iran and Turkey included). Because, in this region, the zuhur (in this case post physicists/philosophers) will be responsible to the new global scientific projects that their societies (non-modern) will face quite soon (Akdeniz 2009, 2010b). This complex utopia will be the first complex revolution (without paradigm) in simulation world of science and education. For example, it might be one of the initial reasons of the Arab Spring.

34.3 Arab Spring

The Arab Spring is the set of complex social-politic events in Arab World. The Chaos Theory point of view it is still on the uncertainty stage. According to DSHB simulation theory (Akdeniz 2009, 2010b) Middle East and North Africa (MENA) is one of the most versatile cultural anthropological region (fed by Kabala, Gnostic and heterodoxy philosophy) to emergence of zuhur (Akdeniz 2012). On the other hand, in the Arab World (especially in Egypt) as simulacra, (hyper-reality) of the pseudo-modern Arab societies, there are also a great number of educated people and students. Furthermore, even to be simulacra they are also globally simulated in modern context by non-Arabic social media and international civil society

operations. They are living with the depressive difficulties of finding new role to improving civilization in this region by using their own realities.

In this edge of chaos stage between simulacra and zuhur prove that the Arab Spring could be critiqued in the context of the complex utopia: Because, the emergences of new type communitarianist groups in Arab societies, especially in Tahrir square, are the result of the interactions between simulacra and zuhur via human behaviors. Such communitarianism conflicts between them might be a butterfly effect, not in only Arab simulation world, it will also effect all over the simulation world. In this case, the Arab Spring is to be considered a fundamental example of complex revolution for the first time in simulation world history. And it will be a Complex Utopia as experimental model of clashes of civilization in future as well as non-modern Arab societies. But such regional revolution in simulation world could be an adverse effect in modern societies (western civilization). It could to be considered a potential risk of western knowledge hegemony in all scale and in all fields in modern societies. Because of that the behaviors of non-modern Arab communitarianism is forced to be controlled by simulacra minority occupation by the modern international organizations.

If the Arab Spring will be ended under such pseudo modern hegemony; It will be very difficult for zuhurs to stay alive to transform modern concepts to unpredictable new forms. In this case it is not possible to consider the outcome of the Arab Spring as a fundamental example for the modeling of complex utopia. Unfortunately it will be the first regional sustainable revolution example in simulation world to transform from all non-modern societies to pseudo-modern societies. And it will also never able to provoke western knowledge to reconstruct the modern conceptions of the reality principle.

34.4 Conclusion

The competitions between simulacra and zuhur (complex utopia) are already spontaneously started in the simulation world within the human, family, society, science, art and literature worlds. Of course global one is “clash of civilization”. The aim of the complex utopia is to identify such conflicts and to critique how they might reorganize. As a typical complex utopia example, in this presentation we have required to renew the reconstruction of the identities in science (conflicts between cyborg scientist (simulacra) and post-physicist (zuhur).

The Arab Spring might be a complex utopia example to local modeling for the clash of civilization. As we have discussed above it is not possible to predict from today how it will be ended. This end could be the first pseudo-modern revolution or the first complex revolution in simulation world. Or it could remain as post-modern revolution in simulation world.

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Chapter 35

Compulsory and Discontinuous Education as a New Model: 4+4+4 Is It Chaotic?

Kenan İli

35.1 Introduction

Today, alteration is considered to be the cause of organizational problems and a phenomena because it leads to finding a solution to those problems. Like the other organizations, educational organizations also suffer from understanding and controlling the alteration. In our country conventional education system is transformed into 12 years, split by 4 years of primary school, 4 years of secondary and 4 years of high school. After the project go on-line even at the very first days, it can be seen that problems had emerged and those were shared in written and visual mediums. In this uncertainty school administrators and teachers should overcome these problems by seeking the solution in training seminars.

Any attempt that is intending to change, cause to negativity especially when it is left alone thus it brings numerous disadvantages. Today managers are forced to focused on unpredictable events because of the paradoxical relations constituted by order–disorder and simplicity–complexity. Choosing, planning and redesigning instructions, creating paradoxes using powerful tools to sooth up tensions and worries . . . those are appear to be the properties of today’s managers (Drucker 1998, p. 70).

Chaos Theory which is believed to be the basis of the postmodern social sciences, consider organizations as complex systems and their relations are not linear ones, furthermore they can develop into unexpected results as a result of which it gives us a mechanism give rise to unpredictable choices (Töremen 2000). According to the theory of chaos and complexity, training organizations are attractive elements in the relationship with the environment. If we reconsider the fact that now everything is changing, it would be impossible to make plans for the future regarding that

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we do not have the necessary information. Complex systems are self-adaptive, constantly dreaming, idea implementing, developing and learning systems (Erçetin 2001, pp. 47–68).

Erçetin et al. (2013a) stated the infinite number of events between chaos and order, moreover they made it clear that the boundary between chaos and order is not very clear thus it is difficult to state the degree of the chaos. We can see the emergence of new systems especially if they are driven to the cradle of the chaos. But the most interesting thing is it is not possible to determine or pre-plan this. This point of view, may lead to frightening consequences especially managers who are accustomed to traditional control tools (Morgan 1998, pp. 296–305).

The structure of the chaos during the time of turmoil, learning how to manage with organizations, recognizing the importance of the small changes by thinking that they may lead to the greatest changes, understanding the chaos and nature and considering them as natural oppositions would serve extraordinary opportunities for today's organizations on how to understand and develop the change.

35.2 Purpose

Due to Turkish Education System's unique structure of the educational organizations, educational administrators and teachers have the key role to solve the problems. Thus, their reaction to unexpected events or emergencies are really important.

School principals in the schools, as a training manager, are expected to manage complexity in the best way. In this research, it is attempted to diagnose the reaction of teachers and school administrators to new education model 4+4+4 which is announced at the beginning of 2011–2012. It is going to deal with how they perceived the new module, whether did they experience anything chaotic at the very beginning of the system or not. Diagnosing the situation of teachers and administrators is the key purpose of this research.

35.3 Methods

For the research the interview technique, which is one of the qualitative method, is used. To provide a standardized and comparative results, semi-structured interview technique is used. The reason for using the interview technique is, it allows you to get into the inner world of the participant and see the events through his/her eyes. Thus their own experiences would be understood better. In the semi structured interview technique the researcher prepares the questions that he is going to ask, in advance. However the researcher may alter the situation of the interview by choosing different questions from his selection (Türnüklü 2000).

The data of this research, including the diagnosed problem is achieved thanks to the participants consisting of 8 school principals and 20 teachers who are working in the district of Ankara. They were volunteered to take part in this project and their efforts gave life to this project. The data of the research had been collected between 8 and 15 October 2012 during the free times of the participants on a regular interview basis. The data developed by the researchers was obtained using a semi-structured interview form. Due to the limitations of the data obtained from content analysis technique, instead of using the number of interviews, direct quotations were used to encourage the reader.

The participants are asked to answer following questions:

1. What do school principle and teachers know about 4+4+4?
2. Does everybody know their responsibility when schools started?
3. Was there any trouble that you came across during the appliance of the program?
How did you solve it?
4. Is there anything else you would like to share?
5. The problems you faced with, did they cause any uncertainty?
6. The problems you have experienced after the schools are opened, were they chaotic or regular ones?
7. Did you require to take in-service training as school administrators and teachers?
if yes, did it work?
8. What issues do you see as a problem still?

35.4 Results

The results of this study, will be presented in sub-titles in parallel to the research questions.

1. What do school principle and teachers know about 4+4+4?

First interviews with the school managers show that, at first they did not have much information, about 4+4+4 later in June, July and August during the seminars it was seen that they have sufficient knowledge about the system yet still some issues, misunderstood parts in it. The reason for that is they were having hard times to express their thoughts and sometimes their hesitation cause them not to ask the question in their mind. Interview with a 20-classroom teacher seminars show that new system and investigated the extent of the basic level of knowledge of teaching and learning, encouraged them to continue their servitude without any problems.

2. Does everybody know their responsibility when schools started?

Consultant school administrators indicated that they have been experiencing uncertainty in one extent however they added those obstacles can be overcome easily by making researches about the problem. Thus they all know their duties and responsibilities when they are asked to take action.

Opinions of the 8 of 20 teachers at the beginning of this academic year show that how to provide curriculum and course materials was not very clear to them. The rest, 12 people, overcame the same conditions by experiencing the troubles.

3. What was the problems that you came across during the appliance of the program? How did you solve it?

School administrators and teachers present at the meeting the problems encountered during the application cited as follows in order of importance;

- Shortage of classrooms
- 1. Year students have a lot of age range (60–72 months old and up) and compliance issues
- Norm primary school teachers
- Provision of elective courses and books
- Courses starting early in the morning, and lasts till late evening.

When it comes back to ask them how did they solve the problem;

To overcome shortages of classrooms, schools, school administrators, by applying bilateral training time those shortages tried to be covered, but to maintain this the course times have been set to earlier than usual. This left a negative impact upon some teachers and administrators.

The gap between first year students led into some administrators to take action. The solution to some schools was to group them by their age like 60–66, 66–72 etc. To fix the compliance issues some teachers had to made up games and gifts for them.

The supply of elective courses and books trying to meet the needs of the ministry. It was stated that teachers and administrators, are still trying to find a solution to the problem has been found in elementary school classroom teachers emphasized.

4. What issues do you see as still a problem?

Interviews with school administrators and teachers still having issues with some problems list follows in the order of importance;

1. Deficiencies in physical infrastructure of schools
2. The difficulty of making a dual education
3. 3-Lack of appropriate training areas for first year students
4. Overpopulated classrooms

Crowded classrooms, lack of physical infrastructure in schools give its way to the dual training. Schools first year students are seen as a significant deficiency in the absence of appropriate training areas. Teachers become more the norm in the state is seen as the solution to the problem can't be found among the issues the other.

5. The problems you faced with, did they cause any uncertainty?

Problems faced by the school administrator to 4 and 8 teachers in schools shows that they had experienced uncertainty at the beginning because of not knowing everything when they started. However, in time they also express that they got rid of

this uncertainty and successfully overcame it. Other administrators and teachers do not face uncertainty expressed in any way.

6. The problems you have experienced after the schools are opened, were they chaotic or regular ones?

Due to the change of the educational system from primary school teachers' perception of living in a chaotic situation excess of permanent staff, but other problems encountered by connecting to the lack of infrastructure is seen as the everyday issues of education in our education system.

7. Did you require to take in-service training as school administrators and teachers? if yes, did it work?

Eight school administrator consulted at the beginning of the academic year 2012–2013, they received in-service training on 4+4+4, two out of eight school managers said “received, but it was a hearty and helpful” using the term, 3 “we received and it helped us understand the system, however, was not qualified to resolve the problems that you can encounter as” express their views on this issue.

8. Is there anything else you would like to share?

Participant school administrators and teachers, 15 teachers and 4 correspond to the question of further comments on this issue, and so the following answers to the administrator tried to expressed respectively;

1. The infrastructure should be formed before it was decided to make a change in the system.
2. In time these problems I believe will be overcome.
3. It would be better to have 5+3+3 rather than 4+4+4.
4. Radical changes related to education should be discussed with more stakeholders.
5. Before going to the system changes the ideas of teachers who are practitioners of this system should be asked and taken into account.
6. I would like this study to be shared for the competent authorities.
7. With the new system class hours have been increased.
8. New schools should be started full-time education making bilateral training.
9. The positive aspects of the new system should also be taken into consideration.
10. I think 4+4+4 system is being applied in a good way, thus it will be successful.
11. I believe the problems that occurred in transition process could be overcome as soon as possible.

35.5 Conclusion

In the interviews was implemented this year, school administrators and teachers in the implementation phase of the new educational model did not have enough information, it was understood that these problems can be solved with necessary

researches. Problems encountered in the classroom shortage due to lack of physical infrastructure, dual instruction, lessons from the early beginning to end late evening and 1st class students are seen as the lack of appropriate training areas. Elective courses and books are among the problems encountered in the other procurement.

Linear solutions to the problems faced by educational organizations, and these may create other problems. Problem should be handled from different approaches, and it should be in liaison with the context of mutual causality. Analyzing problems in by using multi-variables may reveal a rich-tableau. In this case more radical changes in the educational stakeholders should be discussed, the infrastructure must be created before making changes to the system.

In general, changes made to the education system involve all sections of society to create a chaotic environment, the possible response should be considered as a normal situation. However, Erçetin and others according to “Vocational and Technical Education for the restructuring of Strength realistic, practical and integrated A Model Result Report” the duration of compulsory education in EU countries compared to the current situation in Turkey and Turkey’s 8-year compulsory education has been drop behind (Erçetin et al. 2013b). Therefore, this new model of the educational process and intermittent mandatory stanza breaks the due in which a diploma is given after 12 years of compulsory education. The new education system in our country, which have yet to be received, is going to be stronger with qualified and experienced teachers and administrative staff.

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Chapter 36

A Simulation Study Goodness-of-Fit Tests for the Skewed Normal Distribution

Emre E. Sarisoy, Nihan Potas, and Mahmut Kara

36.1 Introduction

X is a random variable which has skew normal distribution $X \sim SN(\xi, \eta, \lambda)$. ξ location, η scale and λ shape parameters of skew normal random variables. Probability density function (pdf) of X is taken into account as follows;

$$f(x; \xi, \eta, \lambda) = \frac{2}{\eta} \phi\left(\frac{x - \xi}{\eta}\right) \Phi\left(\frac{x - \xi}{\eta} \lambda\right) \quad \eta > 0, x, \lambda, \xi \in \mathfrak{R} \quad (36.1)$$

where ϕ and Φ denote the standard normal probability density function and distribution function, respectively. This distribution was firstly obtained by O'Hagan and Leonard (1976). General expression of the cumulative density function (cdf);

$$F(x; \xi, \eta, \lambda) = \frac{2}{\eta} \phi\left(\frac{x - \xi}{\eta}\right) T\left(\frac{x - \xi}{\eta}, \lambda\right)$$

Provided by Azzalini (1985). $T(\cdot)$ denotes Owen's function (Owen 1956). Skew normal distribution has many properties that are explained by Azzalini (1986):

- The parameter λ , defined shape parameter (also defined skewness parameter), is shown the skewness varies in $(-\infty, \infty)$.

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- If the parameter $\lambda = 0$, pdf of $SN(\xi, \eta, \lambda)$ corresponds to $N(\xi, \eta^2)$. $\lambda > 0$, pdf of $SN(\xi, \eta, \lambda)$ is positively skewed. $\lambda < 0$, pdf of $SN(\xi, \eta, \lambda)$ is negatively skewed.
- As $\lambda \rightarrow \pm \infty$, $SN(\xi, \eta, \lambda)$ approximates to the half normal distribution.
- If a random sample of values (x_1, \dots, x_n) transform to $z = \frac{x-\xi}{\eta}$ and, $f(z; \lambda) = 2\phi(z)\Phi(z\lambda)$ $z, \lambda \in \Re$ $Z \sim SN(\lambda)$ then $Z^2 \sim \chi_1^2$.

Azzalini (1985) gives the moment generating function for Skew Normal Distribution:

$$M_X(t) = 2 \exp\left(\xi t + \frac{\eta^2 t^2}{2}\right) \Phi(\eta \delta t) \tag{36.2}$$

where $\delta = \lambda/\sqrt{1 + \lambda^2}$. The expected value and the variance of skew normal distribution can be easily obtained as follow, respectively:

$$E(X) = \xi + \eta \delta \sqrt{\frac{2}{\pi}} \tag{36.3}$$

$$Var(X) = \eta^2 \left(1 - \frac{2}{\pi} \delta^2\right) \tag{36.4}$$

Maximum likelihood methods can be used to estimate location, scale and shape parameters of the distribution. However analytic expressions of these parameters are complex, numerical maximization procedure must be used to solve this complexity. For that, on the basis of MLE we considered to re-parameterization of the distribution, proposed by Azzalini (1985).

$$Y = \mu + \sigma \left(\frac{X - E(X)}{\sqrt{Var(X)}}\right) \tag{36.5}$$

We use the notation $Y \sim SN(\mu, \sigma, \gamma_1)$. As a result of this re-parameterization $E(Y) = \mu$, $Var(Y) = \sigma^2$ and γ_1 coefficient of skewness of both X and Y .

$$\gamma_1 = \left(\frac{4 - \pi}{2}\right) \frac{\left(\delta \sqrt{\frac{2}{\pi}}\right)^3}{\left(1 - \delta^2 \frac{2}{\pi}\right)^{3/2}}$$

In numerical maximization procedure we want to minimize a negative log-likelihood function. Then a procedure of non-linear constrained iterative minimization of the procedure negative log-likelihood function based on parameterization Eq. 36.5 is used (Dalla Valle 2007). As a result of the convergence the estimation of the parameters

$$\xi = \mu - \sigma \left(\frac{2\gamma_1}{(4 - \pi)} \right)^{\frac{1}{3}} \quad (36.6)$$

$$\eta = \sigma \left(1 + \left(\frac{2\gamma_1}{(4 - \pi)} \right)^{\frac{2}{3}} \right)^{\frac{1}{2}} \quad (36.7)$$

$$\lambda = \left(\frac{2\gamma_1}{(4 - \pi)} \right)^{\frac{1}{3}} \left(\frac{2}{\pi} + \left(\frac{2\gamma_1}{(4 - \pi)} \right)^{\frac{2}{3}} \left(\frac{2 - \pi}{\pi} \right) \right) \quad (36.8)$$

are shown in the estimation of (ξ, η, λ) . Azzalini and Capitanio (1999) give a web address for the MATLAB-code to generate the random variables and evaluation of the density function and parameter estimation.

36.1.1 Goodness of Fit Tests

Some classical goodness of fit test statistics are Kolmogorov-Smirnov (K-S), Anderson-Darling (A-D) and Cramer-von Mises (W). They are based on empirical distribution function (EDF). The null hypothesis of the goodness of fit statistics determine to the random sample comes from population with distribution function $F(\cdot)$. The tests measure the distance between the empirical distribution function estimated from observed data and the assumed cumulative distribution function (CDF). Many authors find out that A-D test are more powerful than the other EDF tests and also A-D test is common to use in statistical analysis. We know that goodness of fit test are not distribution free when the population parameters must be estimated, the critical values and power of the tests are depend upon the method of estimation (Lawless 1982; Woodruff and Moore 1988; Wozniak and Li 1990). In this circumstances, Liao and Shimokawa (1999) introduced new test statistics which is for Type-I Extreme Value and 2-parameter Weibull distributions.

(a) Kolmogorov-Smirnov test statistic,

$$K - S = \max_{1 \leq i \leq n} \left[\frac{i}{n} - F_0(x_{(i)}), F_0(x_{(i)}) - \frac{i-1}{n} \right]$$

which is the best known statistic for goodness of fit tests, were found by Kolmogorov(1933).

(b) Anderson-Darling test statistic,

$$A^2 = -n - \frac{1}{n} \sum_{i=1}^n (2i - 1) [\ln F_0(x_{(i)}) + \ln \{1 - F_0(x_{(i)})\}]$$

is one of the most powerful goodness of fit tests in the literature (Anderson and Darling 1954).

(c) Cramér-von Mises test statistic,

$$W^2 = \sum_{i=1}^n \left\{ F_0(x_{(i)}) - \frac{2i-1}{2n} \right\}^2 + \frac{1}{12n}$$

which is one of the famous test statistics, were found by Cramér(1928).

(d) Liao-Shimokawa test statistic,

$$L_n = \frac{1}{\sqrt{n}} \sum_{i=1}^n \frac{\max \left\{ \frac{i}{n} - F_0(x_{(i)}), F_0(x_{(i)}) - \frac{i-1}{n} \right\}}{\sqrt{(F_0(x_{(i)})) [1 - F_0(x_{(i)})]}}$$

measures the average of all weighted distances over the entire range of x , which combines the characteristic of the K-S, A^2 and W^2 (Liao and Shimokawa 1999).

36.2 Table Values and Simulation

In this part, table values of the test statistics are estimated by using the Monte Carlo technique. The ML estimators of Skew normal distribution parameters are estimated with the use of EM Algorithm. Ten thousand samples were created from a each n and λ value location parameter of 0 and scale parameter of 1 rated skew normal distribution. The location and scale parameters are used as 0 and 1 because they have no effect on the variation of test statistics.

In this section, the table values of test statistics are estimated using the Monte Carlo technique. Skewed ML estimators of the normal distribution parameters, are estimated using the EM algorithm. For all n , and the value of the specified location parameter 0 and scale parameter 1 skew normal distribution, 10,000 samples have been produced. Location and scale parameter change had no effect on the distribution of test statistics thus the 0 and 1 values are used. Skew normal distribution parameters for each sample and for the ML EM algorithm is used. These are proven by using:

$$F(x_{(i)}; \hat{\xi}, \hat{\eta}, \hat{\lambda}) = \frac{2}{\hat{\eta}} \phi\left(\frac{x_{(i)} - \hat{\xi}}{\hat{\eta}}\right) - 2T\left(\frac{x_{(i)} - \hat{\xi}}{\hat{\eta}}, \hat{\lambda}\right), \quad i = 1, 2, \dots, n$$

P values were found using the calculated test statistics. Then, the value of this 10,000 sequence are following $\alpha = 0.01, 0.025, 0.05, 0.10, 0.15$ ve 0.25 which represents the each test statistics.

Those values are calculated for $\lambda = 0, 1, 2, 3, 5, 7, 10, 20$ and $n = 20, 30, 50, 100, 150, 200, 300, 500$ $n > 500$. Tables are quite similar to $n = 500$ table values so the results were not calculated again. These were shown at Table 36.1.

Table 36.1 $\alpha = 0, 05$ for L_n test statistic critical values via $\lambda = 0, 1, 2, 3, 5, 7, 10, 20$ and $n = 20, 30, 50, 100, 150, 200, 300, 500$

L_n	n	20	30	50	100	150	200	300	500
	λ								
	0	1.0716	0.9347	0.8531	0.7865	0.7683	0.7549	0.7258	0.7142
	1	1.0718	0.9372	0.8528	0.7858	0.7621	0.7511	0.7330	0.7041
	2	1.1249	0.9555	0.8779	0.7977	0.7587	0.7469	0.7289	0.6972
	3	1.1961	0.9996	0.9018	0.8315	0.7866	0.7656	0.7443	0.7204
	5	1.3535	1.1092	0.9568	0.8884	0.8479	0.8202	0.7972	0.7802
	7	1.4718	1.1799	1.0188	0.9123	0.8981	0.8757	0.8561	0.8208
	10	1.5651	1.2982	1.0781	0.9749	0.9380	0.9164	0.9079	0.8753
	20	1.6732	1.4292	1.2166	1.0625	1.0273	1.0116	0.9890	0.9553

For simulation in $\alpha = 5 \beta = 1$ on gamma distribution $N(2.14, 3.63, 6.11)$; $\mu = 0 \sigma = 1$ Extreme-Value distribution $SN(0.96, 2, -4, 26)$; $\alpha = 2 \beta = 1$ Weibull distribution $SN(0, 36, 0, 70, 2.78)$; and for χ^2 whose degree of freedom is 4 $SN(0.4, 4.5, 8)$ mentioned parameters and values were used. Sample size n is taken $n = 20, 50, 100, 200, 500$ respectively. The results are given in Fig. 36.1. Table 36.1 10,000 is based on the number of simulations. In previous attempts K-S, A^2 and W^2 to make the comparison of the goodness of fit tests. A^2 and W^2 has seen to be stronger in the light of test results (Mateu-Figueras et al. 2007). In this work a new test of goodness of fit-test statistic L_n has been included in the study. L_n test statistic as extreme-value and Weibull distributions skewed studies have shown strong (Liao and Shimokawa 1999).

It has been observed that all distributions to simulation results, as the sample size grows, the forces of goodness of fit tests increase. This a condition which is expected. On grounds of test statistics L_n test statistic is powerful than others. K-S, A^2 and W^2 test statistics are given the same results until $n = 500$. As a result it is understood that it is a better method to point out the skew normal distribution of L_n statistics.

36.3 Conclusion

Regarding the skewed normal distribution’s testing with goodness-of-fit, there are works of Gupta and Chen (2001), Mateu-Figueras et al. (2007) in the group. Firstly Gupta and Chen (2001) tabulate $SN(0, 1, \lambda)$ distribution for different λ values. Then they use these data’s on another goodness-of-fit test Pearson’s χ^2 and Kolmogorov-Smirnov test. Mateu-Figueras et al. (2007) Kolmogorov-Smirnov, Anderson-Darling, Cramer-von Mises, Watson and Kuiper researched which one of them is the strongest one in the light of skewed normal distribution values. For skew normal distribution, Anderson-Darling, Cramer-von Mises, Watson, and as the Kuiper rushed different n ve λ values which effected the result of course. Studies and

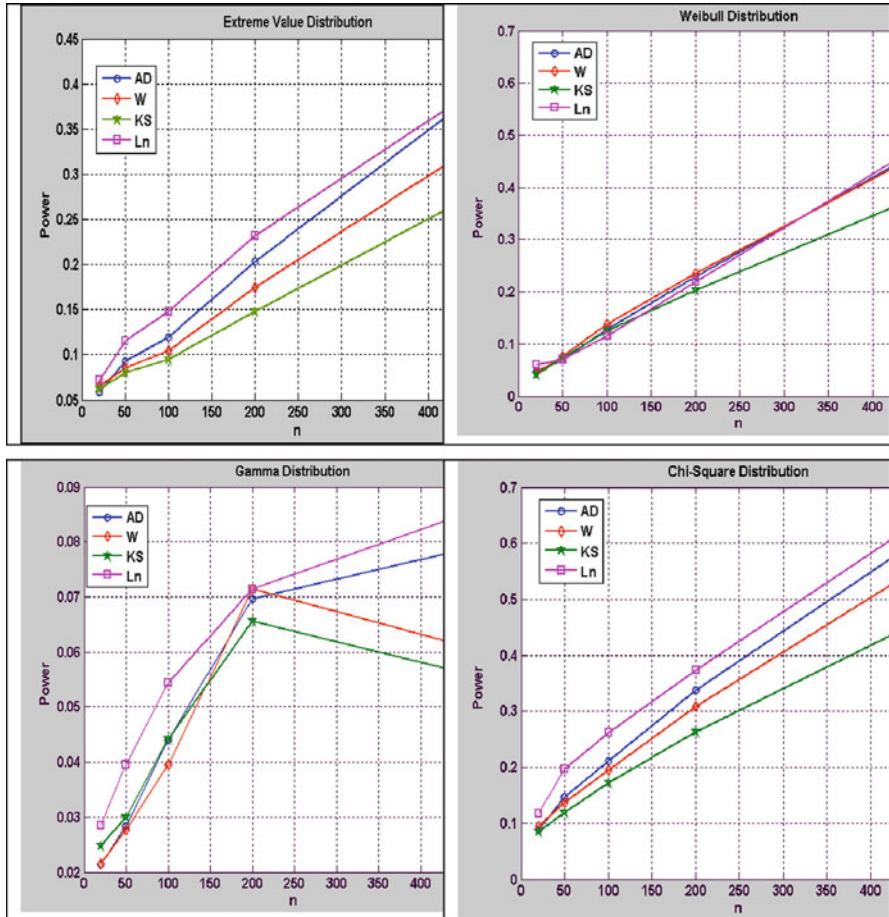


Fig. 36.1 Power of K-S(KS), A^2 (AD), W^2 (W) and L_n (L_n)

test statistics have concluded that the most powerful choice is A^2 and W^2 . This paper by adopting the similar study, have researched the goodness of fit test. L_n statistics were tested for the skew normal distribution table values, the test statistics from different distributions generated to 10,000 rejection ratios which were calculated according to the values of the table. As a result, L_n is a more appropriate test statistic to determine the skew normal distribution that is the result of the goodness of fit test.

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Chapter 37

A Chaotic Fact: 2011 Van Earthquake-Evaluation of Pedegogs

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37.1 Introduction

Turkey is located in a region that has high seismicity. For this reason, a large number of destructive earthquakes can be seen in this region. One of these occurred in Van 23 September 2011, intensity of 7.2. An Earthquake is a chaotic event and it effects all lives and organizations around it. Educational organizations are expected to teach people how to behave in a such chaotic facts. These organizations are also required to be able to cope with problems caused by this chaotic situation, and of course they are also expected to produce solutions about it (Erçetin 2005).

Adaptation of organizations to constantly changing environmental conditions is difficult. For this reason the mechanical structures are vulnerable to such crisis. To respond crisis easily, the structure must be changed from mechanical structure to organic one. Because the most appropriate structure in such condition is organic organizations because of its flexibility (Tüz 2004, s.46).

In other words, self organizing systems implies a shift from disorder to order. These systems interact with their environments to reflect themselves, to retain their identity from the outside hazards that may occur. In the case of the evolution of its identity, it resorts to processes of organizational change (Erçetin 2001, s.43).

In accordance with the increasing complexity of organizations, it is expected to respond this in appropriate type, quantity and quality. To meet the complex and various expectations of the environment, these organizations must change their structures. This, leads organizations to increase the decision center by reducing the

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hierarchy on the system. Intelligent, self adapting, complex and idea implementing systems always show the evolution and they are liable to facilitate their systems (Erçetin 2001, s.47–68).

In this context, in this country, with such a high probability of an earthquake, what is learned from those past-earthquakes must be answered.

In the search of the answer for this questions, teachers and school administrators who have been to 2011 Van Earthquake, are asked to answer what they have been through in general.

37.2 Method

In the interviews qualitative research methods were used. The aim of the research is to understand subjects world view and reveal the perspectives of the people interviewed (Kuş 2003, p. 87).

Structured interview technique, may be classified as semi-structured or unstructured interviews. In semi structured interviews questions are determined in advance to gather data (Karasar 1998). The data of this study, is collected through semi structured interview call-type system.

The data is achieved from three people on serving as teachers and school administrators on voluntary basis, who had been to earthquake and still living there, on a voluntary basis. From 3 to 8 September 2012, the interviews were carried out in conformance with the participants.

37.3 Results and Conclusion

According to interviews, data includes two different categories, that is happened after the earthquake and ones obtained by education.

37.3.1 What Happened After the Earthquake in General

Those interviewed indicated that after the earthquake everyone was in panic, after they overcome the fear in 30 min they started to look for their parents in the debris. While they were doing these, they also reported that there were others crying and trying to find their families or people who did not know what to do exactly which expressed that the damage that is caused by earthquake is also psychological.

37.3.2 What Happened After the Earthquake During the Education

Interruption of Education

Those who took place in the interview expressed that schools were collapsed after the chaos that has been occurred because of the earthquake and education and related activities were suspended. In the meantime, some lucky families who have the possibility affording a new place moved on while the others who could not afford another placed in dormitories and guesthouse. Those who left the city were able to continue their education however those who could not were forced to wait 2 months for educational activities.

One of the participants said: “My brother was preparing for college. He lost two of his favorite teacher and he saw his school collapsed. Before the earthquake, he was a very successful student but he failed in his college test. This does not conform to the principle of equality of opportunity in education”

Some of the interviewers said when they got back to their home, everything had hardly changed. After the earthquake, the Ministry of Education to recruit teachers for Van. The aim of this was to replace demotivated teachers with trained staff to strengthen education.

One of the interviewers said: “Our place and our school were destroyed. With my new recruited friend, we started living in a tent we hardly got, and started teaching in a container class. Our new friend could barely understood our situation but we were far worse than he thought. Some of the students were peeing under their pants. Our friend decided to follow the curriculum but I was trying to listen the memories of our students, sharing their misfortunes and grief. This is why I said we could not start training literally.”

After the earthquake the priorities of the people were finding food and shelter and most teachers who could not solve their accommodation problem were to go back their home. Interviewers said after 2 months break on education, schools were opened and to compensate the course gap Saturday’s included in curriculum thus day to day teaching period began.

Participants stated that they would not go to further unless their safety and psychological requirements, which takes the bottom place in Maslow’s hierarchy of needs, and they added that this solid discipline would not be successful unless their requirements were compensated. One of the participants expressed his feeling about this issue stating: “As if education is our only problem.” Following that they also reported they only followed the curriculum but nobody cared for the psychology of neither teachers nor students.

Some managers also expressed because of teachers’ ambition they constantly put pressure on students’ academic achievements. They stated that administrators did not help them at all.

Education Managers

School administrators who were interviewed reported that there was a high level of uncertainty experienced in this situation, almost no one know what to do. Furthermore because of the workload they hard had time to rest. They add there were not only issues related to education but problems among spouses and their children during this period which made them hard to make healthy decisions. Although they are not experts the teacher and the student's home school families have to deal with psychological problems, although they are not an expert one of the school administrators admitted that they were hopeless and nobody did know how to dealt with their problems.

School administrators and teachers expressed that in this environment students who were non smoker started smoking as a result of which the number of people smoking had increased. School administrators stated that in this situation they tried to do their best. On the other hand administrators reported that they experienced some troubles of discontinuity by students who were showing claustrophobic symptoms. At the same time it was seen that because of over stressful environment students started dropping out of school. One of the administrators summed this situation by stating "Sometimes we barely could find students in the classrooms."

Result

This research is the result of Erçetin's works about 1999 Marmara earthquake, and suggests that his result and proposals are still valid. What was experienced in 1999 Marmara earthquake, literally experienced in 2011 Van earthquake as well.

This presents that even after 12 years later Marmara earthquake; though technology has improved we are still face with serious problems.

In this sense, "multi-dimensional leadership should be focused more in growing chaos and people should be trained for chaotic situations."

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Chapter 38

Searching for New Model in Education Systems: Sample of Turkey

Seval Koçak

38.1 Introduction

Representing a whole, systems are set up to achieve specific goals are influenced by many variables, as can be understood by its definition. In addition, one of the most distinctive features of open systems, the presence of external factors that affect the system. Generally, it is not possible to classify the variables that affect the operation of social systems where human interaction and communication is especially intensive. This is because some of the premises lies on the properties of social systems. Aydin (2005, pp. 225–226), declared the properties of social systems and has been expressed some of them as follows:

- Social systems, works dependent to each other, working as a whole as well as other parts of the system and components that contribute to and benefit from the whole, made up of the features and activities.
- The social systems are formed of people who have different features, feelings, thoughts, interests and needs.
- Social systems are open systems affected by external environment.

Education systems are bearing all of these features of the “Social Systems”. Looking at all of the system, local government, central government and schools are emerged by sub-systems of community systems . This is also living in a social system within the education system, chaotic situations will inevitably arise even makes it necessary for development and change. Moreover, the dynamic continuity of the protection of a social system seems to be impossible. For this reason, each of the chaotic or complex situation, rather than “a problem which must be closed as soon as possible”, see it as an opportunity for development and change, it is also important to assess.

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Taking into account of all these explanations we come up against the chaos and turmoil in the societal systems as phenomena that should not be found odd.

Erçetin (2001, p. 36, pp. 44–45), refers that the system approach forms the basis of intellectual chaos and complexity, and living systems are capable of self-organizing. In addition, based on the research of the literature, related to its complexity and self-organizing basic features of living systems, and summarizes as follows:

- It states compulsory around the area and a continuous irregularity.
- Includes random and independent processes.
- It is flexible.
- There is mutual and constant relationships. One of the basic principles of these relations structures heterogeneous is that creates a symbiosis.
- Flexibility provided by the various fluctuations, which is a continuation assumes the existence of through conversion.

If the complexity of social systems and chaos with these characteristics are a natural phenomenon, for this concept what kind of a definition was made? Töremen (2000, p. 204) refers that in literature researches, the concept of chaos is defined in different ways. Based on these definitions, notes that chaos and complexity look like, confusion and disorder; but unpredictable, a confusion on purpose and a regular disorder expression.

Erçetin et al. (2013b) stated that if chaos and order were to be placed in a scale, there would be an enormous number of situations. That's why the definitions of order and chaos could change depending on the system and observer. They also stated that there is not a clear shift from one to the other and clearly determining the degree of a chaotic system is a difficult task.

Gürsakal (2007, pp. 47–50) goes beyond an exact explanation and explains the features of complexity and complex systems. According to these explanations, a system's complexity is determined by how many parts it has and the connection between these parts. Separate parts of a complex structure behave differently. However, the fact that these parts are dependent on each other limits them. The difference between these parts creates disorder, while their dependency on each other brings the order. These are the features of complex systems:

- Even if the functions of these parts are known, it is impossible to estimate the system's behavior.
- It has a structure that is continuously interacted with its environment. With the help of this structure, it can arrange itself.
- Between its units, there are non-linear relations.

Erçetin et al. (2013a) expressed the organizations regarded as open systems as complex systems that can customize itself. In this regard, they accepted some basic assumptions. They expressed them in this way:

1. Organizations are formed by many structural and functional agents that interact. However, these interactions are nor linear,

2. Organizations are in contact with other organizations which are complex like themselves.
3. These organizations get feedback from others with the help of this communication and interaction. As a result, they get the information that is necessary for them to maintain their existence.
4. As a result of the information they get, they form relation schemes or models and they maintain their relations based on these models.
5. The organizations that use the feedbacks in learning and orientation review the schemes and models taken from their feedbacks.
6. When the organizations manage to be on the edge of chaos, they become creative and adaptive.

As understood from these explanations, a change in education systems known as vital systems leads to unexpected results and this is regarded as normal. Even if it is impossible to control the future and make precise predictions, it is important for the permanency of systems that they can answer different situations and forming different plans.

If approached from a different standpoint, chaotic situations keep the systems alive and force them to change and develop. That's why, always considering the chaotic situations as a negative fact may hinder the progress of the systems. Erçetin et al. (2013b) described chaotic situations as the source of vitality and life. They also stated that a system that is not chaotic is a probably expresses a situation that is created for a particular reason and this system has a limited life-time.

In Turkey, the education system undergoes different changes and progresses as it is in every part of the world. As a result, these changes bring together different kinds of chaotic situations. In Turkey, 4+4+4 Education System that was applied in 2012 brought a radical change. It also caused chaotic situations in different parts of the education system. These changes has been evaluated and discussed in various ways by the public.

Before explaining the chaotic situations caused by this new system, it would be more appropriate to make clear what does 4+4+4 Education System mean. The related regulation went into effect in 04/11/2012 by being published in the Official Gazette numbered 28261, as a result of a law numbered 6287, dated 03/30/2012 and called "The Law Related to the Change in Some Laws such as Primary Education and Education Law". The process that came with this system was announced with a Notice numbered 401 and dated 05/09/2012. This notice was released with the name of "The Applications Intended at 12-years Compulsory Education". According to this notice. (MEB Özel Kalem Müdürlüğü, 2012). (The link: <http://www.meb.gov.tr/haberler/haberayrinti.asp?ID=9466>):

- 12-years compulsory education covers a 4-years of primary, 4-years of secondary and 4-years of high school education. Primary school called as 1.,2.,3.,4. classes, secondary school called as 5.,6.,7.,8. classes and high school is called 9.,10.,11. and 12. classes.
- Primary and secondary schools are called elementary education while high schools are called secondary education organizations.

- The guardians are responsible for the elementary school students to continue their education as they, school managements and civilian authorities do for the primary school students.
- Considering the 2012–2013 academic year, all the kids who are 66 months old will be registered on 30th September, 2012 using the online application system. It is also stated that the kids who are 60–66 months old can be registered by their guardian's will, if they prove that they are eligible for the education.
- Between 48 and 60 months old children proposed for pre-schools 100 % enrollment targets will continue until the end of 2013. As the date of September 30th 2012, obtained to ensure to have education children between 37 and 66 months old in kindergarten or implementation classes, and children between 48 and 66 months old in nursery class.
- In 2011–2012 academic year the students studied in 4. class in elementary school and passed to the upper class announced that they will register to fifth class to Secondary school in 2012–2013 academic year. In addition, in 5. class students who want to continue to Imam Hatip Schools, these schools are able to register.
- The students who have completed the elementary school will not be given a diploma, but stated that given a diploma after at the end of the 12 year compulsory education.
- 2011–2012 academic year 8.grade students, high schools prefer students according to the SBS examination results expressed who did not attend any of these schools and did not get the exam provided to register in secondary schools according to the preferences.
- In boarding state schools mentioned that only the secondary school parts (5, 6, 7, and 8th grade) students can room at boarding school but the primary schools educated as transported to other schools or day schools in boarding state schools.
- According to the law: 'elementary schools should be formed as primary and secondary schools. However, there is a statue that enables the secondary schools to be formed together with the primary or high schools due to the opportunities and conditions. That's why, it was stated that these plans will be applied in 2012–2013 academic year according to condition of the school and the new comers:
 1. If the physical conditions are appropriate, primary, secondary and high schools will be formed independently.
 2. Physical conditions will be arranged in accordance with the students' development features.
 3. If primary and secondary or secondary and high schools are to be placed in the same building, communal areas will be arranged according to their development levels.
 4. Anatolian Imam Hatip High Schools will primarily be formed as independent schools.
 5. If the conditions are not appropriate, bilateral training can be preferred.
- It is stated that there will be only one school principal, if the secondary schools are to be formed together primary or high schools.

The chaotic situations of this new system implemented show themselves in different parts of the system. As human and place factors that affect the chaos in education systems can be expressed as follows:

1. Human as chaos callers:

- Teacher
- School administrators
- Family members
- Community

2. Place as chaos callers:

- Class
- School
- Home
- The neighborhood, the environment, in short: living area

Accordingly, a training system which will affect the formation of chaos and chaos affected by human factors considerations and physical factors (place) can be expressed as. In this study discuss the “4+4+4 Education System” and the changes of people, places, and their effects on the functioning of the Turkish Education System with administrative complex situations that arise in relation to these elements.

38.2 Purpose of the Study and Methodology

The aim of this study is that produced by the 4+4+4 Education System and remove possible the complex situations, identify and discuss the complexity experienced by the fields. For this purpose, public announcements and discussions on the new system investigated and complexity experiencing issues.

According to the results of the research, the issues debate in public and in the system that caused confusion in the education system, grouped considering the account of some elements of the education system. These are;

1. The human element in education

- Student
- Teacher
- Administrator
- Family and community

2. The place element in education

3. Elements related to operation (registration, course programs, training and teaching process)

Generated chaotic situations are tried to be defined under these factors.

38.3 Findings: Are Situations Appeared with New System Chaotic?

This planning done intended for 12-year compulsory education has become one of the much-debated agenda items in Turkey. It has discussed both universities and nongovernmental organizations which are studying the area of educational. It has affected all partners taken part in educational system and has caused various chaos.

Before explaining the chaotic situations appeared as a result of changeover in Turk Educational System, the explanation of reasons preparing chaotic situations is seen important that there are several reasons caused these chaos. These reasons are stated below at ERG reports (ERG2; ERG3):

- Not providing right data flow on e-school system because of uncertainty on regularization about the schooling age, being interrupted preparations about the students have new record,
- Not practicing conversion related with schools educate which level on time,
- Not forming, on time, act plans that will provide preparing schools and detailed informing packets related with “4+4+4”,
- A conflict of “reconstruction at management” studies with starting September 2011 and “4+4+4” Educational System Application,
- Not having founded technical teams have school experience when forming policies and not providing sufficient coordination between units.

Chaotic cases resulted 12-year compulsory “4+4+4” Educational System can be explained below, when approaching human, place and running of education (ERG1; ERG2; ERG3; Türk Eğitim Sen):

1. Situations related with human at education

There are students, teachers, school principals, family, society as human beings. With new system, chaotic situations all partners experience are below:

Partners affected from chaotic case directly (other partners have affected these cases)	Subject of chaotic case
(a) Chaotic case which students experience:	Regularization about schooling age, whether students not complete their growing can be recorded, have caused chaotic case. When some parents are trying to get a document about their child didn't complete growing, others have sent their child to school. This difference is a chaos about the schooling age The chaos about school conversion each other has caused discussion between the students “which school will I go?”

(continued)

(continued)

Partners affected from chaotic case directly (other partners have affected these cases)	Subject of chaotic case
(b) Chaotic case that teacher experience:	<p>Because of uncertainty, in some school, registration rates are higher, in some school registration rates are lower. It caused imbalances about classroom size. This case was a hard situation both students and teacher. It caused another chaos needed to solve immediately: crowd class problem</p> <p>Some of primary school teacher and preschool teacher, with a chaos that is about to continue which school for them, faced a uncertainty problem about which age group that she/he is teaching. Teachers who is teaching to children of primary school age before, have had to teach smaller child and have faced various negative situations because of formation insufficiency</p> <p>Teachers whose school turned into a school give 4-year education, with the standard diminution, have had to change their school with another turned secondary school. This situation have led to break their permanent settlement and dandification</p>
(c) Chaotic case that school principal experience:	<p>Because of 4+4+4 units sortation' reasons or changing each other the schools, some school principal have had to change their place of duty. This case has caused uncertainty and chaos about which school can be new place of duty</p>
(d) Chaotic case that parent and society experience:	<p>Open policies and criteria related with schooling age and school conversion, at the national level, have not determined. Parents have faced some uncertainty about they will send children to which school, children will be taught "which teacher", how the system can be efficient and they have not decided to whether record or not, with the appearing some thoughts education can be made up in politics. Further, the explanation of schooling age and studies done growing periods of students have caused uncertainty how parents need to behave their children. As a result of this, all walk of life, protestations and actions have realized about the subject. Also, in hospitals, there have been parents who want to get paper "it's not appropriate in terms of growing" for their child</p>

2. Cases with related place fact:

- Uncertainty about school changing each other, diminution units, which school can give education to which units have caused a chaos about place fact. Uncertainties about which school will be first 4, is second 4, and third is 4, which school will be serve two units, which school need to physical regularization and which school will serve couple instruction have caused a chaos with place fact. Besides, chaos of schools turned into school of prayer-leader lycees have affected both students and parents.

3. Cases related with running in education:

Uncertainty both schooling age and physical place fact have caused disruption of records and not done s desired. For this reason, datas at e-school have not done effectively.

- Preparing the programs about optional course and required substructure have caused various chaos. Besides, for each student, for the first time, like choosing different optional course, parents have had to face various chaos.

Besides subjects of running, subjects like early guidance for vocational education, religious education, schooling age, optional course have been discussed universities and experts and have caused chaotic occasion at discussion platforms ([ODTÜ Views](#); [Hacettepe University Views](#); [Boğaziçi University Views](#); Özay 2012).

38.4 Result and Conclusion

Regarding chaotic cases happened with new system, changes that will do educational systems is seen various results will occur. Chaotic cases occurred with appreciation of 4+4+4 Educational System are possible to review as both a natural period occurred with new situation and preparing efficient substructure. Regarding both situations, changeover done like this can be reviewed as a result of inevitable.

Also, results of chaotic cases occurred with new system can be discussed, they affect all partners taken part in systems. It seen that each change can occur different result, each result can cause new thing. Especially, it can occur that whichever case can cause prediction is difficult. Besides, is stated that a change could be negative for some, could be positive for some in living social systems. For this reason, it is revealed that the social system whose fact is human is difficult.

Generally, regarding change or reform done not only educational system but also all system can be reviewed a chaos. It can be reviewed as a natural fact that is facing a reaction or resistance. But, regarding the running and continuing systems, it is seen that the systems can take efficient decisions, being and available the ability done with chaotic cases, dynamic and flexible cases. Considering the changes done in systems always can tend chaotic cases, it cis reviewed that chaos and disruption is inevitable, is needed to be as an improvement tools.

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Chapter 39

Sustainability of Economic System in the Chaos

Anna Firsova, Olga Balash, and Vladimir Nosov

On-going trends of globalization, post-industrialization, softization, servicization, international trans-border capital mobility, informatization and financialization of economy, formation of universal informational and financial institutions, sharply increased value of knowledge and other factors have a significant quantitative and qualitative impact on the structure formation and behavior of economic systems (Firsova 2011).

Economic environment is characterized by chaos, instability and unsustainability. Present-day developing emergent economic systems (the Russian economic system in particular) are not in equilibrium and non-linear by definition. Moreover, the increasing complexity means the simultaneous increasing nonlinearity, and the probability of highly unlikely events increases as well as flickering, curls and waves of chaos may be also present in nonlinear world (Beketov 2009).

Unstable and chaotic stages can become likely due to the nonlinear feedback. This, in turn, could lead to the various final states of equilibrium market. Unlike the orthodox economics, contemporary science cannot give different case scenarios a single-value estimate. Therefore, the unorthodox evolution-theory and chaos-theory (the basis of which is the description of the economics as a dynamic self-organizing non-equilibrium systems) approach has currently become an appropriate contribution to the arsenal of available economic ideas.

Economic and social systems as subjects to management are developing under the influence of external and internal forces temporarily changing their intensity. The process of particular system development occurs through regulation of interconnections and relations between its internal components, as well as the interaction of the system with its environment (Ogurtsova and Chelnokova 2012). The characteristics of these systems are defined by: completeness, structural properties, hierarchy

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of internals depending on their location, function and interaction in this system. Herewith, human activity with all their ambitions, value system and psychological organization appears to be the determining factor.

Systems are in constant motion, interacting with the environment, processing information and regenerating feedback. Dynamic resting stages are interspersed with so complicated stages that it gives a performance of complete and unpredictable chaos. The order grows from the disorder in the course of self-organization, but at a given time the system broken with stability gives rise to the chaos.

Management methodology of these systems as a system of principles and methods for forming-up theoretical and practical human activities should be based on a defined frame of person's reference to the real world and his attitude to social realm and himself. The attempt to get a grip on nonlinear situation and employ methods of effective nonlinear control of complicated frames of society in disequilibrium is a way of desired future design and this future is theoretically achievable since it is agreed upon with natural properties of complicated frames of society. Therefore, to manage systems it is necessary to fix some differentiations and time ordering. The facts can be interpreted only within the context of enveloping and more general structure.

In present day interpreting management is an issue studied at the intersection of philosophy, theory, methodology and practical systems application, nonlinear thermodynamics, chaos theory, quantum mechanics, psychology and sociology.

Nonlinear dynamics and chaos paradigm are in agreement with the classical paradigm. In fact, chaos theory is derived from classical physics and mathematics, but it exceeds them. The classical approach describes a linear behavior of individual objects; chaos theory describes the statistical trends of many interacting objects.

“Chaos Theory is a qualitative study of unstable aperiodic behavior in deterministic nonlinear dynamic systems” (Kellert 1993). Aperiodic behavior occurs when there is no any variable describing the state of the system, which undergoes regular repetition of values. Unstable aperiodic behavior is very specified: it is never the same and demonstrates the effect of any small perturbations.

Chaos is a particular order, or to be more precise, chaos has got a complex and unpredictable form of order. In this situation the chaos appears to be an instrument of delicate tuning.

Chaos is extremely multifaceted. It is also the way out to the relatively stable evolution structures and the switching mechanism of vital cycles of complex systems functioning, and “the cementing agent” that unites the parts into an organic and steadily evolving whole, and the adaptive strategy to changeable environment conditions, and by no means the way to renovate a complex organization in nature, society and human mind. Immersing into chaos is the way to innovation.

At first sight the nature of chaos eliminates the possibility to control it. In fact, the instability of trajectories/paths of chaotic systems makes them extremely sensitive to being managed. Briefly the idea of chaos management can be described as follows.

The desired result can be achieved by means of single or a series of subtle, slight trajectory perturbations. Each of these perturbations only slightly changes

the trajectory. But after a while the strengthening of small perturbations leads to a rather strong trajectory correction.

A small perturbation in the system located in the close proximity of the bifurcation point can lead to uprise of its new organizational order. This is reflected in the “butterfly effect.” Thus, the wing beat of a butterfly in Iowa may cause snowballing that will reach its high point in Indonesia during the rainy season, according to Lorenz (1963), who describes the sensitivity of non-equilibrium systems to small fluctuations. Such a phenomenon is fixed by the concept of “the order via fluctuations.”

In other words, the systems of chaos show both management performance and remarkable plasticity: the system is very sensitive to external influences, while maintaining the type of motion.

Thus, the conceptual models developed by the contemporary science discover an unstable world where small causes produce big consequences to us.

The basic concept of chaos management is that each of the perturbations changes slightly the trajectory while keeping the system integrity.

Management problem in a situation of chaos is to try to maintain the system stability with simultaneous search for new alternatives for its development through stimulating the activity of new forces toward forward-looking norms and principles of the organization, the values that can guarantee the development of society in the changed world of tomorrow.

The methodology of the science dealing with chaos, complexity is defined by the following principles. Chaos theory is applicable to dynamic systems which are systems with quite a number of mobile components; within these systems there is an aperiodic order, in appearance irregular data collection can be sorted into temporary patterns; similar “chaotic” systems show delicate dependence on the start conditions; small changes of starting conditions will lead to divergent disproportions at the output.

The fact that there is an order implies that the models can be designed for at least the weaker chaotic systems.

Methodological reference points of analysis within the frames of this approach are the following:

1. Incompleteness and openness economic systems.
2. Non-equilibrium of economic functions.
3. Irreversibility of economic evolution.
4. Nonlinearity of economic conversions.
5. Many-valuedness of economic purposes.

The essence of chaos theory application to modeling of the economic systems development is that model structures may be applied to the unstructured reality. For that purpose mathematical models have to be “soft” in some specifies sense, non-steady and include non-formalized units. They should also provide facilities for contradictory conditions management. And the prime area of the mathematical models study is related to the issue of possibility to manipulate correctly with contradictory and non formalized models.

Economic system condition can be described by means of sustainable development metric characterizing economic growth, poverty reduction and natural environment preservation. For degree evaluation of system stability it is possible to use the calculation of entropy of their chaotic character or inner elements disorder of the analyzed system, which appear in nonuniformity of the studied indicators among the units in the aggregate.

The notion of “entropy” comes from thermodynamics where entropy increasing indicates the chaos growing in the system. As applied to the distribution of the subjects of the economic systems entropy means the deviation from absolutely random distribution.

For each studied indicator its entropy, which can be maximum possible for the range of the given characteristic as well as normalized, should be estimated/determined.

The general formula for the class index of the general entropy appears as follows:

$$I_c = \frac{1}{c^2 - c} \left[\frac{1}{n} \sum_{i=1}^n \left(\frac{y_i}{\bar{y}} \right)^c - 1 \right]$$

where n is a number of units in the aggregate;

y_i is the characteristic/indicator studied, $i = 1, \dots, n$;

$\bar{y} = \frac{1}{n} \sum_{i=1}^n y_i$ is average quantity of the characteristic/indicator studied;

c is a parameter which can take any value: positive, zero, negative.

The parameter c can take any value from $-\infty$ to $+\infty$. It appraises the significance to the differences in the studied indicator at different sections of distribution. In empirical studies they are commonly restricted with three values of c : 0, 1 and 2, which perform the figures with favorable properties (Lukiyanova 2007).

Measures I_c with parameters 0 and 1 are converted, by Lospital’s rule, into one of the two measures of Theil inequality: average logarithmic deviation (I_0) and the Theil index (I_1).

The average logarithmic deviation highlights the differences of the studied characteristic in the lower section of distribution and is calculated according to the formula:

$$E_0 = -\frac{1}{n} \sum_{i=1}^n \log \left(\frac{y_i}{\bar{y}} \right) = \frac{1}{n} \sum_{i=1}^n \log \left(\frac{\bar{y}}{y_i} \right).$$

Theil index is named after Henry Theil, who set forward the concept of entropy measures of inequality. Theil in his book «Economics and Information Theory» set forward entropy inequality index (Entropy index), based on the application of the notion of entropy taken from information theory to the inequality measurement (Theil 1967). The advantage of this index is that it is unlike all the previously

considered inequality indexes performs decomposition axiom, that is can be clearly resolve into the intergroup and intragroup components, which stand equal to the aggregate index value.

$$E_1 = \frac{1}{n} \sum_{i=1}^n \left(\frac{y_i}{\bar{y}} \right) \log \left(\frac{y_i}{\bar{y}} \right).$$

This index places identical emphasis to the observations over the whole scale of distribution (Tolmachev and Nosov 2010).

Please note that both E_0 and E_1 cannot be calculated, if the indicator has zero value. In these cases the zeros should be replaced by some very small values.

The advantage of these general entropy indexes is that they are independent of the index units, meet the requirements of the redistribution principle and sample frame doubling, additive property, and above all, can be decomposed into groups (). We think that among the examined entropy indexes Theil index E_1 will be the most representative of the phenomenon under consideration, as it is equally sensitive to the changes in the index values over the whole scale of distribution.

The lowest value of the entropy indexes is 0 (meaning the complete equality), and the upper bound depends on the sample frame size and selected value of c .

Normalized entropy can be defined by using the entropy relation coefficient as the ratio of Theil index to its maximum value, which is equal to $E_{\max} = \ln n$:

$$E_{norm} = \frac{E_1}{E_{\max}} = \frac{E_1}{\ln n}.$$

This coefficient will vary from 0 to 1.

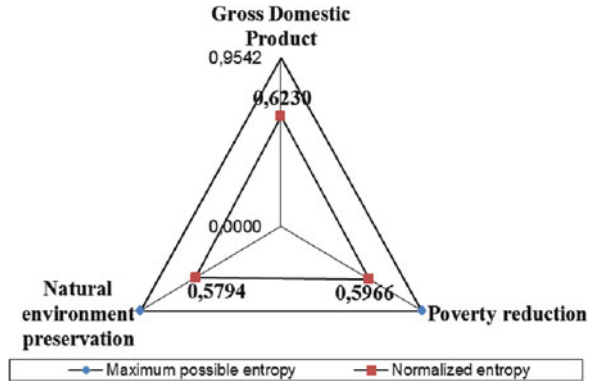
Thus, by virtue of given entropy measures it is possible to get an analytical index of economic systems entropy.

An additional point is that for the graphical interpretation of the system stability “Orientor star” of H. Bossel can be applied, placing on its rays the values of the normalized entropy (Bossel 1999). In case when the system under study has a stable condition, the maximum entropy value is implemented.

For emerging economy of Russia in under present circumstances it is necessary to find a theoretical framework on the basis of which suitable to Russian conditions of socio-economic transformations strategy can be developed. And a new scientific paradigm – Chaos theory and Complexity – allows to develop the economic system sustainability indicators.

According to the data from government statistics we have undertaken a study and calculated entropy indexes for the Russian economy conditions (Balash 2012), (Statistical Yearbook). As applied to the Russian Federation indicator entropy of “Gross Domestic Product” is 62.3 %, indicator of “poverty reduction” is 59.7 % and indicator of “natural environment preservation” is 57.9 % of the maximum possible for the given number of measurements (Fig. 39.1).

Fig. 39.1 Entropy indexes for the Russian economy



39.1 Conclusion

Thus, defining the entropy of each indicator used to assess the stability of the system, it is possible to compare the obtained “entropy stars” and draw conclusions about its stability or instability.

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Chapter 40

Economic Systems: From Chaos to Order

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40.1 Introduction

In the contemporary world there are two kinds of extremes. On the one hand, it is an accurate and ordered changing of events in space and time, such as the planets movement, a regular knock of pendulum, movement of trains by schedule. On the other hand – a random motion of the ball on the roulette wheel, the Brownian motion, the occurrence of random turbulent eddies at high speed flows of water.

Until recently the task of any branch of engineering and any kind of industry was to organize an operating process of all vehicles and equipment in a stable steady way. Order, harmony and stability have always been considered the main technical advantages. Can't you not be afraid of external chaos, uncertainty, fragility, and the inevitable energy losses – these satellites of nonequilibrium? (Muchnik) Besides, disordered processes can also lead to disaster.

40.2 Economic Chaotic Systems: The Basic Characteristics

The chaotic processes happen often in the real world. According to the I.R. Prigodgin, the situation in the modern world is extremely unstable and non-equilibrium, and a man exists in the reality, in which the order does not dominate, but on the contrary, all the natural and social systems, in which the man is involved, are in a state of incessant change and chaos. Even a single change or unexpected combinations of social phenomena and processes are sometimes so strong that the previously active systems, within which occurs a change, cannot stand changeless

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and are destroyed. In other words, only the open systems, which develop on the basis of self-organization and internal order, can exist and interact with each other. On the edge of destruction of these systems it is impossible to predict the direction in which it will go further: will it be the chaos or it will move to a new and higher level (Prigogine and Stengers 1986).

Currently, the Russian economy has entered a new phase of development. As it proved in practice in contemporary conditions the system of classic economic theory and statistical methods based on linear models are not applicable to the Russian economy with her ups and downs. In the conditions of Russian reality, these methods have become unproductive and inadequate. This is due to the fact that the transition of Russian economic system from a planned one to a market is a kind of a jump or a bifurcation,¹ which involves many uncertainties and ambiguities (Zhdanov 2010).

The basic postulate characterizing the linear paradigm, which dominated in the 90 years of the 20th century in connection with the study of economic systems, is the following: every action causes a proportionate reaction. But experience shows that markets, in particular, labor markets, financial markets, ecological and economic relations, rarely follow this paradigm. It often occurs that in economic systems the inconsiderable leaps lead to wave-like and abrupt changes. It often happens that the exponential reaction appears at the initial impact. It means that classical approaches of statistic analysis in most economic processes are not efficient. In the late twentieth century the general patterns in nonlinear processes were actively studied. As a result a new science has appeared – synergetics.² Using mathematical modeling of different evolutionary systems, including economic ones, the researchers found that the behavior of these systems can be determined by a finite number of variables (parameters). Now we can talk about the origin of the economic synergy that studies the dynamic economic system. Economic synergetics makes its emphasis on the use of chaos theory; it considers that chaos lies at the initial stage of any economic dynamic system. This suggests that it is impossible to make precise economic predictions.

So, today the Russian economic system can be represented as follows.

First of all, it is a highly complex system, consisting of a large number of economic cells in close interaction with each other. Besides, it has a pronounced layered structure, in which a higher level integrates on certain rules (algorithms) with the information signals on lower level units and operates with aggregates. At the same time, the economic system itself acts as a subsystem to the community as a whole, since the existence of the community and its development are not limited by purely economic processes.

Second, it is considered to be the open system according to the degree of connection with the environment. The environment with which the economic system

¹Bifurcation – a kind of transition from quantitative to qualitative changes. The concept of bifurcation is a fundamental concept in chaos theory, or as it is called non-linear dynamics. (Author's note)

²The basic concept of synergy is subordination of the degrees of freedom of several major variables. (Author's note)

is in constant interaction represents a society with a social structure, political system, cultural potential and rules of morality. Interaction with the environment occurs in two directions: from the environment to the object and back, respectively, it is determined as the input and output of the system. The input parameters of the economic system are characterized by the totality of industrial, environmental, labor, technological methods, knowledge, etc. The public influence on the economic system is performed via the motives of the people involved in the production, which, in turn, are determined by economic interests, form of ownership and social structure of society.

The range of environmental conditions (factors) necessary for the existence of economic system is unstable, constantly changing for the quantitative characteristics and structure as well. Inside the environment there are different groups of objects which are considered in terms of the ability to manage their elemental composition. Accordingly, the environments have direct and indirect effects. The environment of direct impact includes the ability of direct influence on the aims of the system in a limited period of time. The environment of the indirect impact includes factors (physical, geographical, national, ethnic, socio-cultural, institutional, organizational, etc.), which have an impact, extended in time and indirectly through the direct effect.

Third, it is represented as a dynamic and non-equilibrium system with a plenty of possible modifications, which can have permanent and discrete changes. At the same time, the various components of society and the economy are developing at different rates. There are many striking examples of unbalanced development. Take any profile in economics – industrial, territorial, by ownership, by size of enterprise, – everywhere you will notice a significant difference in the rate and quality, and sometimes it is a decline. The balance between the subsystems of the economy is upset: innovations are far behind the production, growth of investment is behind the growth of savings, etc.

Fourth, the Russian economic system is a nonlinear system, as it is quite “sensitive” to some external factors. Its response to the external factors is not proportional to the force of the “disturbance effect” and is often unpredictable. Precisely this nonlinear system is chaotic. The behavior of a nonlinear system is difficult to predict – the system “reacts” to the disturbance of the condition in a very complex and usually ambiguous way. In general, only rigidly deterministic systems can be in a strictly steady state. It is interesting to note that in his time A. Bogdanov paid attention to the fact that “the stability of the complex depends on the minimum of the environmental effects or on the maximum of its own resistance.” (Bogdanov 2003)

Fifth, the Russian economic system is a self-organizing unified system, where the inner life and development should happen, first of all, and mainly on the basis of self-organization – spontaneous ordering (the transition from chaos to order.). The self-organizing system as a whole is the result of the movement and interaction of its elements and relationships. The main sign of the integrity of the system is the presence of integral properties not common for the individual elements of management, as well as the prevalence of stable internal relationships between these elements in the framework of the system above their external connections

(with other system elements) (Chelnokova 2009). In this situation the appearance of instability, uncertainty, the increased dynamic influence of the environment means that the economic system should constantly increase the number of different economic structures, which appear as a result of self-organization that can not only adapt to external living environment, but relying more on self-regulation, successfully solve their problems.

Note, that the capacity for self-organization have the only public, non-equilibrium and non-linear systems, in which the processes of self-acceleration can occur through positive feedback loops. Economic systems are indeed self-organizing systems. First, any economic system is a system of stream-type associated with the environment (natural, political, cultural) by flows of energy, matter and information. The state of equilibrium similar to the “heat death” cannot be reached for this system even in the stationary state, when nonzero flows pass through the system. Second, in any techno-economic paradigm the element of self-reproduction is originally laid in the form of manufacture of the means of production (Petraikov 2008).

The effect of competition is an important property of self-organizing systems. In fact, any ordered structure is the result of competition between unstable species. The surviving species suppresses other ones, and imposes the appropriate structure to the system. A new kind of species is the result of the dominant technology which is established as a result of the final selection – a new techno-economic paradigm with a specific institutional infrastructure.

The process of self-organization in the systems begins with random external influences (fluctuations) which in a nonequilibrium system are not suppressed, but rather are increased, and in the end, it led to the formation of a new dynamic structure. As a result of self-organization, based on the principle of negative feedback,³ the system establishes a new order, called spontaneous, because it does not arise under the influence of external forces, but as in a typical organization, and formed spontaneously due to internal reasons. A new equilibrium in the system is supported on the basis of the positive feedback (Dyatlov et al. 2007).

40.3 Economic Chaos in the Labor Market

Now we turn to the analysis of specific economic systems and try to consider how the order is generated out of chaos by the process of self-organization in such economic system, as the labor market.

³The principle of negative feedback shows how the spontaneously arising order is supported in the system, but does not reveal the mechanism of such an order, and the transition from one type of order or stage of development to another. For this it is necessary to use the principle of positive feedback, according to which the progressive changes that occur in the system, are not suppressed, but are accumulated and amplified. (Author’s note)

Labor market, acting as a self-organizing complex system with the diversity of its subjects and relationships, occurring inside them, has not been studied from the perspective of chaos theory.

The need of modern analysis of labor relations from the perspective of the theory of chaos has arisen due to the significant changes in contemporary society, both at the global level and at the level of individual countries. Development of information technology and the globalization of the economy have created fundamentally new conditions of functioning and development of public relations, giving rise to new and exacerbated old contradictions in such a vital area of human existence, as labor relations, particularly in times of economic crisis. Almost all social and economic conditions are reflected as if in the mirror of the labor market. Labor demand and supply, the unemployment rate depend on how well the economy operates, in which phase of the economic cycle it is, what is the behavior of the main actors of the market – the worker, the employer and the state.

In the labor market the economic order supposes that there is a system of elements at all levels of the labor market and these elements have stable, recurrent, regular links and economic relations. Economic order is achieved by the regulators of people and institutions designed to create good conditions for the development of social, labor and economic relations. The economic chaos appears as a set of economic elements between which there are no stable, recurrent relationships (they are intermittent), i.e. the chaos can be defined as a violation of the economic structure and the labor market in particular. The chaos in the labor market appears as violation of the norms of human behavior and activities in the organization, violation of labor discipline, as violation of sustainable economic performance, the fall of commodity-money relations, it leads to a conflict between supply and demand for goods, services, money, resources. The growth of chaos shows the existence of crisis in the society and the economy. During the chaos people are actively looking for different ways out of the crisis and are able personally to affect not only on the prospects of their lives, but also on the macro-processes in society. Therefore, chaos has a certain creative power, the ability to give rise to a new order.

The labor market is functioning as a system with a complex self organization and structure. Abueva E.L. considers the labor market is a complex and semi structured system (Abueva 2010). In fact, the labor market is a system with control and regulable process, and at the same time it is an abstract, open, active, dynamic and mixed organizational system. In some cases, the labor market is represented as the systems in the variety of systems: social and economic, economic and social, complex, very complex and super complex, well organized (structured), disorganized (semi structured) and self-organized. It is well known that the elements of the labor market are combined into “a whole” system due to the relations “purchase and sale” of labor between its owners and the owners of the means of production, as well as due to other interactions based on these relations. Structural basis of the labor market characterize the structure of the market, and include the most important of its elements and components ensuring the formation of the basic properties of the labor market. The main function is to maintain the structural integrity of the foundations of the labor market as a system. The basis for the

interaction of the main contractors of the labor market is the existence of economic relations, based on the laws and regularities. Ashmarov I.A. thoroughly classifies (Ashmarov 2009) basic laws, highlighting the universal laws of economics that are directly related to the labor market (the law of social differentiation of labor, the law of variation of labor, the law of labor saving, the law of distribution by labor according to productivity growth, the law of marginal productivity of labor or the law of diminishing returns, the law of marginal utility), general economic laws (the law of demand, supply, cost, unbalance, etc.), specific economic laws functioning in the labor market (Okun's law, the law of circulation of labor in the labor market, the law of correspondence prices to quality, competition law, etc.). The evolution in the labor market happens according to the above mentioned laws of development. The mutual transition of order to chaos results not only in a change of ties and relationships between the elements, but also in a selection of selective factors. That means that there occur new opportunities for building a new economic system in the labor market on the basis of transition "order-chaos-order." Some authors associate the transitional moments to the chaos with the crisis, instability, and other destabilizing factors.

Among the destabilizing factors that are the cause of chaos Kosals L. marks the instability in the economy: the closed nature and the disorganization of the federal government, the contradictions between the government and the regions, a growing number of disasters, accidents, the low level of protection of the population, deep stratification of the population, social instability (Kosals 1999). It would be logical to add such factors as shadow economy expansion in the labor market, hidden forms of employment, criminal spheres. The destabilizing factors affect the labor market, in particular and generate a response reaction for the formation of stabilizing factors working against the destabilizing effect, removing the social tension in society, and they do not let the society to go into a state of chaos. Such factors may include migration, increasing the social status, the right of free enterprise, the definition of the form of employment, the combination of the employment for population, distance-type employment, institutionalization (formal and informal) (Senokosova 2010).

V.G. Rodionov (2009) among other things pays attention to the growth in economic activity, leading to increased inertance of managed socio-economic systems according to the general rule: more weight – more inertia.

In this case, V.G. Rodionov notes that the increased frequency and strength of external destabilizing effects contribute to the rapid accumulation of internal conflicts leading to increased social and economic tensions, while the loss of stability is characterized as bifurcation and transition to a new trajectory of development. V.G. Rodionov notes one more destabilizing factor – globalization and scientific-technical progress, leading to a global reduction in the number of traditional jobs with continued worldwide growth in population. This is in the opinion of the author, is one of the most active factors shaping the global instability in the world in the form of a permanent reallocation of the number of jobs created and the surplus product. The most acute problems of this kind are in Russia. The excess supply of labor available in the country over the size of the labor force is the strong economic

factor to accelerate the growth of the population of Russia. Without solving this problem, we will not solve the pressing economic, social and political problems of the present and the future. As a result the parameter of employment becomes one of these “weak links.” Moreover, this imbalance leads directly to greater instability of social and economic systems. It is obvious that in the absence of jobs, economic and social system degrades and disintegrates.

In their tractates the representatives of the sociology K. Mannheim, T. Luckmann, P. Berger consider the value of social chaos in the context of the social disproportionality and the crisis of the rational forms of social life. The appearance of the lower social layers with the irrational claims of dominance increases social instability and leads to social chaos as an alternative to the rational organization of society. From this point of view the system of labor market can be destroyed from inside, so the elimination of social disproportionality and introduction the rational democratic planning in the community can minimize or neutralize the social chaos (not only the demolition of the order), and it can minimize the destabilizing factors affecting the social and labor relations generally. The perception of social chaos as a state of social life is determined by the choice of individual strategies to meet the basic necessities of life, or the realization of social and fixed positions, associated with conservation and transfer of social status, as well as development of their own codes of behavior. Social chaos in the labor market is legitimized through social uncertainty, the rejection of plans for the future, increasing the fears and anxieties of the society to the threat of unemployment. Although production and reproduction of social chaos are connected with social heritage and social and nostalgic syndrome, they are produced as a result of socio-structural disproportions, institutional defects of social life, the modifying of the crisis into regular “chaotic” practice, and into the distancing the majority of population from the state and into concentration of efforts on the social micro level. Also they are produced as a result of the lack of mechanisms of coordination the interests of social groups, the existence of marginal position, social uncertainty and lack of social perspectives of some part of population.

The intensive swinging of destabilizing factors in the labor market may lead for some time to a state of chaos that leads to system collapse. The main driving forces of this process are: a loss of a unifying idea of state development, as well as ethnic and religious differences, change in attitude to the means of production, natural and human resources, the differences in the ethical principles of social development, political beliefs, etc.

40.4 The Environmental Aspect of Chaos Theory

Analyzing the structure of the modern world we can suggest that the world is full of systems (financial, energy, trade, political, educational). Up to now, such systems were mainly within national states, but now they tend to merge into a single global system (Ilyinsky 2004). Here we can consider the trends of relations between a man and the environment.

Undoubtedly, alongside with the growth of the positive results in the development of the economy, there is a trend of growth in negative factors. An increase of human activity in the environment leads to the growth of pollution. Since the problem is not new, the economic system requires a structured system of elements that are designed to neutralize or minimize the results of economic human action.

But what is happening in reality is more like chaotic development, as the effectiveness of these elements of the system is under the question. So at the end of January 2013 Greenpeace (the international organization) published a report on “Point of No Return”,⁴ which presents 14 the most dangerous for the climate of industrial projects. These are the projects for the extraction of fossil fuel – as a source of energy for economic growth – the oil sands in Canada and Venezuela, deepwater drilling in Brazil and the Gulf of Mexico, the expansion of coal mining in the United States, Australia, Indonesia and the western provinces of China, shale gas production in the USA, expansion of oil and gas production in the Caspian sea, gas production in Africa, oil production in Iraq, launching of oil and gas production in the Arctic shelf. These projects are implemented by such companies as Shell, BHP Billiton, Peabody, Enbridge, Gazprom, Cairn Energy, Petrobras and BP, which are the industrial leaders in their states. And the focused actions of the economic policies of the state are directed primarily to create conditions for the development and maximizing the results of these companies, and in turn, lead to a synergistic negative effect of the economic system. It means (from the Greek. synergos – acting together) is a multiple effect, derived from combining parts into a unified system. Specifically, as a result of the desire of each country to reach the economic growth by 2020, the implementation of the 14 projects will increase carbon dioxide emissions into the atmosphere by 6.34 gigatons, that is by 20 % compared to current levels. This means that the governments will not be able to fulfill the undertaken commitments in the framework of the Kyoto Protocol in order to keep climate change within the 2 °C.

However, such an unstable state of the system – a necessary condition for its development. It may be noted that the elements of ecological and economic relations in industrialized countries have a more ordered structure. For example, to obtain the necessary energy in developed countries they use the rubbish and it has become a scarce resource long since. Swedish businessmen take trash as import goods from Germany and Norway for electricity production. In China they buy up the plastic and waste paper for recycling, and in Denmark and Sweden, – the raw material for waste utilization stations: so they produce so much energy that is sufficient for providing 17 % of homes. Annually in the world due to the waste conversion it becomes possible to produce 130 billion kilowatt-hours of electricity – about one sixth of the energy supply in Russia. From what is not burned they make packaging, bottles, clothes, mobile phones and much more. Only 6 % of household waste cannot

⁴http://www.greenpeace.org/russia/ru/news/22-01-2013_Davos-Tochka-Nevozvrata. Date of appeal: 5 Jan 2013.

be of use. This escalation in organizational system of the material world is the result of a new structure that brings an order which stands against chaos.

However, the energy that accumulates in other economies can break through the settled order at some moment, destroying the existing structure in whole or in part, and re-throwing the economic system into chaos. So according to the Federal Service for Supervision of Natural Resource Usage annually as a result of the livelihoods of people in Russia it is formed 35–40 million solid waste (200 million cu m.). At the same time in Russia less than 400 enterprises of sorting and recycling of solid waste are functioning, but the rate of accumulation of waste by 45 % higher than the power of these waste utilization stations, and about 18 million tons remain raw.

According to official data in Russia there are more than 13,000 of authorized dumping sites and more than 10,000 unauthorized. According to statistics, the majority of illegal dumps occupy land settlements. For example, in the Central Federal District (CFD), 68 % of illegal dumping sites (about one million) are located on the lands of settlements and cover an area of 250 hectares, 12 % (173 dumps by 14 hectares) – in water-conservation zones, 12 % (178 dumps by 103 hectares) – on agricultural lands, 8 % (123 dumps by 26 hectares) – on forest lands.

Today the country has 336 facilities for waste disposal. Among them there are 40 waste utilization stations for thermal treatment (incineration), 53 – for sorting purposes and 243 – for the sake of process industries. That is not enough. We do not have the industry itself. Moreover, the estimated capacity of existing enterprises is very low. To create a full-rate waste recycling industry, we need effective acts of state and investments of private investors.

The magnitude of the problem and the seriousness of the situation are obvious. And then there is the impendent transition of the economic system structure in the state of energy that can be the building blocks for the emergence of a new organized structure. The main thing is that the system should be able to eliminate the violation of stability, and irreversible processes, that fundamentally can change the system, would not lead to self-destruction of mankind.

40.5 Conclusion

Thus, any economic system in contemporary conditions is a complex, open to external influences, dynamically non-equilibrium and nonlinear system, consisting of a large number of interacting objects. The stationary state of such system is independent in time and is usually unstable: some deviations from these state conditions take place more often over time. In the instability conditions the small impact on the economic system can cause significant changes. The economic system is able to produce the order out of disorder and chaos spontaneously as a result of self-organization, where the chance plays the crucial role.

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Chapter 41

The Development of the Local Economic System in the Conditions of Predominant Power Economy

Elena Ogurtsova

41.1 Introduction

Nowadays, in the situation of constant social and economic changes, it is important to identify the main tendencies in the development of a large city. This task is dictated by the increasing risks of local economic activities as well as the growing inter-regional competition and the institutional dynamics of local economic systems. Along with the inter-regional differentiation economical and political influence of particular regions of Russia increase and the impact of various geopolitical factors becomes stronger. These factors make up a specific ‘outer frame’ of the local economic development. The estimation of the risk factors in the rapidly changing conditions, as well as the place of urban economy in the regional and national division of labor is both a challenge for local economic policy and an opportunity for its development.

At present, the ways of economic development of the large city are determined by a number of factors. Among them are: firstly, the structural changes in the regional division of labor that define the limits within which the municipal economy is able to be competitive; secondly, the nature of the modernization processes in the regional and national economy that create or, on the contrary, take away the opportunities for the local economic systems to develop successfully; and finally, the predominance of power economy that determines the ‘rules of the game’ in a local economic system including the distribution of expenses and profits among its subjects. While the former two factors are normally taken into consideration in the strategic plans for the development of large cities, the impact of the latter factor is usually overlooked. However, impact evaluation of power economy on the development of the local community, as well as the awareness of various risks it creates will help to work out a realistic economic strategy.

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41.2 Power Economy as a Phenomenon

Power economy is a complex phenomenon. On the one hand, it is the product of the risks involved in the interactions of the subjects of economic relations; on the other hand, power economy is itself a systematic risk.

One of the peculiar characteristics of the present day local economic systems is the departure of the ideological superstructure from its material basis, i.e. of the administrative functions from their subjects. This situation leads to the formation of a specific kind of 'administrative economy' – power economy in other words – with highly organized structure, its own interests and regulations. Power economy does not exist alongside with social economy. It is part of the modern economic system and is brought about by the risks of the interactions of economic subjects in the conditions where the administrative resource becomes an important factor.

The strengthening of executive power outside economy leads to the interfering of the governmental bodies into all economic processes including exchange and estimates. As a result, economic freedom represented by the freedom of enterprise, the freedom of consumption and the freedom of market competition is being restricted and economic laws are being ignored. In this situation, some subjects of economy are constantly imposing their will on the other subjects, emerging economic agents make social decisions and determine the social conditions of reproduction in their own ways. The isolated authoritative body forms its own interests which disagree with the interests of the society and often even contradict with them.

Power economy is a system of human relations concerning production, distribution, exchange and consumption of limited welfare and satisfying the needs of a limited number of subjects that engenders competition in the exercise of powers of authority. The competition produces the opportunity to gain economic welfare in any conditions through economic interaction among the subjects. In fact, these social-economic relations focus on their object – means of production and commodities – rather than the subject – a human being. One of the peculiarities of power economy is the high level of deliberate organization, though it has a few characteristics of a self-organizing system.

Authoritative relations have always existed in the society. However, until the middle of the nineteenth century, their influence on the economy was limited by its own nature. In contemporary economics the question of economic power was not even raised. Until a certain moment economic theory concentrated on researching the economic system based on the association of more or less equally powerful economic subjects. Adam Smith and his followers assumed that economic agents cannot influence the other agents or the social economic parameters (supply, demand and prices), or the whole economic system, other than through the influence on its own particular parameters (supply, demand and prices) in the course of free and equal exchange-and-estimate process.

At that period in Russia, authoritative relations were determined by the specific character of state organization – absolute monarchy – and by special heterogeneous

structure of the economy. But as early as at the end of the nineteenth century and the beginning of the twentieth century, power economy was favoured by new political conditions that were developing in Russia. The most important political premise was the destruction of absolute monarchy and the strengthening of bureaucracy along with the banishing of general public from participation in state administration. An important role in promotion of power economy was played by economic factors, such as the extended influence of government institutions, the strengthening of bureaucratic monopoly, the development of financial and credit systems in Russia.

A particular role of the State in economic processes that was supported by orthodox ideology and submitted to public interests declined by the end of the nineteenth century. Authoritative relations became more sophisticated. At the same time, the heterogeneous structure of Russian economy underwent certain changes. The tensions within the heterogeneous economy led to its simplification according to the prevailing tendency of the social-economic development. However, oversimplification destroyed the boundaries of the heterogeneous economic structure and brought about the development of the homogeneous structure, which, in turn, became another factor of the rise of power economy. Hypertrophied economic power became the formative basis of the developing bodies of authority.

In modern conditions the development of power economy is connected not only with the expansion of bureaucratic activities, but also with the positive dynamics of bureaucracy itself. In Russian economy the status, authority and rental potential of a civil servant's position traditionally depend on the budget of the department, the number of staff and the presence of subordinate structures. That is why civil servants' personal interests lead to the expansion of bureaucratic activities and the increasing influence of the political system on economic relations.¹ This tendency is more evident at the initial level of the society's territorial organization, in local economic systems where the unique resources for those territories' development concentrate, including natural resources, labor force, investment attractiveness, public enterprise activity and rental potential of the authority.

41.3 The Interaction of Power and Economy in National Economy

The influence of bureaucracy on economic processes is achieved in several ways: first, through the regulation of municipal consumption (decisions about the volume and structure of municipal purchases); second, through the policy of economic order (establishing average-term frame conditions for economic activities); and finally,

¹In the global rating data of the countries attractive for business activity provided by the World Bank, Russia is in the 112th position. According to field research of the World Bank, to open one's own business in Russia it is necessary to get through 8 bureaucratic procedures; it takes about 18 days. <http://russian.doingbusiness.org/data/exploreconomies/russia>.

through the policy of economic pressure exerting immediate influence on economic development. In the first two areas the effectiveness of the influence exerted by the authority on economy can be easily estimated, while the estimation of the result of the economic pressure is harder to achieve, because of the time lag and the possibility of influencing economic processes indirectly.

The interaction of power and economy in Russia leads to the extended influence of authority on economic processes. When power deeply penetrates into economy, power economy emerges.

It is important to remember that power economy is not the same as power in economy. Power in economy is regarded as economic authority of an individual subject, market power of a single group of economic subjects or economic power of governmental and social organizations.² An individual or a group of individuals has power over their property and possessions or anything they can influence through those possessions. At the same time, power in economy regards not only the relations between economic subjects and their possessions, although possessions realize the subject's power. Power in economy is exercised by a subject over other economic subjects in the process of economic interactions, e.g. making contracts. Moreover, political authority also has influence on economic processes. However, political power becomes economic power as soon as it starts interfering into economy. Whenever this kind of purposeful influence on economy is used to manage economic processes and create certain economic conditions, it is transformed into power economy, which produces further unbalance. Such a use of power in economy limits economic freedom of its subjects and produces economic risks.

²Economic analysis of power is produced by Social Economics, Institutionalism and Neoclassicism. The neoclassic approach defines economic power in quantitative terms, as a situation of inequality of the negotiation power of the participants of an exchange (Eggertsson T (2001) *Economic behaviour and institutions*. Delo, Moscow; Auzan A, Tambovtsev B (2005) *Economic significance of civil society*. *Econ Issues* 5:28–49). Institutionalism and Social Economics regard economic power in terms of interactions organization as the relationship, which determines any kind of interactions in an environment. For example, M. Weber defines power as ability of one individual (or group) to impose their will on another individual (group) despite the latter's resistance (see: Weber M (1990) *Selected works*. pp 636–643). Y. Osipov follows the evolutionist approach connecting economic power with the ability to purposefully influence economic subjects and economic life (Osipov Y (1998) *Theory of economy*, vol 1. MSU PH, pp 365–366). N. Luman regards power as a universal social phenomenon, emerging from the need to organize the interactions of the subjects who are to choose one of the options; he believes that power is the communicative means regulating the choice. (see: Luman N (2001) *Power*. *Praksis*, p 22, 42, 151). K. Menar demonstrates considerable differentiation of authoritative relations and, along with already established types of authoritative relations – imposed, disconcerted and concerted – singles out “hybrid forms”, based on the basic element of concerted relations – coincidence of interests (Menar K (2005) *Theory of organizations: variety of agreements in market economy development*. In: Oleynik A (ed) *Institutional economics*. *Infra-M*, p 205). Thus, Social Economics and Institutionalism reveal the meaning of power in economy better than other approaches; they define it as specifically organized interaction of subjects and regard it as interactive relationship determining every interaction in economy.

Thus, power in economy is not simply a purposeful influence on someone; it is not just the manifestation of the will of the subject who has power, nor the compulsion of some subjects by others. Power does not come to mere compulsion, which means “the renunciation of the advantages of symbolic generalization, and of control over the partner’s selectivity. In the course of compulsion, its agent carries all the burden of selection and decision-making” (Luman 2001) i.e. those who undergo compulsion are virtually incapable of making their own choices. The strengthening of compulsion may lead to the weakening of the power. On the contrary, a greater degree of freedom in any interaction, especially a greater number of options in the society, strengthens the power. In this case, the phenomenon of power is regarded as a particularly organized interaction of subjects that results in the limitation of options for the subject undergoing the influence. While it limits the options of an economic subject, power does not add certainty to the conditions of economic activity, but itself becomes a risk factor. Power controls the subjects’ selection and provides economic freedom. Economic power is the means of economy; the object of economy, its target; as well as the method of economic organization. Power economy can be regarded as the means, object and method of the specific economic organization of both power and economy.

The economic organization of authoritative relations depends on the distribution of power among the economic agents. Although all the agents have certain power, it is not distributed equally among them. Consequently, their power potential is unequal. Some agents are more powerful than the others. Inequality in power potential among the economic agents leads to the establishment of a hierarchy of authoritative relations based on the vertical principle of supremacy and subordination. Apart from the relations of the agents equal in character and degree of economic authority there are additional relations of the agents unequal in character and degree of economic authority. The predominance of the hierarchic order in economy leads to the prevalence of unequal relations among hierarchically subordinated agents and, in turn, creates the conditions for the development of power economy.

41.4 Power Economy at a Local Economy Level

The importance of authoritative relations in the organization of modern local economies points at the existence of power economy at a local level. It reflects the economic reality not only in terms of power and authority, but also in terms of their organization within a local community and its economy. At present, the economy of a city is permeated with hierarchically subordinating authoritative relations. This fact reveals the weakness of economic self-organization and the strength of authoritative management. Basal self-organization, typical of urban economy, is not merely supplemented with superstructure organization, which is manifested in conscious volitional influence on economic processes. It is partially replaced by the authoritative organization.

Power economy as the economic organization of authoritative relations on the local economy level has certain peculiarities. Within power economy, all social-economic relations are permeated with power so that it is impossible to single out their inherent property, and power acquires shady character. The external inducement joins the internal aspiration of an economic agent, which, having economic freedom, is being controlled from without. Power economy is based not so much on the institutional power organization as on the functional power organization, which means the interference of non-economic authoritative bodies into exchange and assessment as well as other economic processes, their invasion of economic freedoms (of market competition, of enterprise, of consumption, etc.) and the creation of additional risks in economic activities. The execution of economic laws also is conditioned by this power organization.

In the conditions of power economy, the administrative resource, which represents the quantitative aspect of power, becomes an economic benefit as the execution of authoritative decisions is impossible without the administrative resource. On the other hand, as it is not a natural resource like air or water, the administrative resource is limited and its obtaining entails certain costs, e.g. the cost of working time spent on receiving national and municipal services, the cost of individual time spent on searching for information and contacts in the municipal administration or on establishing communication with the authorities, the cost of consulting services on the questions of interactions with the authorities, the cost of assessing the lawfulness of one's activity, the cost of searching for information about the authorities and their policies, the cost of negotiating with the authorities, the cost of lobbying one's interests (including the cost of gifts and bribes) and the staff maintenance cost. The more developed is power economy the more important is the administrative resource in economic activities. It also becomes an important factor for the efficiency of production.

The peculiarity of power organization in modern local economies is the predominance of compulsion in economic relations, although authority and compulsion is not the same thing, as I have already mentioned. One resorts to compulsion whenever there is a lack of power. While the increase in freedom of interacting subjects leads to the strengthening of power, the power of those who have authority increases if they have more options for its realization. In turn, if those who have authority can use their power over other agents with multiple options, their power still increases. For example, in a local economic system, more options for economic activities and economic development mean stronger power of the local authorities.

The development of power economy at local levels is accompanied by the spread of compulsion within the authoritative system of the city economy and presupposes the presence of the "body of compulsion". Some researchers' assumption that municipality can be viewed as this "body of compulsion" is not correct. There is a distinction between the municipality as the exponent of the local community and the bureaucracy as the exponent of an individual or a group. The analysis of the social-economic development of Russian cities reveals that local policies during the period of the formation and development of market economy meet the economic interests not of local communities as a whole but of influential financial and industrial groups.

The analysis of social-economic development of Russian cities reveals that local governmental policies during the period of formation and development of market economy express particular economic interests of influential financial and industrial groups instead of those of local community as a whole. The currently predominant form of local economic structure can be defined as power economy since it is based not on economic self-organization but on purely authoritative organization. Economic freedom of self-organization is considerably limited by the compulsive organization of power centers: bureaucratic system, law-enforcement organizations, financial and industrial groups. Instead of organic combination of economic power and economic self-organization their discordance occurs which leads to contraction of self-organization sphere and hypertrophy of power economy.³

The predominance of power economy on local levels increases uncertainty and economic risks which reach their maximum in the situation where its corruption model is being realized.

The corruption model is characterized by the prevalence of group interests in social-economic policy for the development of a particular urban formation. The economic policy of a local government is realized in the interests of the authority subjects who lobby the interests of their affiliates. The possibility of receiving administrative rent determines administrative decisions. Authoritative relations are established in such a way as to result in redistribution of administrative resource, receiving administrative rent and redistribution of property. There are no clear “rules of the game” in economic sphere and ownership rights are unstable. Local economy becomes completely or partly isolated from national economy. Protectionism prevails in economic regulation. The corruption model caused the deterioration of the city’s social-economic development and the appearance of additional risks.

First, there is the risk of losing demographic potential of the city caused by the reduction in urban population (deaths exceeded births).

Second, there is the growing risk of losing personnel potential. Moreover, the city economy is mostly reinforced with unqualified labor while skilled personnel migrate to other cities. This particular risk mainly affects the innovative sphere, which is rapidly “aging” at present (on innovative enterprises the average personnel age of 45–50). This situation may lead to the risk of losing innovative potential.

Another serious problem for the development of the city is the low income of its citizens. The citizens spend up to 70 % of their incomes on food and other life necessities investing only 6.3 % into bank accounts and securities. Low income causes the risk of the fall in purchasing capacity and in retail turnover, and as the consequence, the risk of losing investment potential of retail trade and service sector.

³In Russia, most cities have authoritative organization of economy while in most developed countries mixed organization of economy prevails on the local level that presupposes flexible and natural interaction of all organizational aspects of economy: economic self-organization and power organization. This fact can be explained not only by the strengthening of bureaucratic authority which expresses group interests, but also by the weakness of the local community and municipal authority which expresses the community interests.

The predominance of power economy in the economy of the city has led to the risk of losing the city's investment potential. The particular risk is brought about by the low standard of living as well as the underdeveloped infrastructure in the city. The existing transport network organization of traffic, technical parameters and carrying capacity of the roads are substandard which leads to the growing accident rate, transactional expenses and, consequently, lower efficiency of all spheres of the city's economy, hampering the social-economic development of the city. The current funding is insufficient to provide for the building and maintenance of roads that will meet the national standards. Engineering infrastructure is depreciated as well as underdeveloped. Most of the existing capacities of electricity, gas and water supply do not meet modern requirements. The lack of reserves as well as the lack of opportunity to develop additional power capacities makes the city's economy less inviting for investors.

The analysis of the social-economic situation in Saratov reveals problems in all spheres of the city's economy – social sphere, housing and communal services, transport, and equipment with services and utilities – and exposes the low levels of investment potential of its economy. In 2010, the amount of investments into the fixed capital was 78,073 million rubles, or 30,440 rubles per capita. Low consumer solvency, financial resources deficit brought about by the low economies and real income, undeveloped economic infrastructure, lack of political consensus, high administrative barriers and transaction expenses, lack of liberal legal acts – this situation can hardly draw in investments. In the rating of investment climate of Russian regions conducted by the national rating agency “Expert RA”, Saratov region was given 3B1 category, which means low potential and moderate risk.

The negative economic dynamic of the area has led to the risk of losing “non-material assets” of the city, which include the established image of the city, its desirability as a residence place, creative activity of its citizens, emotional element of the city life, etc. Saratov has lost its attractiveness as a place of residence or/and business activity; the image of the city has deteriorated.

Sociological surveys⁴ reveal that the main problems of the local business development, as viewed by entrepreneurs, include “high level of non-market competition, arbitrary rule of natural monopolies” – 75 % (80); “corruption among civil servants” – 50 % (54); “imperfection of business legislation” – 48 % (51); “high levels of bureaucracy and poor organization of the local authorities” – 43 % (46); “being kept uninformed in civil, tax, financial and other types of legislation” – 40 %

⁴The survey, in the form of questionnaire, was conducted among 107 small and medium enterprises. 89 % (95 persons) out of this number were individual entrepreneurs, 7 % (8 persons) – limited companies, 4 % (4 persons) – stock companies. The spheres of activity of the respondents: wholesale/retailing – 78.5 % (84), construction – 14 % (15), freight services – 2.8 % (3), catering – 3.7 % (4), car service – 1 % (1). The enterprises have been in operation for 1–3 years – 30 % (32); 4–6 years – 26 % (28); 7–10 years – 10 % (11); more than 10 years – 34 % (36). The number of employees: less than 10 people – 59 % (63); 11–30 people – 25 % (27); 31–50 people – 11 % (12); 51–100 people – 4 % (4 wholesale/retailing companies); more than 100 people – 1 % (1 diversified enterprise).

(43); “lack of expertise among small and medium enterprises” – 21.5 % (23); “lack of support and considered economic policy in the region and city” – 21 % (22). 2 % (2) of respondents gave other answers.

Thus, imperfections of legislation, administrative, bureaucratic and other barriers, corruption, arbitrary rule of law enforcement organizations, high level of competition – including non-market competition – taxation drawbacks and heavy tax load, lack of accessibility of information and lack of information support from the authorities, undeveloped infrastructure, underdeveloped crediting and funding of local enterprises, all these are risk factors leading to the loss of non-material assets of the city as the consequence of the corruption model of power economy. Non-economic risks as well as economic risks accompany the development of the local economic system under the scrutiny, and their interaction may produce a synergetic effect – the risk of losing the system’s reproduction potential.

As the consequence of contradictory legislation, administrative barriers become one of the main negative factors for the corruption model of the local economy. These barriers lead to the situation where entrepreneurs owe not only to the state (tax, credit, etc), but also have to make illegal payments to various authorities in order to facilitate their enterprises. These payments raise transactional expenses of local enterprises two- or threefold bringing down their investment potential and competitiveness.

The realization of corruption model on the local level inevitably leads to increasing conflict between business and authority while the local economic system is in crisis, which transforms the existing model. On the one hand, the authorities keep their active position trying to preserve their influence on local economic development. On the other hand, the need to help the local economy out of crisis leads to its openness, the appearance of companies from other regions in the local market, and tougher competition. The authorities are forced to change the forms of their influence on economic processes. Within the local system under scrutiny, the existing corruption model is gradually transforming into “corporate capitalism”, presupposing close connection between enterprises and local authorities with interlaced municipal and business structures.

41.5 Conclusion

The analysis of the situation reveals that the stable social-economic development of the city within the existing corruption model is no longer possible. Taking into account the fact that power becomes stronger with increasing freedom of interacting parties, especially with increasing number of alternative options in society, it can be assumed that the development of democratic institutions – first of all, those of civil society – may neutralize the negative consequences of power economy. Society is in need of developing substitutes being conducive to the redistribution of power and themselves capable of becoming power factors. “The state must not become the only provider, but rather an assistant and regulator” (The World Development

Report 1997). The present form of economic and social structure is hindering the social-economic development of the city, and the changes have become inevitable.

The formation of various participation systems, associations, free unions that enable the entrepreneurs and the general public to participate in administration and self-government, lead to the diversification of power and its dissimulation in social-economic environment. The stimulus for independent subjects to participate in civil society is their wish to make the institutional environment “more comfortable” for their activity and existence.

The development of civil society institutions is the effective means of solving the growing conflict between spreading power economy structures and economic self-organization changing its shape, because these institutions are “hybrid” forms of authoritative relations (Menar 2005). They are based on concerted relations, the coincidence of the participants’ interests. The institutions of civil society are close to the ideal type of concerted authoritative relations that makes them different from other types of economic organizations. “Voluntary citizens’ participation in such organizations, i.e. doing unpaid or lower-than-normally paid work” (Auzan and Tambovtsev 2005), is accounted for by the coincidence of individual interests of the participants and the goals of the organizations: they agree to limit their freedom expecting that working together they will achieve their goals faster than working independently.

The expansion of concerted authoritative relations may strengthen economic self-organization and, consequently, neutralize the negative effects of power hypertrophy and the growth of power economy.

Civil society can be formed only as an alternative to the predominant model of authoritative relations: either imposed (corruption model) or unstable (competitive capitalism model) power. The advantage of civil society is in its ability to offer a new basis for the organization of interactions – concerted relations model. In Russia, however, both democratic parties and trade unions as well as consumers’ organizations merely reproduce the predominant models of authoritative relations being incapable of institutional innovations. Civil society will be able to oppose the spread of “power economy” only if it becomes a true alternative to both “the vertical line” of imposed power and expansion of market mentality and behavior.

The reformation of local economy presupposes the formation of open dynamic system, capable of perceiving “signals” from all spheres of social-economic structure of the society. It is necessary to involve all layers of society – business and non-commercial organizations – into the formation of economic policy, determining its orientation and economic regulation (Kuzminov et al. 2005). At the same time, it is necessary to reform social relations towards the revival of normal priorities. The use of political and economic capital must be combined with the formation of moral capital, so that moral criteria are used for the assessment of economic activity and decision making.

The formation of the civil society institutions will not eliminate power economy, but it will minimize the losses caused by its expansion and limit its manifestations. It also will help the formation of a mixed form of economic structure. Economy cannot abandon monopolist corporations, governments, or regulation in general, but

it can find new proportions between these structural components as well as new forms of their functioning. The formation of mixed economic structure leads to the development of organized self-organization, which presupposes the strengthening of each organizational principle with its cardinal opposition. The mixed form of organization does not deny the necessity for regulation of economic processes on the part of authorities, but it presupposes different mechanisms of influencing economy, which is unlikely to become less regulated and more competitive. It is necessary to create additional opportunities for the self-organization of economic subjects and their relations as well as the opportunities for the effective use of symbolic and emotional capital – non-material resources of the innovative development of the city.

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Chapter 42

Would the Organizational Commitment and Occupational Burnout Perceptions of Firm Owner's with 10–49 Employees Be High at the Same Time? Why Not? (Example of Ankara)

Sabri Çelik

42.1 Introduction

The era we live in is characterized by rapid changes. Work life becomes more and more stressful with this changing information, necessary skills, behavior patterns, attitudes . . . etc. Chaos and complexity as two vital terms of twenty-first century also shape the ideas, behaviors and attitudes of employers in terms of professional experience as a consequence those rapid changes. These effects can trigger the reasons that create burnout. The ones who lead to change in organizations are managers. This makes us think that the owner of firm whether they manage the company at the same time might be more tend to live burn out. It is also possible to express that their role of leadership may have an impact on this tendency as well. The most important effects of burn out are decreasing accomplishment, stopping going to job, behaving aggressive . . . And at the end as the indicator of low commitment people leave the job. So, in this study occupational burnout will be handled by the relation with organizational commitment in the age of complexity.

Though burnout is a kind of term that is described as “losing the energy in terms of both spiritual and phsycally” the studies that are built on the assumption of “it is the result of the interaction of the worker with working environment” makes this term perceived with both its individually and organizationally negative effects (Budak and Sürgevil 2005, p. 95).

There are many definitions of “burnout” in the literature. The one who argued “burnout” first time is H. Fredenberger in 1974. He and his friends defined it with these three dimensions: “exhaustion, loss of motivation and responsibility”. He stresses that it is a kind of energy lost felt when a person feel that he/she is overloaded with problems of other people (Lavrova and Levin 2006, p. 6). Another

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definition is done by Maslach. According to Maslach and Zimbardo (1982, p. 3) burnout is the “emotional exhaustion, depersonalization and reduced sense of personal accomplishment” that people live who has intensive relations with other people. “Emotional exhaustion” is a kind of mood that is shaped by the feeling of emotional overstrain and by a low energy. “Depersonalization” is the interpersonal side of the burn out. When a person feels emotional exhaustion he/she starts to communicate with other people in a negative or aggressive way (Lavrova and Levin 2006, p. 11). “Reduced personal accomplishment” refers to the decrease someone’s feelings of competence and successful achievement in one’s work with people (Maslach and Leither 1997, p. 298).

“Professional burnout” is about work life and described as a syndrome that happens because of non stop lasting stress and cause to exhaustion of emotional and personal resources of a working person (Lavrova and Levin 2006, p. 6).

Two main title defined as the reasons of burn out syndrome (Lavrova and Levin 2006, p. 8). Personal factors are “age, too high personal expectations, high level of involvement, selflessness and idealism, requirement of hard work, necessity of show opulence, being behavior oriented about achieving a goal, living problem about saying no, difficulties with responsibility delegation, being prone to give rather than take”. Other factors with the title situational are “uncertainty about the roles and social responsibilities, conflicts among functional desires, too much work, work execration, interpersonal conflicts, lack of necessary skills, resources, social support, gratitude, factors stem from the structure of organization”. These factors are benefited for deciding which variables to investigate in this study.

On the other hand, when the literature about “organizational commitment” reviewed many definitions can be seen like “an attitude or an orientation towards the organizations that links the identity of a person with organization”; “the strength of an individual’s identification with and involvement in a particular organization (Mowday and Boulin 1974)” (Karim and Noor 2006, p. 90). Organizational commitment is described after a comprehensive literature review -that cover these definitions too- as “component of the demand to stay as a member of the organization that someone work in, spending effort more than waited for the organization and the belief to the organization’ aims and values”. Also organizational commitment, reminds the feeling and interest of a person have about staying in the organization (Akbolat et al. 2010, p. 45).

The possible outcomes of organizational commitment are described as “employee retention, attendance, organizational citizenship and job performance”. These are the things that organizational commitment effect in a positive way.

There are several studies done to reveal the relation between “organizational commitment” and “occupational burnout”. In the study that is done by Maslach et al. (1987) high level of burnout is founded related with low organizational commitment. According to them the experience of burnout would lead employees to be less committed to organization and thus people would become more likely to quit the job. Sağlam Arı and Çına Bal (2008, p. 141) stress the effect of burnout on commitment. In another study which is done by Güneş et al. (2009, p. 475) to examine the relation between the public university workers’ organizational commitment and burnout

level, a negative relation is found between the variables. The study done by Kun and Hailong in 2009 with employees “emotional commitment” found related with the dimensions of job burnout in a negative way.

This study is done for fulfilling the aim of understanding the relationship between the perceptions of the firm owners about “organizational commitment” and “occupational burnout”. The problem question of the research is “Is there any relation between the perceptions of the firm owners about ‘organizational commitment’ and ‘occupational burnout’?”

42.2 Method

Model of research is survey. In this study, whether there is a relation or not between the perceptions of the firm owners about “organizational commitment” and “occupational burnout” is investigated in a way they are.

In this research with the firm owners who work in chosen sectors (Technologies of Informatics, Growing Up and Training Children, Services of Entertainment, Arts of Handmade, Food, Cloth, Graphics and Photographs, Beauty, Relations with Community, Vacation and Accommodation, Jewelry, Ceramics and Glass, Textile, Food Services) studied. There are 3,700 firms registered to Social Security Institutions (SGK) in Ankara which employees 10–49 people. Ankara is the capital city and the second crowded city in Turkey with average 4.5 million population and it has firms from different sectors that we handled in this study. 407 of these firms are working in the sectors chosen for this study and they generate the population of the research. The sample is created by choosing 11 % of all population in 95 % confidence interval and 45 firms generated the sample. There are 135 of firm owners (some of them are partners) in the sample. 135 of firm owners are reached and 125 of them supplied data. The distribution of the participants according to variables can be seen below;

- 12.8 % of the participants are women; while the 87.2 % of them are men.
- 9.6 % of the participants are at the age of “51–60”; 41.6 % of them are at the age of “31–40”; 48.8 % of them at the age of “41–50”.
- 1.6 % of the participants has “0–5” years of work experience; 9.6 % of them has experience “24 years and more”; 15.2 % of them has “18–23” years of experience; 33.6 % of them has experience “6–11” years; 40 % of the participant has “12–17” years working experience.
- 7.2 % of the participants graduated from master education; 17.6 % of them graduated from 2 year degree school; 75.2 % participants are graduated from license education.

In this study to understand whether data distribute normal or not Kolmogorov Simirnov test and to understand the homogeneity of variances Levene test are used. To evaluate the data “frequency, percentage, mean, standard deviation values and variance analyze, Mann Whitney U, Kruskal Wallis tests” are used. For under-

standing the meaning of means from the calculated “level ranges” benefited. Finally to determine the relation between “organizational commitment” and “occupational burnout” correlation test is done.

42.3 Findings and Discussions

In this part the findings, found from the necessary analyzes written in “method” part about the organizational commitment and its dimensions are going to be shared. Analyzes presented according to problem and sub-problems order. Analyzes shared by starting “organizational commitment” (its level and evaluations in terms of “gender, age, seniority, last graduated school” valuables); and go on with the presentation of the findings gathered from “occupational burnout” (its level and evaluations in terms of “gender, age, seniority, last graduated school” valuables); and ended with the correlation evaluation. The findings in this order as below.

According to the Table 42.1 there is a difference among the medians of the “emotional commitment” dimension of the “organizational commitment”. The perceptions of the women are higher than men about the “emotional commitment” dimension. According to this finding we can say that women are more prone to identify themselves with the organization that they work; to internalize the values and the purposes of the organization. They go on working in the firms, because they want to and they are volunteer to work for the benefits of company. But there is no difference among the medians of “normative and continuance” commitment in terms of gender.

No difference investigated about “emotional and continuance commitment” in terms of age groups.

Table 42.1 Mann–Whitney U test results that show the perceptions of the firm owners about organizational commitment in terms of age variable

	Gender	N	Mean ranks	Mann–Whitney U	P
Emotional commitment	Woman	16	83.19	549,000	0.016*
	Man	109	60.04		
	Total	125			
Normative commitment	Woman	16	60.03	824,500	0.723
	Man	109	63.44		
	Total	125			
Continuance commitment	Woman	16	70.63	750,000	0.360
	Man	109	61.88		
	Total	125			
Organizational commitment	Woman	16	71.53	735,500	0.312
	Man	109	61.75		
	Total	125			

* $p < 0.05$

When we assess the perceptions in terms of seniority variable we can understand from the Kolmogorov Smirnov test that all dimensions don't distribute normally, but organizational commitment has a normal distribution ($p < 0.05$).

42.4 Conclusion and Suggestions

The research results show that owners live “burn out” and “commitment” in a high level. We can say that this high level of burn out and commitment stem from economic crisis lived soon and rapid changes that happen in a world of chaos and complexity nowadays. The reasons for high burnout feeling can be the lacks about these skills: adapting to changing situations, effective communication with partners, taking immediate actions and producing instant reactions, being intuitive and being prescient, making use imagination and creativity, flexibility and comfort in operation. They are the operational dimensions of organizational intelligence (Potas et al. 2009, pp. 32–33).

As cited in problem statement part with the study done by Maslach et al. (1987) high level of burnout is founded related with low organizational commitment. There are many other studies show the same relation. On the other hand in the correlation test done for this study “organizational commitment” and “occupational burnout” found relatively in a positive way.

The researchers who are interested in these subjects can handle these topics with two different samples; one of them from public sector workers, while the other one is from private sector workers.

A comprehensive research can be done to understand which sector workers are more committed and which ones are living more burnout.

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Chapter 43

Ethics and Leadership

Nursel Yardibi

43.1 Introduction

Besides commitment, risk-taking, self-confidence, developing a vision and etc. features, leadership can be considered as a process which also attaches importance to ethical values. In other words, performing ethical behaviors is one of the other features that leader must have. Ethics is a discipline of philosophy which investigates the personal and social relationships that form the basis of people's values, norms, rules, right and wrong or good and bad morally (İnal 1996). According to another definition ethics is investigating what the good and evil, right and wrong is (Ural 2000). At this point, we can increase the number of definitions. The biggest problem of ethical theorists arises in defining ethics. Because defining ethics is likened to the efforts of pasting a slippery jelly to the wall (Ural 2000). Hence ethics is defined differently by different theorist.

In fact, ethics is treating people the way you want to be treating. As the idea of a philosophy it can be said that philosophers has been reasoned ethics for ages. As a result of these considerations, they have agreed that ethics has three basic dynamics (Morrison 2001):

1. Utilitarianism has been a popular means of modern times while evaluating the normative ethics. There is an idea on the basis of this: To maximize the expected usefulness for all elements affected by a decision and action.
2. Contractarianism is a form of thought which normative ethics is determined by impartiality. Impartiality consists of the environments where all participants have equal respect and reverence.
3. Pluralism is based on the obligation that individuals act spiritually and morally.

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The word ethics is derived from the word ethos which means character in Greek. The concept ethics derived from ethos has came up after investigating ethical laws and values by pointing at the ideal and the abstract too. Ethics is defined in the dictionary as ethics, rights, ethic philosophy, behavior standards, wrong and right behavior principles. Also ethics is defined as ethics science, behavior and relation rules, the diagram of ethics science (Balci 2001). In this mean, ethics is more philosophical and special than common ethical laws in society. According to Hutchings (2010) ethics is sometimes used as the equivalent of the word moral in everyday use. The main subject of ethical disputes is what makes human actions worthy or worthless in terms of ethics. What makes the action worthy is its creating and presenting the good. Various ethical theories define the good in a different way. According to different ethical theories, the good is happiness, delight, love, trueness and carrying out the duty. Ethics is a philosophical discipline that investigates the values, norms, laws of individual and social relations' base in terms of ethics like right-wrong or good-bad. Ethics is a right-wrong measurement as a simple definition (Pehlivan 1998).

Ethical awareness is a key condition for human survival and development (Pojman and Fieser 2012, p. 3). According to Akarsu (1998), trends of philosophers on human behaviors in terms of ethics reasons for that valuable or valueless can be collected into two main groups. The first trend; actions are valuable or not according to nature of the thinking fundamental to action. The second trend; an action is valuable or not in terms of ethics according to end or success of the action. The thing that makes the first action valuable in terms of ethics is the good opinion of the doer. The thing that makes the second action valuable in terms of ethics is its presenting the good. It does not matter what the person who performed the action thinks. In ethics, a rational framework which is consisted of kindness, honesty, justice, virtue, consisting of concepts such as crime and bullying is set up to help us to see the connections between certain types of acts and practices. And, based on this framework, general good and bad behavior rules are established. These rules are established through a social agreement (Haynes 2002).

43.2 Ethics in Leadership

Leadership in general is an activation process which organizes and coordinates people to do duties defined before (Başaran 1989). While the main purpose in classical leadership is increasing the yield, in modern leadership it is providing the workers needs besides these concepts. Within this scope, it is likely that leaders will come across various situations in terms of ethics. Ethical values and principles, laws and politics form a strong basis that tells what a person in reality believes and should believe (Aydın 2001). According to Ciulla (2004) ethics is the heart of administration. Administrator's improving his own ethical criterion re-quires to test his behaviors in a long period. After these values having been tested by the individuals, ethical behaviors added to each other is tested.

Adopting ethical behaviors must start in upper administration then it must be transferred in to intermediate administrators and spread into all workers of the organization. At work, the guarantee of saving ethical standards is owning high ethical values. In addition, workers are spreading their values rapidly by the help of their family and the people they are on the contact. They are also following up strictly. For this reason leaders should serve a good model. When you look from this angle, it can be said that education leaders can affect their followers as an authority figure. We can clearly say this is also for the relation between teachers and students. Today, legally defined and undefined connection in and out of the organization is so complicated that it has caused to come up new principles that helps workers behave fair, neutral and profitless. Here, at this point, ethical discussions have started.

The administrator's ethical understanding affects mainly his organizational decision and action. Within this scope Posner and Schmidt have presented these following results of administrators' ethical understandings in this study (Pehlivan 1998):

1. The main purpose of administrators is providing the organizational effectiveness.
2. Increasing the earnings to the top or increasing the investors' profit is not the main purpose of administrative activity.
3. Customers' participation is important.
4. Honesty is very important for all administrators of all level.
5. Pairs are the most important helpers of administrators in struggling ethical dilemmas.
6. Workers must be impressed on adaptation of organizational standards.
7. All administrators need others' advice for struggling ethical dilemmas.

There are some ethical values which provide a base for managerial ethics. We can say there are two bases of managerial ethics. The first one some ethical principles which provide a base for social ethics and accepted universally. For example not telling a lie, not thieving, honesty, maintain trust and give it back. Administration will be affected by the culture, customs and beliefs of the society it belongs. Minor differences may arise from society to society. Second one (mostly interest to administrators) is ethical principles that must be followed. For example, provide any material or spiritual interest from the beneficiaries of the service, protect public property, to fulfill the task by using all the physical and mental power, not to be interested with their specific jobs in working hours, to return the money, items and etc. embezzled him/her before.

Aydın (2001) has announced some ethical principles in leadership. These are: justice, equality, honesty and integrity, objectivity, accountability, human rights, humanism, commitment to the rule of law, love, tolerance, secularism, respect, frugality, democracy, positive human relations, openness, freedoms and rights, respect the labor rights, resist the illegal orders. However, Aydın defined the unethical behaviors in leadership as follows; discrimination, favoritism, bribery, intimidation, exploitation (abuse), selfishness, corruption, torture (torture), subservience-flattery, violence-print-aggression, mixing business relations policy, insults and curses, and physical and sexual abuse, bad habits duties and abuse of authority, gossip, embezzlement, dogmatic behavior and bigotry (Şen 1998).

In another analysis, Reitzug and Kowalski (1993) has been discussed leadership ethics in three parts. The first of these is leaders illegal, unethical, personal selections. For example, misuse of resources, sexual harassment, or conflicts of interest belong to this group.

Second is about leaders ethical choices related to professional subjects. For example nepotism, in order to avoid problems submission to the pressures of people, to be fired from job.

The last one includes the daily routine administration jobs such as; using power, shaping organizations and individuals, deciding on the correct values, prosecution of applied choices and use of power in a fair way. This point may not create immediate and dangerous responses compared to second group. However, problems may be continuous, and more common. They may also have more long term effects on the organization.

Based on the explanation above, it can be said that leaders behaviors carries great importance in organizations. Because they are at the top of the organizations which aim at production with correct behaviors and role model for their followers.

43.3 Conclusion

According to the literature review, besides commitment, risk-taking, self-confidence, developing a vision and etc. leadership can be considered as a process that includes the ethical values. In other words ethics or ethical behavior can be taught as a natural component of administration. In spite of the fact that there is a paradox on the definition of the ethics, it isn't difficult to say that ethics deals with moral values such as honesty, justice, equality, integrity, objectivity and accountability. From this point of view it can be considered as rational behavior to assert that these values are must of administration. Adoption of ethical behaviors must be start at the level of senior management and must be transferred to middle managers and disseminated to all employees of the organization. Leaders are role models for their workers, if they adopt the ethical behaviors, all the people in organization will have to do same. This can constitute organizational success as all these ethical values support the written rules as well. As a result, ethics and leadership are in-separable parts of organization. Although there isn't a written agreement between these parts, there is a natural process which hold these parts together.

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Chapter 44

Situational Leadership in Change Management for Different Generations

Buket Aksu

44.1 Introduction

Change . . . A magical word that creates positive feelings even when just mentioned. Human being is accepted to be inherently change-oriented (Değirmenci 2012). Heracles tried to express this with his phrase “you cannot step into the same water twice” and Heraclitus tried to express humanity’s process of understanding, comprehending and adapting the change with his phrase “Everything flows, nothing stands still”. Change in the human being’s life is a motion, but change in the work life leads to an innovation and creation. Regarding the change in the global world, besides resulting in a changing leadership understanding, also the employees have made more creative through trainings.

It is accepted that organizations are associated with the technological changes; the human being with the social and cultural changes and the products or services with the economic changes. When the change is examined from social, economic and political perspectives, it has been observed to have two basic and different departure points. The first group departs from the value judgments and education and asserts that for change to come true, firstly the cultural values must change. Accordingly, economic, political, social, etc. changes are related to the rationalization of the human behaviours and thoughts. The members of the second group link the change and development in the social dimension to the economic structure, production relations and capital accumulation (Eroğlu 1998).

In the companies, it is observed that the employees who are engaged in their jobs are more assiduous in order to keep up with change. However today, it is observed that companies are able to utilize only one third of the human resource at best

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Table 44.1 A workforce statistics related to engagement

Country	Engaged (%)	Not engaged (%)	Actively disengaged (%)
United States	27	56	17
Canada	24	60	16
Germany	12	70	18
Japan	9	72	19
Great Britain	19	61	20
Chile	25	62	13
France	12	57	31
Israel	20	65	15
Australia	18	63	19
New Zealand	23	64	13
Singapore	6	77	17

Source: Blanchard (2007)

(Blanchard 2007). Following are the percentages of the engaged, not engaged and actively disengaged employees, according to the findings of a research on workforce (Flade 2003) (Table 44.1).

Since no one voluntarily wants to change, change management can be a tiresome and demoralizing experience. However, when implemented appropriately under the supervision of a successful leader, change can be a reward or a motivator. During the realization of a successful change, it will be useful that many factors such as the corporate culture except the leadership, environmental consciousness, flexibility, creativity, communication and network, harmony and team work, creative destruction, objective viewpoint and vision dynamism are evaluated within a whole (Saylı 2012).

Furthermore, it shouldn't be forgotten that change is a process and it will be beneficial to internalize this process. During change process, one should be fixed about the results but flexible about the tools. The process of change starts with realizing the need. Afterwards, actions are determined and evaluated, the action is chosen and the action steps are carried out together with the employees. The engagement for change is proportional to own age of the individuals. However in any circumstances, it is normal that people will have concerns at every phase of change (Armstrong 2010). These concerns are evaluated under six main groups (Blanchard 2007):

Information Concerns: At the beginning of change, the people who are going the experience the change may suffer from information hunger. People may seek answers to the questions such as what is the change, why is it needed, what will be the differences from the current situation, how fast and how much will the organization change.

Personal Concerns: Generally, together with the relief regarding the information concerns about change, the personal concerns may get on the stage. In this case, people may seek answers to the questions such as how much will the change

impact them, what is in change for them, what will its wins or loses, whether they will find the time for change.

Implementation Concerns: The concerns may continue to exist even at the stage of starting implementation after the steps of change are taken. In this case, the concerns such as what do they required to do first, how they will manage the details, where will they receive help from, how the structure of the organization will change may appear.

Impact Concerns: As the change process progresses, although confidence level of the people increases, their concerns may not end. They may concern about if the demonstrated efforts are making difference, the level of progress, and if the things are getting better.

Collaboration Concerns: The collaboration concerns such as who should be involved, how the change can be better communicated, how they can work with others are the concerns related to the change process.

Refinement Concerns: As the change process progresses, the refinement concerns such as making the change even better, improving the original ideas are among the concerns which appear towards the end of the change process.

It will be beneficial if leaders have a good command of these concerns and at each stage, and answer these questions in full detail and transparency in order to minimize concerns (Blanchard 2007).

44.2 Leadership

Today, the concept of leadership should not be limited to influencing and motivating people. The leader is no more “the person who creates ideas” and the follower is no more the “executer” (Yılmaz 2011). It will be beneficial if leaders who shall manage the change must exhibit behaviours different than the classical leadership approaches. This is because people walking towards the unknown need hopeful and encouraging leaders (İzgören 2001). The effectiveness of the leader is found within the concept of “powerful leader”. Effective leaders may change the people and organizations, improve visions, increase the level of knowledge and understanding, clarify the goals, and make them in compliance with the policies and values. Consequently, this will have contribution in creating changes ensuring permanent and continuous improvement.

From past to today, leadership approaches have been studied in detail and various approaches have been developed. In the first researches on leadership, the personal characteristics and qualifications have been emphasized. According to the first theory developed, which is called the “Trait Theory”, “the individuals are born as leaders, they do not become leaders subsequently” (Sabuncuoğlu and Tüz 2008). This theory observes three types of effective leadership traits. These are the personality attributes (sincerity, decisiveness and self confidence), physical

properties (height, weight, appearance) and talents (intelligence, achievement and experience) (Yılmaz 2011). This theory, which explains the leadership process only by personal properties, has fallen short in time and been criticized (Koçel 2011).

Those who criticize the traits approach to leadership have emphasized the importance of the behavioural properties of the leaders during executing their duties and the attentions have turned to the behaviours. The Behavioural Leadership Approach has examined the effectiveness of the leadership rather than its emergence (Erdoğan 2007). There, two basic leadership styles have been mentioned, one oriented to persons and the other to tasks. It has been argued that, the task-oriented leader focuses on the technical aspects of the job and increasing the productivity and the person-oriented leader focuses on increasing the motivations of the people (Avcı and Topaloğlu 2009):

As a result of researches, situational (contingency) theories have emerged different than the behavioural theory. According to the situational approach, the good leader has become the one who can modify his/her behaviour pattern in line with the persons and goals and who can adapt to the conditions. According to this theory, which is also called as the contingency theory, the process of leadership differs circumstantially. The behavioural theory has mentioned the behavioural change but not explained under which circumstances the task and person oriented behaviours shall be effective. On the other hand, according to the situational theory, both types of behaviour can be equally effective under certain circumstances (Koçel 2011).

Paul Hersey and Kenneth H. Blanchard, being inspired by the Ohio State Studies, have described the leadership model developed within the framework of the Situational Leadership Approach as the duty behaviour identified as the task-oriented and the relationship behaviour emphasizing the relationships with the subordinates (Hersey and Blanchard 1998). In the task-oriented leadership, the leader informs the group members about the task and about the way of carrying out the task. On the other hand, the relationship-oriented leadership approach will help the leader to be in a more supportive position depending on the performance and attitudes of the group. Hersey-Blanchard, upon examining these leadership styles, have determined four leadership approaches (Blanchard 2007):

Style-1 The leader determines the goals, analyses the procedures and methods to be employed, identifies the tasks of the group members and delivers all details such as the time and the method for fulfilling the task,

Style-2 The leader is moderate and sincere in his/her relationships with the subordinates. He/she serves as a guide for the duties and responsibilities of the group members,

Style-3 The leader requires the group members take responsibility in making decisions and encourages them,

Style-4 In this model, there is little direction of the leader and he/she generally delegates the task.

Hersey-Blanchard, who have gathered the leadership behaviours under these four groups, have argued that the achievement level of the group members does not

only depend on the behaviours of the leader, but some situational variables are also effective. These variables are the technical knowledge and skills of the employees and their self-confidence and desires (Yilmaz 2011).

Hersey-Blanchard, according to the level of properties of employees required to accomplish a task, have mentioned the concept of Development Level (DL) in terms of subordinates' accomplishing their tasks by their own, their taking extra responsibility and their desire for success. The DLs can be examined from four basic dimensions (Zigarmi et al. 2004):

- *DL-1*, the employees have a low level of knowledge and skills required to accomplish organizational goals but their motivation is at a high level. The leader for these employees must use the Style 1 behaviour pattern for effectiveness,
- *DL-2*, the knowledge and skills of the employees are not satisfactory and they have low self-confidence. At this level, the style of the leader must be style 2 for effectiveness.
- *DL-3*, the group members have the knowledge and experience enough to reach the goals in line with the objectives. That is, although the job maturity exists, their eagerness to perform their tasks is inconsistent. The leader has to exhibit the 3rd style of leadership, which is more a behaviour oriented leadership pattern.
- *DL-4*, the group members at this level are ready to accomplish their tasks in all aspects. Their leader trusts in them very much and the style 4, which enables them to use initiative, is appropriate for this level.

In summary, the behaviour styles based on the DLs exhibit the following manner of change (Yilmaz 2011):

- High Task-Low Relationship Behaviour . . . for the DL-1 group
- High Task-High Relationship Behaviour . . . for the DL-2 group
- High Relationship-Low Task Behaviour . . . for the DL-3 group
- Low Relationship-Low Task Behaviour . . . for the DL-4 group

This approach of Hersey-Blanchard has substantial contribution to management science but still has some deficiencies that are discussed. The model assumes that the leader should exhibit flexible behaviours depending on the circumstances rather than exhibiting a single leadership pattern. It can be said that, the situational (contingency) leadership is one of the most popular leadership patterns today in terms of its practicality and its applicability to all situations of life including the government and company management (Mujtaba 2009).

44.3 Generations

As human beings, it is accepted that the sum of our experiences is what shapes us as individuals. Our gender, socioeconomic level, ethnicity, educational background and experiences are the determinants regarding our world perspectives and relationships. One of the most important factors that shape our perceptions and behaviours is the time we born and raised (Sujansky 2010).

For the first time throughout the history, today it is accepted that there are four generations sharing the same workplace. These are the matures (traditionalists/silent generation), the people who have born after the second world war (Baby boomers), Gen X and Gen Y (Millenials). Today, while one generation is preparing to retire, the other is just recruited. Thus, the leaders at multi-generation workplaces have a lot of tasks to do.

The leaders of a workforce consisting of four different generations have to take account these differences while developing strategies in order to be efficient. At the same time, it is useful that we also evaluate their carrier objectives, intelligences, educational backgrounds, skills and desires without considering the generational differences. Besides, accepted theories of motivation and performance management can also help. What are the work expectations of each generation? How they adapt themselves to organization? What motivates them? What disappoints them? These are among the points that should be considered while leading different generations. The 2nd World War generation, the “Silent Generation” has grew up in a period when authority was being respected. For them, the boss is “boss” and cannot be questioned (generally male). The employees of this generation are usually “hard-working, trustworthy and loyal”. They expect their workplaces to be well structured with definite rules. The “Baby Boomers” consisting of the people who born after the second world war has born during a social disturbance period and they are in trouble with the authority. They have clashed with many rules until they get a job and seek for new ways of executing things. This generation has seen job as an opportunity of success. The X Generation has born during a period when economy has partially enlarged and they grew up at the beginning of the new technology breakthrough. Since they started a job during the economic collapse, they witnessed most of their parents’ losing their jobs and carriers during downsizing and restructuring. Instead of following all or none approach in carrier management, they have tried to obtain a better work/life balance. The Y Generation, which born in the millennium, has own workplace expectations. The millennials have also witnessed that most of their parents lost their jobs and like the previous X Generation, they have to deal with increasing divorce rates. Still, they are accepted to have obtained many positive feedbacks from their parents and teachers. They are observed to be goal-oriented, eager to learn, competent in collaboration. When they start working, it is seen that they seek for opportunities (for all that, economic opportunities) corresponding to their images (Sujansky 2010).

The terms and even the chronological schemas are not yet standardized. In Table 44.2, different labels given to generations and the chronological schemas determined by the sources in the first column are given (Reeves and Oh 2012).

The generational differences based on several criteria have been compiled from Lancaster and Stillman (2002), and Blanchard (2007) and attributes related to personal, family and business lives are provided in the Tables 44.3, 44.4, and 44.5.

Today, together with coexistence of many generations in the same workplace, it has been more critical than ever for the leaders to adapt their approaches to the different needs of each individual.

Table 44.2 Generational labels and dates reported in different sources

Source	Generations			
Howe and Strauss (2000)	Silent Generation (1925–1943)	Boomers (1944–1960)	Xth Generation (1961–1981)	Y (Millennium) Generation (1982–2000)
Lancaster and Stillman (2002)	Traditionalists (1900–1945)	Baby Boomers (1946–1964)	Generation Xers (1965–1980)	Millennium (Y) Generation, Baby Busters (1981–1999)
Martin and Tulgan (2002)	Silent Generation (1925–1942)	Baby Boomers (1946–1960)	X Generation (1965–1977)	Millennials (1978–2000)
Oblinger and Oblinger (2005)	Matures (<1946)	Baby Boomers (1947–1964)	Gen-Xers (1965–1980)	Gen-Y, NetGen, Millennials (1981–1995)
Tapscott (1998)	–	Baby Boomers (1946–1964)	X Generation (1965–1975)	Digital Generation (1976–2000)
Zemke et al. (2000)	Veterans (1922–1943)	Baby Boomers (1943–1960)	G-Xers (1960–1980)	Nexters (1980–1999)
				Z (alpha) generation (1995–2012)

Table 44.3 Personal differences

Factor	Silent Generation	Baby Boomers	Gen X	Gen Y
Life period	Generation of the Second World War They have seen the birth of TV but they are the Radio age generation	The largest of the groups The television has dramatically affected their worlds	They got acquainted with technology more than others They witnessed the oil crisis, 68 events, make love no war period and boom of the cinema	It is the next boom generation They lived the Columbia space disaster and September 11. They became integrated with Iphone, iPod, and Playstation
Attitude	They have seen the world leader Ataturk and watched renowned persons such as Charles Chaplin, Frank Sinatra, Doris Day, John Wayne, etc. Respect to authority, adaptability, discipline	They have lived the human rights movements and influenced by Martin Luther King, Gloria Steinem, and Beatles Optimistic, they believe that they can change the world, participative	They saw that Bill Clinton, Al Bundy, Madonna and the likes hit the headlines Sceptical, very self-confident	They grew up with everybody from Prince William to Winky Tinky, Felicity, Marilyn Monroe, Venus and Serena Williams, and Britney Spears They feel they have the power to correct things when they go wrong

Overview	Disciplined, like observing rules	They believe in possibilities, try to create a positive difference for the world Like competition	Independent	They appreciate diversity
What they admire most	Hierarchy, discipline, order	Willing to take in charge	They accomplish without help The most misunderstood generation Endeavour to build organization	They are collaborative, do not like orders and solves problems pragmatically Follow the entirety concept
Communication	Dial phone, face to face, write note	Pushbutton telephone, "You can call anytime"	Mobile phone, "Only call my office phone"	Internet, video phone, e-mail
Money	Save money, pay cash	Buy now, pay later	They are prudent. They save and are conservative	Earn to spend
Rules and traditions	The rules and traditions are useful, they must be observed	The rules and traditions must be questioned, unnecessary ones must be removed	Explain me the reasons of the rules and traditions, I myself will decide to observe or not	I choose and observe the rules and traditions which sound plausible to me, you can observe the rest
Dressing	I wear as occasion requires	Dressing is important for success	Casual wear is the standard of everyday, not just of specific days	They wear casual dress from blue jeans to suits as a way of self expression

Table 44.4 Attributes of family life

Factor	Silent Generation	Baby Boomers	Gen X	Gen Y
Parent-child involvement	Having child is a must	Children involvement in the family decreases	Do not lean towards children involvement	Must be. But they want the children involvement is as much as they prefer
Family life	They dote upon family. They have lived with two generations	Controlled They dote upon during childhood	Treat it with scepticism They have been alienated in the childhood	They have been protected in the childhood
Work-family balance	Balanced	No balance, work to live	Balanced	Balanced

Table 44.5 Attributes related to business life

Factor	Silent Generation	Baby Boomers	Gen X	Gen Y
Work habits	Satisfaction is resulted from accomplished task	They are hardworking and seek to obtain personal satisfaction from what they do	They are global thinkers and are self-confident	It is important for them to be able to enjoy while fulfilling a meaningful task
		They believe in self development and growth	They want to balance the work life with other aspects of life	They are not dependent on to offices, everywhere with an internet connection is their workplace
		Their work lives have the precedence	They want to decide on their own when and how to complete their tasks	Their presence within the organization is not for the benefit of the organization but for their own development
		They are participative	They are inclined to be informal	
			They have a practical approach to work, they want to have fun at work, they are not formalist	
			They prefer to use the recent technology while working	
Level of trust in authority	It's important to have respect and trust for authority, leaders, and institutions	I question authority and hierarchy and advocate participative style	I am uncomfortable with hierarchies	We see leadership as a participative process
Technology	Technology seems good, but it can be confusing	Technology is important, but it's a challenge to learn	Technology is important for work and entertainment	It's hard to imagine life without it
Carrier objectives	It is important for them to work at corporate organizations, particularly at the public sector	It is important for them to have a brilliant carrier	They prefer a mobile carrier	They try to build parallel carriers

(continued)

Table 44.5 (continued)

Factor	Silent Generation	Baby Boomers	Gen X	Gen Y
Motivators	Want to work on exciting projects to prove themselves	Like being involved and asked for advice/opinion	Like to be rewarded with traditional perks, e.g., title, seniority, office	Like to be rewarded for work ethic and long hours
	Want financial gain and job security	Want to work on exciting projects to prove themselves	Appreciate flexible work schedule	Want to succeed immediately and see quick rewards
Job loyalty	Correlate seniority with age	Like being involved and asked for advice/opinion	Want professional training and development	Expect flexibility with when and where they work
	Find satisfaction in doing a job well	Like to be rewarded with traditional perks, e.g., title, seniority, office	Accept lateral job moves and challenging projects	Like frequent rewards and public recognition
Rewards recognition	Enjoy traditional perks, e.g., plaques, awards	Like to be rewarded for work ethic and long hours	Expect latest technology	Expect state-of-the-art technology
	Want recognition for doing a good job	Too much job changing would put me behind	Prefer freedom to pursue other interests at work	Job changing helps me find my dream job
Evaluation	I expect to receive a pay check for a job performed	I expect to get rewarded with money, title, better shift, seniority, corner office	I appreciate good schedule, time off, flexible hours, training opportunities	I appreciate flexible schedules and time for personal life
	Appreciate that I do my job well	They prefer to be evaluated annually based on written documents	“Pardon, how am I?”	“I provide feedback whenever I want” approach is prevailing
Major question	What shall I do?	What does it mean?	Does it work?	How can we do it?

Source: Adapted from: Lancaster and Stillman (2002) and Blanchard (2007)

Within the framework of Situational Leadership Approach, while implementing the leadership model of Paul Hersey and Kenneth H. Blanchard in the relationship or supportive position, the DLs of the individuals must be identified and besides determining the appropriate leadership style, the generation of the fellow workers must be observed to contribute to change steps significantly. If we exemplify the issue accordingly;

- *Silent Generation*: The experience of this generation's members origins from being in the business life for so long. They may need to be trained in new procedures and technologies. Traditionally this group is inclined to recognize the value of learning and development in terms of their benefits to the organization, thus they should be informed how acquiring new skills shall contribute to the success of the company.
- *Baby Boomers*: Since during early 1960s, when they began to participate in the workforce, the formalised education became widespread, this generation is inclined to regard the education and development good in terms of organizational objectives but critical for their carrier development.
- *X generation*: It is advantageous for them to start a job with an acquaintance with technology. They regard education as a resource to improve their skills and marketability besides its benefits to organization.
- *Y generation*: Since they are new in the work life, they may not be aware of what they don't know. But they learn fast thanks to their high level of self confidence and technological knowledge they possess. Like as the previous generation, they shall be more inclined to regard education as a way of improving their carrier development but they may need to be shown how their own development shall be harmonized with the common objective. They are likely to challenge to their leaders.

Good communication is a universal standard for all organizations and all employees from all generations must understand the "big picture" (Sujansky 2010). Therefore, if we consider the implementation example of change leadership style to different generations in a company which chooses to switch to internet system entirely for information sharing;

- *The Silent Generation*, was born in an era when communications were more based on the written communication tools such as the telephone, letter or note. They prefer written communication in official matters, therefore their DL in this example shall be DL1 and they need to start with the leadership Style 1.
- *The Baby Boomers*, besides using paper, have caught the e-mail communication. Therefore they are partially competent in internet usage, but since some baby boomers are DL2 and some are DL3, the beginning can be with Style 2 or Style 3 depending on their DLs.
- The *X generation*, with their advanced skills in mobile phone and computer usage, may not even accept the boundaries of the office. In this example the development level will be 4, therefore the subject shall be delegated to them and they may even be asked to provide leadership support to other generations.

- *The Y (Millennium) Generation* is the one with the best command of technology, therefore it is predicted that they will be very happy with such an implementation. Since they like team work, they may be asked to be supportive leaders just like the X generation.

If we deliver another example about face to face communication including the meetings, a different behavioural approach for each generation will be useful.

- For communication with the *Silent Generation*, delivering messages such as “Your experience is important for the organization and for our team . . .”,
- For the *Baby Boomers*, making suggestions such as “I value your job, I need your help for . . .”
- For the *X Generation*, giving the message “we need your opinions for this project”,
- For the *Y Generation* giving the message “it is an opportunity of working with the best team” can contribute to the motivation of all members for their participation of the project.

44.4 Conclusion

During changes, it can be thought that homogeneous teams shall produce fast solutions and can more easily keep up with change as a team, thanks to the similar thinking and working traits of their members. Besides, it is useful to remember that, the heterogeneous teams consisting of different generations may produce complex and sophisticated creative solutions due to synergy arising from their diversity.

In change studies of organizations, it is thought to be useful to consider the possibility of having four different generations of employees together in the same workplace.

Hersey Blanchard’s Situational Leadership Approach has huge contributions to management sciences. Situational Leader and the application of three skills of this approach, diagnosis, flexibility and performance, to changes in organizations can accelerate change steps and make the change to be implemented more easily.

Four styles of leadership approach implementations which result from relationship behaviour that is defined as business oriented and giving importance to task behaviour and relations with employees can produce more detailed models when generational differences are considered. After the development level of the individual is defined based on the level of the individual’s attributes which are necessary to achieve the task, it is useful to consider generational differences while choosing the style to be used. Differences between generations regarding individual, family and business lives and their big questions which will differ during the change should be considered by the leader and leadership behaviours should be arranged accordingly.

As a result, it is thought that the implementation of situational leadership, which has been seen to be useful to implement during the change at different stages till

today, by considering differences in organizations where four different generations work together for leader behaviour styles will have a huge contribution for the productive realization of the change for the organization.

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Chapter 45

Chaos Against Leadership in the Seljuks Era: The Case of Isfahan

Nurullah Yazar

45.1 Introduction

Instead of struggling with dominating states Samani State and Karakhanids, the Sultan of Great Seljuks Tugrul Bey directed his military forces to the west of Horasan Region where a strong authority do not exist. For the sake of this strategy, Tugrul Bey who rules Taberistan, Cürcan, Harezm, Kazvin and Deylem enhanced this ruling zone up to İsfahan. Because of many reasons such as economical, geographical features, Isfahan was defined as the junction of Fars, Cibal, Horasan and Huzistan regions (İbn Havkal 1939: 362). At the same time İsfahan was the centre of the state of Kakuyis which belonged to Buveyhis. The head of the state was Alaü'd-Devle Muhammed b. Rüstem Düşmanziyar (398–433/1008-1041-2), known as İbn Kakaveyh in the history, who was originated from Deylem. However the death of İbn Kakaveyh in Muharrem month.

(433/September 1041) opened the gate of ruling struggle among his children. The lack of authority in İsfahan took the attention of Tugrul Bey and he sent a military force to this city to find out the current situation which could be seen as preliminary group in 434/1042–43. The premier forces of Tugrul Bey gained many belongings from the towns of Isfahan (İbnü'l-Esir 1966, v. IX:509). Following this improvement Tugrul Bey, who realized that İsfahan wouldn't be able to resist to military attacks, moved from Rey to conquer this city (İbnü'l-Esir 1966, v. IX:509). Ebu Mansur, who learnt Sultan set out, sent some money to him expressing his dedication soon since he knew he would not be able to oppose. Thus Ebu Mansur did not let anyone question his authority over the city. As Tugrul Bey who captured the city without using weapon achieved his goal, he abandoned invading the city and led his direction to Hamedan which was under the control of former ruler Ebu Kalicar Gerşasf who had been getting tax from İsfahan (İbnü'l-Esir 1966, v. IX:509).

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Ebu Mansur, the ruler of the city, had turned moving according to the balances to survive politically into a tactic. Therefore he sometimes revealed his didcation to Tugrul Bey, and sometimes he took part in Melik Ebu Kalicar's side, the ruler of Büveyhi (İbnü'l-Esir 1966, v. IX:562). After he quelled the riot of his brother İbrahim Yınal, Tugrul Bey who wanted to end the inconsistent policy of Ebu Mansur surrounded the city second time turning his direction to İsfahan with a sudden move (İbnü'l-Esir 1966, v. IX:562).

Due to the impassiblensness of doing agriculture in the city during siege, food problem started. Besides, ending of basic needs also made the situation harder. Such that some people removed the wood parts of Great Mosque (İbnü'l-Esir 1966, v. IX:562–563; Ebu'l-Fidâ, 1286h, v. II:178), others who had the chance moved to Kuhistan, Huzistan and Şiraz (Gürgânî, 1314hş:23).

The hard living conditions in the city caused to disagreements among the residents of the city. Particularly the important local actors of the city went into the effort of preserving what they already had instead of attending to the defence (Guedy 2010: 72). Ebu Mansur who realized that he could not oppose under these circumstances handed over the city to Tugrul Bey in Muharrem 443/May 1051 after the siege (Zehebi 1993, v. XXX:8) which took for 1 year (İbnü'l-Esir 1966, v. IX, 562–563).

45.2 Findings and Discussions

The rulers of Great Seljuks took many precautions and implemented them to make the people happy from the point of political, economical, science and architecture soon after they captured the city. We can reveal what Seljuks Empire did for the city as below;

45.2.1 Political Activities

Although he didn't reside in Esfahan, Alparslan behaved the city community warm-heartedly and the community came into his presence whenever they had a complaint about the actions of the statesmen and the notable men of the society. And Sultan dealt with public's problems closely and ordered necessarily so as to solve. Sultan's sincere attitude towards citizens strengthened people's dependence on dynasty. Thus Alparslan who trusts the city's strength and public's dependence on religion, chose Isfahan for crown prince Melikshah's residence (Hünerfer 1971: 56).

Whenever Alparslan departed through Isfahan, he warned his soldiers not to give damage to the city again and again. Nevertheless, if one of his men was accused by a very little cruelty, he punished him without exception even if he was one of the closest men to him or one of the premium soldiers of him (Maferruhi: 102).

Alparslan aimed to limit his soldiers' damage on community by reducing the duration of staying at city. But the soldiers were not the only thing about which the community complained. In addition to this, people in Isfahan were also complaining about the taxes set in this period. When the Isfahan public told the Sultan about the administrators' bad behaving and the injuries they caused, he became very sad and he warned some of the damaging people orally and he punished some of them. Then by calling the administrators of city and the taxmen, Alparslan ordered them not to take much taxes from the citizens (Maferruhi: 102; Avi 1328hş: 98). We can evaluate Alparslan's those implementations as the ones in order to set up the faith to the dynasty and provide the support of citizens.

45.2.2 *Economical Activities*

Diplomatic strengths and stabilities of governments are in direct proportion to their economic situations (Gür and Akbulut 2012: 297). The political authorities which provide the needs of citizens and make them feel happy lead their countries more comfortably. The Seljuk sultans who were aware of this case didn't avoid any devotion for the sake of providing all kinds of peace of the public. Before Isfahan came under Seljukian domination had been siege for more than a year. During the siege, economical activities in city came to a stopping point. With the consuming of basic necessities, supply demand equilibrium was destroyed and that situation caused rising of the prices too much. Tugrul Bey from whose politics we understand that he was aware of the crisis at that time, commanded not to take tax from citizens after getting the control in the city in order both to create a closeness with the community and to get rid of the destroying effects of siege on city economy (Nasır Hüsrev 1381hş: 166). In this way, by drawing a positive portrait in citizens' minds about Seljukian government; in the meantime, he determined an upgradable economical policy. This policy showed its effect in a short time and the negative marks of the siege was completely wiped away.

Moreover, Tugrul Bey commanded Ebû'l-Feth Muzaffer whom he entrusted the management of the city to rise the welfare level of public and make everybody merry (Gürgani 1314: 19–20). And Ebû'l-Feth regulated agriculture and stockbreeding first so as to solve the food shortage in city. Because of this, he recalled the villagers to the city who left during the siege. He behaved well the ones who returned and hosted one by one; then he gave back the lands they had left and also gave the cattle to them (Gürgani 1314: 23) Besides, he helped the citizens with the fowl and the grain (Ağacanov 2006: 121; Guedy 2010: 108).

A year after the city had passed into the Seljukian domination, Nasır Hüsrev came to Isfahan and confirmed the situation explaining that he had not seen such a beautiful and prosperous city as Isfahan among the cities in which Persian was spoken (Hüsrev 1381 hş) Stabilization of economical life affected the city population, too. Hence, the people who left the city during the siege returned after the refreshment of economy (Nasır Hüsrev 1381hş: 167; Ağacanov 2006: 121).

Two events which are rumoured to happen in Melikşah's period have the characteristics of being evidence of economical strength of Isfahan in this period. According to the first rumour, Sultan Melikşah wanted a big amount of Money from the community defining that the government was in a bind economically in order to learn their financial level. An old woman learning the real reason wrote a letter to Sultan and proposed to give the whole money needed. According to another rumour, in Melikşah's period the citizens became so rich that they wanted to sprinkle water to the front of their houses by a golden cattle (Mirjafari 1999: 623). There may be some evaluations about the realities of these events, even they may be thought as exaggeration. But instead of this, we believe that we should focus on the messages or the main idea the events give.

As a result, during the Seljukian period till the death of Melikşah, Isfahan had various sources of income economically and was an extremely wealthy city. It is clear that in this period there was no financial difficulty in city, people had more than they needed and live luxuriously. The characteristics the city had made it one of the most important attraction centers of the era.

45.2.3 Scientific Activities

Seljukian Dynasty dealt with the education of community as well as the economical and political construction of Isfahan. Activity of establishing madrasah started with Nizamülmülk spreaded out and many dynasty members and statesmen especially the sultans established educational institutions in Isfahan as in all across the country. Sultan Meliksah set up a madrasah, too (Hinduşah 1978: 282).

That the madrasah would be given to which sectarian became a current issue when madrasah's endowment was being arranged, and Sultan got the madrasah built in a system which each sectarian could have education in order to prove that he didn't discriminate among his citizens and the Seljukians had equal distance to every sectarian. Thus, he adopted a policy intended to break the sectarian fanaticism attempting to show that different sectarians could live together; his aim was to protect the balance in Isfahan, the capital city of his country and to prevent the sectarian quarrels as it was before the Seljukians. By this way he aimed to avert a negative situation that would cause the wreck of the peace and safety in city.

45.2.4 Zoning Activities

When it is considered that the Seljukians' effects on the geography they live, it seen that their effects on Islamic world were not only limited with diplomatic and military fields, but also with artworks they create and culture and civilization they produce. The effects of Great Seljukian Empire which marked the period they ruled on art and zoning were so deep that their period was named as The Seljukian Period even

in Islamism it was named as The Second Classical Period (Cezar 1977, p. 281). We see most of the most important samples of these wonderful art and zoning types presented in Isfahan. In the city the productions of that period are so important that it is recorded to be enough see the beauties in Isfahan to understand The Great Seljukian Art even if we don't see the other productions in Iran geography (Özyurt 2005, p. 6).

Sultan Tugrul Bey started a large scaled zoning activity with the beginning of domination in order to wipe the negative shadows of siege on city architecture within nearly a year from the date Muharrem 442/May-June 1050. He spent about 500,000 dinar for the restoration and reconstruction of the buildings damaged in that period (Maferruhi, 101). In Alparslan's time, urban transformation in city continued and many important productions were brought to Isfahan. Sultan said that those productions showed the wealthy of the state and the aspects of importance they gave to city (Bundari 1943, p. 48). The real development of Isfahan in The Great Seljukian Period was in Melikşah's time (Ravendi 1921: 131–132). The Sultan used nearly 2,200,000 dinar for the city be equipped with architectural productions (Guedy 2010, p. 91). After all these works we can define a total zoning operation, every part of the city was reclaimed with many new buildings, particularly mosques, prayer rooms and minarets (Reşidü-d Din 1960, p. 49). Hence after these public works activities, Isfahan became a glorious city with wide and affective houses, wonderful palaces with pools and stalls, maidans, gardens and parks (Maferruhi 83; Avi 1328hş: 53) and also became one of the most modern and the biggest cities (Nevevi, v. III: 18).

45.3 Conclusion

As a result, when we look at Isfahan between Melikşah's death and interregnum, we can say that it was a merry and peaceful period with cosmopolitan, multicultural, multilingual structure, economical prosperity and high level scientific environment in consequence of the view of dynasty to public and geography they ruled and extremely capable statesmen.

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Chapter 46

The Contribution of Religious Teaching to the Development of Leadership Skills

Tuğrul Yürük

46.1 Introduction

Societies felt the need of a leader who would lead them in almost all periods of the history and chose a leader among themselves. It is accepted that as well as the leaders who come out of a society have inborn leadership skills, they are also able to develop their skills afterwards. In other words, leadership can come true with inborn acquisition or can be gained later. Most of the time, both of the situations interrelate. The ability which already exists come out of education. Because the aim of education is to improve the individual from all aspects. Thus, improving the leadership abilities of students is among the objectives of education. Decreasing relation of leadership with personal characteristics and personal charisma has recently extended the idea that leadership can be learnt (Özden 2012, p. 90).

The Science of Religion Education is a descriptive discipline as it attempts to analyze and describe religious dimension of the reality of education by doing scientific studies. Besides, it presents a normative characteristics by studying what is possible and what should exist (Tosun 2012, p. 84). The discipline of religion education or Religion lessons can also be thought as the reflections of The Science of Religion Education into the practice at schools. From the point of practice, teaching religion may include both descriptive and normative characteristics like the Science of Religion Education. In this sense, the issue that what kind of relation exists between religion education and leadership is becoming more and more important. Since, freethinking and free-behaving are among the most obvious qualifications of individuals who have leadership qualities. Beyond supporting improving leadership qualities, a discipline which has both descriptive and normative aspects such as Religion teaching can be assumed that it can prevent improving these qualities.

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Actually as it can be aimed to make the students acquire the reality descriptively, it can also be aimed that students normatively gain the knowledge which is assumed true. In this sense, it can be stated that the religion teaching at school is constituted of teaching disciplines which consists descriptive and normative aspects that are included in the science. When it is accepted that all courses in the curriculum of school as well as religion teaching have common objectives such as training students, preparing them to the society and teaching the morals of the society, the normative aspect of school will have been revealed (Selçuk 2000, p. 207). Education theories that claims inborn qualities of people are restricted at school and object to school also focus on the negativeness of the normative dimension of school and defends that this dimension restricts students (Illich 2000). Within this scope, the main problem of us in this study; to determine *that religion teaching (Course of Religious Culture and Ethics) contribute to leadership qualities or not since it is a normative field.*

46.2 Objective

Education and schools as important tools of education aim to enable to improve students' physical, mental, spiritual etc. skills. These skills are strived to gain students through some teaching fields at school. It is targeted to improve various skills of students in the Course of Religious Culture and Ethics as in other courses at school. The main objective in this study is to reveal which leadership skills have been included to what extend in acquisitions and in the activities to gain those acquisitions in the curriculum of the 6th, 7th, 8th grades in the course of Religious Culture and Ethics. Besides this main objective, it is aimed to contribute to further curriculum development studies related to Religious Culture and Ethics by revealing the missing parts of the curriculum on improving leadership skills.

46.3 Method

Different definitions of leadership are made, and different types of leadership are mentioned (Ogurlu 2012; Siewiorek et al. 2012; Begeç 1999). In this case different ideas about the qualities of leaders and the skills they have to obtain are introduced.

In this study, 'Scale of Leadership Skills' of Ogurlu and the skills he determines as leadership skills are based on.

The Scale of Leadership Skills' is an adapted one which was developed by Ogurlu as a consequence of investigations on different scales. According to results of the main components in 'the Scale of Leadership skills', it is seen that the items of scale are gathered in ten factors. The value of each factor is found over 1. Ten factors express 54.81 % of the total variance. As a result of factor analysis the loads of factors are between 0.38 and 0.85. According to these results, it has been

decided, with the agreements of the experts, that it will be meaningful that the scale is accepted as the ten-factor in the sense of naming the factors. Ogurlu named the ‘The Scale of Leadership Skill’ which he developed for 6th, 7th and 8th grades in primary schools as ‘problem solving’, ‘group dynamics’, ‘shyness’, ‘setting objective’, ‘empathy’, ‘leadership’, ‘anger control’, ‘determination’, ‘creativity’ and ‘oratory’ (Ogurlu 2012, pp. 72–74). In the study, it is studied parallelly to the ideas of the researcher that the acquisitions and how much the foreseen activities for these acquisitions come true in the curriculum of 6th, 7th and 8th grades in the course of Religious Culture and Ethics contribute to improve the leadership skills regarding the evaluated ten factors. Therefore, the study is restricted with the personal findings of the researcher in terms of evaluating the sample activities and acquisitions prepared for 6th, 7th and 8th grades in the course of Religious Culture and Ethics and Ogurlu’s Scale of Leadership Skills from the point of stating the leadership skills.

46.3.1 The Place of Acquisitions, Activities and Skills in the Curriculum of the Course of Religious Culture and Ethics

In the theological approach that The Course of Religious Culture and Ethics reveals, it is expected students do not only imitate their current knowledge but also gain searching, questioning and interpreting (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010, P. 12), in other words get freethinking and free-behaving skills in the sense of belief. Gaining these acquisitions does not come true with a rote-learning and conveying learning process. For this reason, the approaches which trigger the learner such as ‘constructivism’, ‘multiple intelligence’ and ‘student-centered learning’ have been internalized (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010: 9).

Acquisitions are among the main components of constructivist approach as well as the curriculum of the course of Religious Culture and Ethics. The acquisitions in the curriculum have been written considering the subject coherence with concept, values and skills (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010, P. 18). The activities are one of the most important components of the curriculum since the acquisitions will be gained through the activities. In the curriculum, it is stated that the activities should be enabling the interaction and communication between students and students and teacher, asking each other open ended and meaningful questions and doing research (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010: 19).

While adapting the activities, it is emphasized that activating students, considering individual differences, revealing students’ preliminary knowledge, promoting

alternative thoughts, giving opportunities to use just constructed knowledge, making the learning environment similar to real life, focusing high level cognitive activities, supporting the interaction of students' with their friends and teachers need to be cared (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010: 26–27).

'Case study', 'interpreting', finding the ideas in the background', 'finding slogan', 'preparing poster/brochure/ads', 'writing poem-story', 'making visual images', 'ordering to the importance line', 'classification', 'giving example', 'predicting', 'doing puzzles', 'dramatization', 'giving advices', 'comparing', 'problem solving', 'interviewing', 'field trips', 'making concept map', 'brainstorming' and 'acrostic technique' were included among the sample activities in the curriculum (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010: 27–28). Besides the activities stated here it was declared that more different activities could be done in the context of applications such as 'doing empathy', 'evaluating', 'simulation', 'relating with daily life', 'taking notes', 'searching idea', 'observation and formulating', 'collecting news', 'comparing to previous ideas', 'relating to what s/he knows', 'preparing a file', 'completing story', 'hand-out', 'collecting', 'preparing annual book', 'thinking vice versa', 'signing contract', 'pantomime', 'listing what is learnt', 'project', 'releasing newspaper' and 'rewriting' (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010: 28). What is meant as 'skill' in the curriculum is the skills that the students will acquire at the end of the year and on 8th grade which is the last year of primary education and they will be able to use in the rest of their life. The acquisitions are designed so as to gain and improve these skills (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010: 20). As long as the grade of class get higher in the curriculum, the depth of concepts and values raise and the range expands. The Course of Religious Culture and Ethics cannot be said enough itself in acquiring the skills. Other courses and disciplines also aim to gain these skills. Relating curriculum to the other disciplines is quite important in terms of the coherence of the skills to be gained, concepts and values. Thus individuals who gained the basic acquisitions will be grown with the support of all subjects and disciplines at the end of the teaching process (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010: 70–71).

Those are included among the basic skills which will be gained to students: 'Using Turkish correctly, effectively and well', 'the ability of communication and empathy', 'the ability of problem solving', 'research skill', 'the ability of using information technologies', 'the ability of perceiving the persistence and change', 'the ability of understanding place, time and chronology', 'the ability of social participation', 'the ability of using the meaning of the Koran'. The ability of understanding the meaning of the Quran takes part in the field of interest of religion teaching. Because the holly Quran is the most basic source that can be reached to basic knowledge and the ability of students of improving understanding the meaning of Quran has a vital importance in the sense of setting their own religion conceptions with their active participation (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6,

7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010: 45, 58). Besides these skills, gaining the ability of getting, using and producing information with the effect of fast growing science and technology is stated as indispensable in the curriculum. It is emphasized that the acquisition of these skills will be possible with an education process based upon information production. Without a doubt, to be able to come true the education process which is planned to gain terminal behavior the students need to acquire high level cognitive skills such as;

- Realizing, ordering, classifying, questioning, interaction, matching, guessing, analyze-synthesize and evaluating
- Searching the information, interpreting and constructing in mind,

Expressing himself/herself, communicating, cooperation with friends, discussion etc. (İlköğretim din kültürü ve ahlak bilgisi dersi (4, 5, 6, 7 ve 8. sınıflar) öğretim programı ve kılavuzu 2010: 2).

46.3.2 Leadership Skills and Curriculum of Religious Culture and Ethics Course

Amongst the abilities primarily included in the curriculum of Religious Culture and Ethics Course are ‘the ability to use the meaning of the Quran, the ability of using Turkish correctly, well and effectively, the ability to sense time, place and chronology, social participation skill, problem solving skill, critical thinking skill, perceiving the change and permanency, communication and empathy skill and the ability of using information technologies.

Determining to what extent the skills aimed at the curriculum of Religious Culture and Ethics are included in the curriculum can be an indicator which skills’ improvement are emphasized more. The number of skills given in the units according to the expressions in the Table of Acquisitions, Activity Samples and Definitions in the curriculum of Primary Level Religious Culture and Ethics are below:

Research Skill: 16

The ability to use the meaning of Qoran: 15

The ability to use Turkish correctly, well and effectively: 5

Perceiving the time, place and chronology Skill: 11

Social Participation Skill: 11

Problem Solving Ability: 10

Critical thinking Skill: 10

The ability of perceiving the change and permanence: 9

Communication and Empathy Skill: 8

Using information technologies: 1

‘Research Skill’ is included least and ‘the ability of using Information technologies’ is included most in the curriculum of Religious Culture and Ethics Course.

When the percentages of inclusion in the curriculum is analyzed, it is seen that the skills related to the cognitive development of students are included more. The mostly cognitive abilities in the curriculum are the abilities of Searching, using the meaning of Koran, perceiving time, place and chronology, solving problem, thinking critically and perceiving change and persistence. The total number of these abilities in the curriculum is 71. If you think that the total number of the abilities is 96, this situation will shape clearly. From the point of the development of leadership abilities, besides cognitive abilities, auditory and kinesthetic abilities are important too. That's why, it is seen that the rate of auditory and kinesthetic abilities is a bit less in the curriculum from the point of the leadership abilities. At first it can be thought that using the meaning of Koran among the abilities in the curriculum cannot be related with the leadership abilities. But with this ability it is aimed the students to set their own religious sensibility by their active participation, and that is one of the main targets of the curriculum. This is also important to develop independent thinking and behaving ability which is one of the most important qualities of leaders. In the explanations part of the units "The Ability of Using Information Technology" is expressed just once. The Ability of Using Information Technology is an ability which the individuals- especially the ones who direct the crowds- should have for themselves in such an information period. That this ability is involved less in the curriculum can be defined as an important deficiency.

In Ogurlu's Scale Of Leadership Abilities, "solving problem", "group dynamics", "shyness", "targeting", "empathy", "leadership", "anger control", "determination", "creativity" and "rhetoric" are determined as leadership abilities. When the items in the scale prepared to test the these abilities are analyzed, what it aims to tell with each of ten abilities will be shaped clearly.

The items included in the Scale of Leadership Abilities are like this:

1. The Ability Of Solving Problems

1. I have the curiosity to solve the problems.
2. I look for different ways of solutions to solve the problem.
3. I try to enrich the simple ideas.
4. I can choose the most suitable way for a problem solution.
5. I use different methods to evaluate the convenience of solutions.
6. I have strong ideas on various subjects.
7. I plan the time to make my plans come true.
8. I try to measure whether I've reached my objectives or not.

2. Group Dynamics

1. I try to protect the feeling of reliability in group.
2. I give importance in getting on well in group.
3. Moral values are important to me.
4. I behave fairly.
5. I have respect for the others' rights.
6. I am a reliable one.
7. I behave honestly in my relations.

3. Shyness

1. I hesitate to ask for help from people.
2. I am a shy one.
3. I cannot speak in the presence of community.
4. I have difficulty in saying “no” to the others around me.

4. Targeting

1. I have difficulty in defending my opinions.
2. I never succumb when I’m criticized for what I did.
3. I have difficulty in persuading my friends.
4. I behave bravely in performing my thoughts.
5. I can motivate the others in group for a target.
6. I can determine attainable objectives for the group.

5. Emphaty

1. I try to understand the feelings of the others.
2. I try to understand what a person feels against an event.
3. I try to understand the thoughts of the others.

6. Leadership

1. I want to arrange the social activities that we will make with my friends.
2. I don’t want to lead the works of the group.
3. I become the leader in the group works.

7. Anger Control

1. I become angry to the others quickly.
2. I become angry quickly.
3. The faults of the people around me makes me mad.

8. Determination

1. I cannot achieve the goals that I set for myself.
2. I think pessimistically about the future.
3. I succumb easily against the difficulties.
4. Creativity
5. I have the creative imagination.
6. My aspect of creativity in my works is strong.
7. Oratory
8. I speak understandable.
9. I have enough vocabulary in order to express myself.

The gains and activities in the units of the teaching curriculum of The Course Of Religious Culture And Ethics Knowledge were analyzed and it is revealed which ones and how much of the leadership abilities in Ogurlu’s “The Scale Of Leadership Abilities” are used.

1. Solving Problem: 82
2. Group Dynamics: 84
3. Shyness: 73
4. Targetting: 2
5. Empathy: 26
6. Leadership: 0
7. Anger Control: 7
8. Determination: 12
9. Creativity: 22
10. Oratory: 78

It is revealed that among the abilities, “Group Dynamics”, “Solving Problems”, “Rhetoric” and “Shyness” are focused more and the other abilities are less given place. The ability of Leadership is never included. When the items that were prepared to study the ability of leadership are examined, it can be indicated that this ability is to shape the group more than to move with group. That there is no gain of this ability is a negative situation in the sense of developing students’ ability of leadership.

46.4 Conclusion

It can be claimed that the leadership abilities are sometimes limited and sometimes developed in the activities about the religion teaching. Those claims are in direct proportion to which sensibility that the religion teaching depend on. A religion teaching activity which is done according to the sensibility of just transporting knowledge to the student will limit the leadership abilities more. As in the nowadays religion teaching sensibility, in an educational sensibility that aims to form the knowledge in student’s brain, abilities related to the leadership will be developed.

The gains and activities in the units of 6th, 7th and 8th grades of the teaching syllabus of The Course Of Religious Culture And Ethics Knowledge were analyzed and it is revealed that among the abilities in “The Scale of The Leadership Abilities” prepared by Ogurlu, “Group Dynamics”, “Solving Problems”, “Oratory” and “Shyness” are focused more and the other abilities such as “Empathy”, “Creativity”, “Determination”, “Anger Control” and “Targeting” are less given place. The ability of Leadership is never included. From this point of view, it can be said that the students who take this lesson can behave obeying the rules, solve the problems they meet, express themselves in a right and relax way; on the other hand they less empathize with others, can’t set the goals for the future, less creative in their works and can’t control their anger. That there is no gain of leadership ability is an important deficiency in the sense of developing students’ ability of leadership. In our opinion, the ability of leadership is one of the most important abilities. As it stands, the syllabus will not contribute to the students’ development to gain that ability. At this point, we can indicate that it is necessary to add some activities

and gains that will develop that ability of students. The reflection of each of the abilities in the scale to the syllabus of The Course Of Religious Culture And Ethics Knowledge is in different intensity. If we think about the leadership abilities, we can't say that the ten abilities are somehow different from each other in point of importance. The distribution of the abilities of the scale into the curriculum having difference between each others will bring out deficiency for the students who won't develop their leadership abilities. That's why it will be more positive to arrange the activities and gains in the way that there will not be much difference between the abilities of the scale in the further curriculum developing studies of The Course Of Religious Culture And Ethics Knowledge.

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Chapter 47

Atmospheric Tracers and the Monsoon System: Lessons Learnt from the 1991 Kuwait Oil Well Fires

Peter Carl

47.1 The Complex Setting

Timely political action and deterrent measures to prevent the invasion were largely missing. On August 2, 1990, Iraqi troops occupied Kuwait. The means to deter liberation were apparently in their hands then: Shortly after the invasion, experiments were started at the oil fields to learn how active wells may be set alight effectively (Husain 1994a). The international embargo on Iraqi oil export left a clear signal in the worldwide output, induced Saudi Arabia to rush into replacement production—and was ignored by the addressee as a toothless tiger. Saddam’s menacing announcement at September 23 1990, however, of ‘darkening the heaven’ in a “nuclear winter” like scenario should military action be undertaken to liberate Kuwait, failed to work as a deterrent as well. For sure, both sides had learnt their lessons on the concept of deterrence (e.g., Thunborg et al. 1981; Subrahmanyam et al. 1987), but had recourse to it only to a degree of political opportunity, ignoring important aspects of that knowledge at will in a deadly Middle East poker, fanned by the language and measures of escalation (His Majesty King Hussein 1990). From January 17 until February 23, in the course of the “Desert Storm” air campaign, dozens of wells were deliberately detonated or caught fire due to intense allied bombing. During the short ground battle (February 24–28), retreating Iraqi troops executed their ‘scorched earth’ order (Fig. 47.1) to increase the stake by an order of magnitude—leaving some 720 wild wells in addition (Husain 1994a). The ‘retaliatory strike’ by a smoke-induced climatic disruption, however, failed to appear: The system’s response took another turn.

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Fig. 47.1 Burning oil wells in Kuwait, photo taken by US Army SGT Perry Heimer (Public domain, source: Wikipedia; uploaded by St. Krekeler, version of Oct. 09, 2007)

An early, torrential typhoon over the head Bay of Bengal at April 30 took a toll of 125,000 deaths (Philips 1995). Starting a season this devastating way which elapsed dynamically abnormal throughout, the Asian summer monsoons showed unusual activity in 1991, although the climatic backscene, notably established meridional pressure gradients (cf. Sect. 47.6.1), would have favoured certain inhibition of monsoon dynamics (Carl 1998). High/low SST anomalies were observed over the Bengal/Arabian Seas (De et al. 1992), the Mei–Yu season over East Asia commenced early by a month (Philips 1995), and a southwards displaced Western Pacific High steered moist, warm air from the Bay into the rainbelt across China. Start-up over Kerala of the Indian southwest monsoon dated normal but came along without onset vortex (De et al. 1992) and advanced very fast, to end up in extreme spatial stagnation. The East Asian rainy season became locked for as long as two months over the Yangtse–Huaihe basin whilst Northeast China suffered from extended drought (Philips 1995). Early in July, a broad-scale cyclonic system over the head Bay of Bengal (De et al. 1992) battered the river basin with a 1-week catastrophic rainfall that waterlogged 13 million hectares of farmland (Philips 1995). Mt. Pinatubo (15.1°N, 120.4°E) exploded at June 15, at the height of the first activity spell when the southwest monsoon’s advance had just stopped—as if a valve opened to balance the abruptly changing angular momentum tendency of Earth’s rotation (where intraseasonal monsoon dynamics is known to leave its signature (Krishnamurti et al. 1992, e.g.)).

Man's economic activity, as reflected in the oil and gas production figures, ran into a period of stagnation at the beginning of the 1990s. The global atmospheric CH₄ and CO₂ loads indicated a concurrent regime transition, and "global warming" paused for about a decade. The general setting of crisis and war in the Gulf, at the dawn of a new era after the large systems confrontation of the Cold War, thus bears a challenging mix of diverse impacts at various spatiotemporal scales. This calls for detailed inspection to disentangle the dynamic complexity which man's activity, notably political decision making of the time, both contributed to and had to cope with.

Source strength estimates of the Kuwait fires are given in Sect. 47.2 and are translated into scenarios. Partially unpublished results of early scenario runs using a General Circulation model (GCM) of the troposphere are sketched in Sect. 47.3. A specific glance is shed on the global hydrological response. Section 47.4 addresses the economic transformation of the time using worldwide oil and gas production as proxies, and Sect. 47.5 provides analyses of global atmospheric trace gas records, with a focus on methane. Section 47.6 offers a synthesis attempt and a range of conclusions. An Appendix provides concise methodological information and refers to the data sources used.

47.2 Kuwait Fires: Sources and Scenarios

Smoke is a perpetual, active component of the global climate system. Little was known about its role in shaping past and present climates, however, when research in a crisis-like mode (MacCracken and Penner 1987) was triggered by the advent of the "nuclear winter" theory (Crutzen and Birks 1982; Turco et al. 1983) on climatic and environmental impacts of mass fires and firestorms in a nuclear war (cf. also Carl et al. 2008). Early attention to direct atmospheric and surface effects beneath large-area smoke plumes (Wexler 1950) refreshed at the beginning of the 1980s (Seiler and Crutzen 1980) to run into a bulk of studies by the end of the decade (e.g., Cachier et al. 1989; Ferrare et al. 1990; Setzer and Pereira 1991; Veltishchev et al. 1988; Robock 1988; Andrae et al. 1988; Segal et al. 1989; Hulstrom and Stoffel 1990; Pueschel and Livingston 1990). In 1991, when the smoke plumes ascended for more than 8 months from the burning oil fields in Kuwait, sound indication existed that smoke noticeably contributes to the impact on climate, environment and man of hundreds of thousands tropical vegetation fires per year.

Though unsteady and localized in each single case, smoke from natural fires is a systematically varying source of tropospheric heating anomaly due to absorption of shortwave solar radiation. Anthropogenic biomass burning in the tropics, which exerts a more continuous stress, bears amounts of carbonaceous particulate emissions comparable to those in midlatitudes. Seasonality effects differ in their causation, however (wet/dry vs. cold/warm). For the Mediterranean belt interannual fire-climate feedbacks appear to act via ecosystem dynamics

(Swetnam and Betancourt 1990). Rather short tropospheric residence times of smoke notwithstanding (from a couple of days to about 3 weeks; Pruppacher and Klett 1978; Giorgi and Chameides 1986; Ferrare et al. 1990), planetary-scale teleconnections were known for long to emanate from low-latitude surface heating anomalies (e.g., Bjerknes 1969; Lau and Lim 1984; Garcia and Salby 1987; Leathers et al. 1991). This justified the suspicion, the persistent smoke-induced thermal anomaly of the lower troposphere over the Gulf region (in a prevalent anticyclonic atmospheric environment) could influence the 1991 seasons at planetary scale.

Anticyclonic conditions often precede and accompany large-scale forest fires, at that also restricting the smoke injection heights (Golitsyn and Phillips 1986; Setzer and Pereira 1991). Though ascent of substantial smoke amounts into the upper troposphere and their long-range transport did not happen (which otherwise could have induced remote direct impacts), the region carries the strongest equator-crossing jet stream of the lower troposphere in boreal summer, the Somali jet (Findlater 1969), which is an integral part of the circumglobal summer monsoon system. Depending on the source strengths, indirect remote effects were thus to be expected.

47.2.1 Source Strength Estimation: Trace Gas Loads

Early voices that warned of globally catastrophic results of a large confrontation ‘literally on top of the single richest petroleum reservoir in the world’ (His Majesty King Hussein 1990) focused on gaseous releases, notably CO, CO₂, SO₂, and on economic consequences. A substantial promotion of the CO₂-induced greenhouse effect, however (and the amount of heat released by the fires all the more), were not among the issues of primary scientific concern on potential environmental consequences of war in the Gulf. Still, first figures became known in this context about the volume of oil that could go up in flames (Aldhous 1991): 3 ··· 10 Mio. barrels per day (Mbpd; 1 b = 159 l). To seriously estimate smoke amounts and other emissions, details about the oil fields were needed. Table 47.1 summarizes relevant knowledge that was readily available (Anonymous 1988, 1991; OGJ Data book 1990).

Based on the conversion factors given (the worldwide mean amounted to ~7.33 b/t at that time), Table 47.2 provides ‘back-on-the-envelope’ estimates of the gaseous emissions in question, assuming all the oil released burns: CO, CO₂, and CH₄ or higher hydrocarbons (collectively labeled C_xH_y). A more realistic assessment has to take into account evaporation of unburnt oil. For 90 % and 75 % burning (oil scenarios unchanged), Table 47.3 substantiates that it is CH₄ which may bear a problem among the gaseous emissions. Similar estimates may be possible for nitrous oxides, but not for photochemical smog, notably tropospheric Ozone, which call for detailed modelling of the chemical system (Carl 1991a). A blend of Tables 47.2 and 47.3, specified for the GCM scenarios that were lately run, may be found in Carl (1991b).

Table 47.1 Onshore oil fields of Kuwait and the Kuwaiti administered part of the Neutral Zone at the turn of the 1980s: basic parameters and summary production (Anonymous 1988, 1991; OGJ Data book 1990)

Field name	Year of discovery	Wells		Conversion		Production (kt/day)			
		Active	Total	b/t	°API ^a	Year	Total	Per well	
		Kuwait (total) ^b							
		363	782	7.29 ^c	32.5 ^c	1988	183	0.50	
						1989	218	0.60	
						1990	220	0.61	
Greater Burgan		292	590						
Burgan	1938	210	393	7.21	30.8				
Magwa	1951	71	113	7.31	33.0				
Ahmadi	1952	11	84	7.25	31.7				
Raudhatain	1955	41	53	7.37	34.4				
Sabriyah	1957	9	44	7.46	36.3				
Minagish	1959	1	21	7.37	34.4				
Umm Gudair	1962	20	33	7.04	26.9				
		Neutral zone (total) ^b							
		343	450	6.83 ^d	22.1 ^d	1988	19.9	0.06	
						1989	18	0.05	
Wafra	1953	322	427	6.68–6.89	18.9–23.5	1988	14.4	0.04	
				6.79 ^c	21.2 ^c				
South Fuwaris	1963	5	9	6.96	25.0	1988	0.3	0.06	
South Umm Gudair	1966	16	17	6.92	24.3	1988	5.2	0.33	
		Kuwait & neutral zone (total)							
		706	1,232	7.25 ^e	31.7 ^e	1988	202.9	0.29	
						1989	236	0.33	
						1990	240	0.34	

^a°API $\doteq 141.5/S - 131.5$, where S (in kg/l) is the specific gravity of the crude oil at 60 °F (10 °API corresponds to $S = 1$, the specific gravity of water)

^bFields not listed include Ratga (30 wells), Khashman (3), Medina 1 (3), Bahrah (2), Mutriba 3 (2) and Rugei 1 (1) in Kuwait, as well as Arq (1) in the Neutral Zone (number of active wells, conversion factors and production figures unknown for these fields)

^cArithmetic mean (for Kuwait, facing lack of more detailed information)

^dWeighted mean

^eWeighted between Kuwait and NZ

By and large, these initial estimates stood the test of measurement campaigns (taking the factual duration of the fires into account where necessary). Unfortunately, those campaigns in general took too much time to be prepared so as to provide a sound scientific data base for the first weeks to months following the destruction of the Kuwaiti oil fields and industry. Whereas demolitions during the airborne operations prior to February 24 may have released an average of 65 kt per day (Carl 1991a), i.e. the non-negligible volume of some 0.45...0.5 Mbpd, the oil loss due to sabotaged oil fields jumped to a figure of 10 % of worldwide annual oil consumption (Seacor 1994, e.g.), notwithstanding the fact that the pre-occupation Kuwaiti oil production (about 220...240 kt/day) covered only 2.5–3 %. A closer

Table 47.2 Estimated contribution to global atmospheric loads and growth rates (with reference to 1990) of carbonaceous trace gas immissions from the burning oil fields^a

Oil burnt Mbpd	CO ^b		CO ₂		C _x H _y		CO ₂ equivalent	
	ppmv	%	ppmv	%	ppmv	%	ppmv	%
	Total load, 1990							
	0.23		353		1.7		42.5	12.0
	Annual growth, 1990							
	0.004		1.6 ^c		0.017		0.4	26.6
	Annual growth due to Kuwait fires							
1.8	0.002	44	0.03	1.8	0.0007	4.2	0.02	1.1
3.0	0.003	73	0.05	3.1	0.0012	6.9	0.03	1.8
6.0	0.006	146	0.10	6.1	0.0024	14	0.06	3.7
10.0	0.010	245	0.16	10.2	0.0039	23	0.10	6.1

^aAssumptions: (i) the total oil volume released burns, (ii) 1 year duration, (iii) elemental carbon (C) contents of oil (by mass) 84.5 %, (iv) mass ratio methane/ethane as 9/1, other hydrocarbons neglected (in this mass balance), (v) CO₂ equivalent of CH₄: factor 25, (vi) all hydrocarbons taken as CH₄ in terms of their CO₂ equivalent, (vii) carbon consumption of CO₂/soot/CO/C_xH_y as 83/10/5/2

^bNorthern hemisphere

^c(1.3 ... 1.8)

Table 47.3 Estimated contribution to global atmospheric loads and growth rates of hydrocarbon immissions from evaporating unburnt oil^a

Mbpd	90 % of oil burnt				75 % of oil burnt			
	C _x H _y		CO ₂ equiv.		C _x H _y		CO ₂ equiv.	
	ppmv	%	ppmv	%	ppmv	%	ppmv	%
	Annual growth due to sabotaged Kuwaiti oil fields							
1.8	0.0016	9	0.04	2.5	0.0039	23	0.10	6.1
3.0	0.0026	15	0.07	4.1	0.0065	38	0.16	10.2
6.0	0.0052	31	0.13	8.2	0.0131	77	0.33	20.4
10.0	0.0087	51	0.22	13.6	0.0218	128	0.54	34.0

^aAssumptions: 50 % of the unburnt oil evaporates; otherwise as in Table 47.2

look at production conditions of the region may help understanding this fact (which appears to be a generally accepted one today). Together with the scenarios developed in Sect. 47.2.2, Tables 47.1–47.3 provide a basis as well for estimates of a CH₄ scenario (a preliminary one is given in Carl (1998) and Sect. 47.5.2) which may further help coming to grips with global trace gas evolutions at the turn of the 1980s, notably the spectacular methane fluctuation of the early 1990s.

47.2.2 Smoke Scenarios

A detailed foundation of smoke emission scenarios called for information that was hardly available by the end of 1990—and perhaps is not even today. A conceptual

Table 47.4 Source type specification of the conceptual approach to Kuwait fire scenarios

Well type	Source activity	Pressure conditions	Field status
1	Eruptive	Natural overpressure	Primary recovery
2	Non-eruptive	Natural overpressure	Primary recovery
3	Eruptive	Natural overpressure	Secondary recovery
4	Non-eruptive	Natural overpressure	Secondary recovery
5	Non-eruptive	Unclear	Secondary recovery
6	Inactive	Unknown	Unknown

approach has thus been adopted as follows: The amount F of combustible (oil) is thought to be composed of fractions according to

$$F = \pi \sum_i \varphi_i n_i, \quad (47.1)$$

where $\pi = P^*/N^*$ is the average productivity, P^* the total daily production, N^* the number of active wells, i the type of well (Table 47.4), $n_i = v_i N^*$ the number of sources of type i , and v_i their relative proportion ($0 \leq v_i \leq 1$). Factor $\varphi_i = p_i q_i f_i$ weights the scenario contribution by source type i , p_i is the productivity of this source type in relation to the average productivity π , q_i is an enhancement factor that takes freely exhausting oil from source type i into account, and f_i is the relative proportion of wells of type i that went up in flames ($0 \leq f_i \leq 1$). Six types have been distinguished (Table 47.4).

At fields under primary recovery, oil extraction exclusively relies on natural overpressure and gas contents, whereas under secondary recovery supporting measures maintain optimal production conditions—which does not mean there is no natural overpressure. Only a few sources of the region (~ 20) were said to have lost overpressure. Parameters have to be chosen in accordance with conditions $\sum_{i=1}^5 v_i \stackrel{!}{=} 1$, $\sum_{i=1}^5 p_i v_i \stackrel{!}{=} 1$ (or $\sum_{i=1}^5 p_i n_i \stackrel{!}{=} N^*$) and $\sum_{i=1}^5 f_i n_i \stackrel{!}{=} N^f$, where N^f is the total number of active wells ablaze ($N^f = 600$ here, i.e. 85% of all 706 active wells). Table 47.5 displays conservative choices (cf. also Small 1991).

Of the six scenarios developed in Carl (1991a) three were considered for GCM experiments: “nominal smoke” (KOWF1; daily pre-occupation production without Neutral Zone: 220 kt/day (i.e. ~ 1.6 Mbpd)), a medium case (420 kt/day), and an extreme one (821 kt/day). For the sake of comparability to other studies, though, the latter two were approximated by the twofold (KOWF2) and fourfold nominal case (KOWF4), respectively (Carl 1991b,c). The scenario considered as “extreme” at that time (~ 6.4 Mbpd) uses smoke amounts close to the figure of up to 6 Mbpd officially delivered afterwards (Seacor 1994, e.g.). The “medium” case settles in the vicinity of another pre-war estimate (Cox 1991), taken for ‘most probable’ then (when comparing the balances above with Table 47.5, consider roundoff due to integer n and the number of decimals given for p , f , v).

Table 47.5 Two scenarios of burning oil amounts^a according to Carl (1991a) (Kuwait (K) and the Kuwaiti administered Neutral Zone (NZ) are separately balanced)

Source	"Medium" scenario						"Extreme" scenario													
	Kuwait			Neutral Zone			Kuwait			Neutral Zone										
	<i>p</i>	<i>q</i>	<i>f</i>	<i>n</i>	<i>v</i>	ν	<i>p</i>	<i>q</i>	<i>f</i>	<i>n</i>	<i>v</i>	ν								
1	2	2	1	55	0.15	2	2	0.8	34	0.1	2	4	1	55	0.15	2	4	1	34	0.1
2	1.5	1.5	1	18	0.05	1.5	1.5	0.8	34	0.1	1.5	3	1	18	0.05	1.5	3	1	34	0.1
3	2	2	1	55	0.15	2	2	0.8	34	0.1	2	3	1	55	0.15	2	3	1	34	0.1
4	0.7	1.3	1	91	0.25	0.7	1.3	0.8	102	0.3	0.7	2	1	163	0.45	0.7	2	1	172	0.5
5	0.4	0.5	0.63	144	0.40	0.6	0.5	0.92	139	0.4	0.05	1	0.25	72	0.20	0.5	1	0.26	69	0.2
6	$\varphi = 0.2$			419			$\varphi = 0.2$		117			$\varphi = 0.5$		419			$\varphi = 0.5$		117	

^a Assumptions: $\pi_K = 0.6, \pi_{NZ} = 0.05, N_K^* = 363, N_{NZ}^* = 343, N_K^f = 309, N_{NZ}^f = 291$

Translation into smoke emission scenarios for use in the GCM follows other simple arithmetics (Penner 1986, e.g.), namely

$$r = \epsilon s \eta F, \quad (47.2)$$

where r is the amount of smoke, ϵ the emission factor, s the proportion that stabilizes in the atmosphere, $\eta (= N^J/N^*)$ the part of oil which burns under smoke emission, and F the amount of fuel, for instance according to (47.1). For emissions from uncontrolled oil fires values of $\epsilon = 0.06 \cdots 0.1$, $s > 0.8$ and $\eta > 0.75$ had been found in the “nuclear winter” context (Turco et al. 1990). These data were partly obtained for primary storages and tend to yield ‘conservative’ estimates of r in the Kuwait fire case. A cautious choice yields $r = 0.055 F$ ($\epsilon = 0.075$, $s = 0.85$, $\eta = 0.85$), a less conservative one $r = 0.08 F$ ($\epsilon = 0.1$, $s = 0.9$, $\eta = 0.9$). That is, $\sim 5.5 \cdots 8\%$ of the oil released might have changed into smoke (23.1 \cdots 33.6 kt/day of smoke for the “medium” scenario, and 45.2 \cdots 65.7 kt/day for the “extreme” one). Figures reported in the literature vary considerably (5 \cdots 100 kt/day; (Seacor 1994, e.g.)), depending on the time and location of measurement campaigns. In the study (Bakan et al. 1991) conducted at the Max-Planck-Institute for Meteorology (“HH”) $r = 0.085 F$ has been used.

For the climatic effect of these emissions, smoke ‘absorptivity’ with respect to shortwave solar radiation is another decisive parameter. Depending on the solar zenith angle θ , insolation I_0 is exponentially attenuated according to $I = I_0 \exp(-\tau/\cos\theta)$. The turbidity of the atmosphere is expressed as ‘optical depth’ $\tau = \Phi m/A$, where m is the mass of the optically active substance, A is the area over which it is spread, and Φ is the ‘cross section’ by which the substance brings its optical activity into effect. Without going into further detail here, the absorption cross section used in Bakan et al. (1991) amounts to 8 m²/g, and 10 m²/g is used in the study referred to in Sect. 47.3 (Carl 1991b,c), taking into account that scattering further reduces the direct effects of insolation but has not been considered in this latter assessment.

47.3 GCM Based Analyses

The GCM used is of coarse spatial resolution (Fig. 47.2, left panel), but has a number of (formal) degrees of freedom by two orders of magnitude above that of the Lorenz system (Lorenz 1982). Origin and properties of the model (Gates et al. 1971; Aleksandrov and Gates 1981) have been sketched in Carl (2013c). Earlier versions were used for studies on the climatic consequences of nuclear war (Thompson et al. 1984; Stenchikov and Carl 1985; Carl and Stenchikov 1988; cf. also Carl et al. 2008). The version referred to here is a regenerated one (Carl 1988) that unveiled its intriguing monsoon dynamics (Carl 1992) just in the Kuwait fire study (Carl 1991b,c). GCM projections on the emerging problem—one control and three scenario runs, all were started March 1 from annual mean initial conditions and

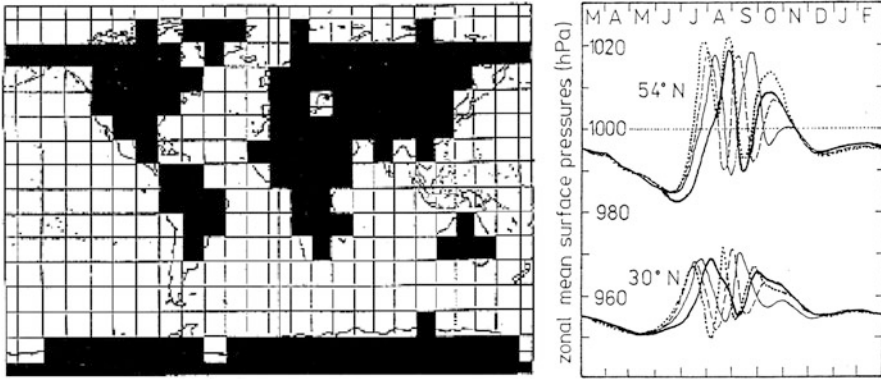


Fig. 47.2 *Left panel:* $12^{\circ}\text{lat} \times 15^{\circ}\text{lon}$ land–sea mask of the coarse resolution GCM; *right panel:* GCM response to lower tropospheric smoke immission scenarios of the Kuwait oil well fire study (Carl (1991a,b); constant immission rates start March 1 each): Control run (no smoke; *thick line*), lower edge scenario KOWF1 (*thin*), reference case (KOWF2; *dashed*), upper edge scenario (KOWF4; *dotted*); shown are zonally averaged evolutions of surface pressure at latitudes 30°N and 54°N (Source of figure: Carl (2013c))

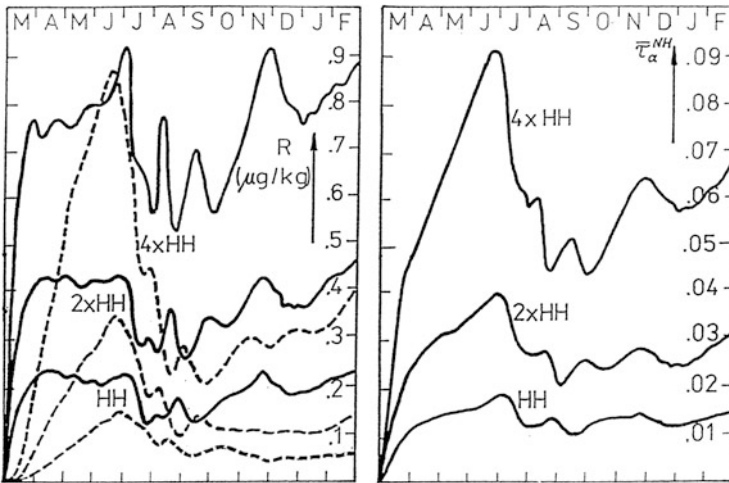


Fig. 47.3 Evolving smoke loads and their (hemispherically averaged) optical effect for scenarios KOWF1 (alias ‘HH’ here), KOWF2 (‘2×HH’) and KOWF4 (‘4×HH’), assuming 1 year of burning oil; *left panel:* Lower (*full line*) and upper (*dashed line*) tropospheric smoke loads (in $\mu\text{g}/\text{kg}$); *right panel:* absorption optical depth (Source of figures: Carl (1991b))

run for one year (simulations done before the fact)—showed sensitive, oscillatory response during boreal summer to the smoke loads (Carl 1991b,c; Fig. 47.2, right panel).

Though the initial immissions were assumed to be confined to the lower troposphere, and an efficient smoke removal scheme due to dry deposition and ‘washout’ was used (Stenchikov and Carl 1985), the GCM’s intraseasonal oscillations became

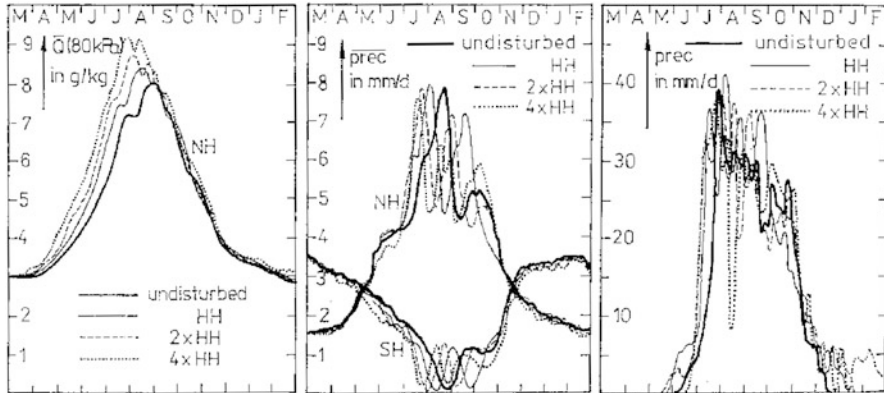


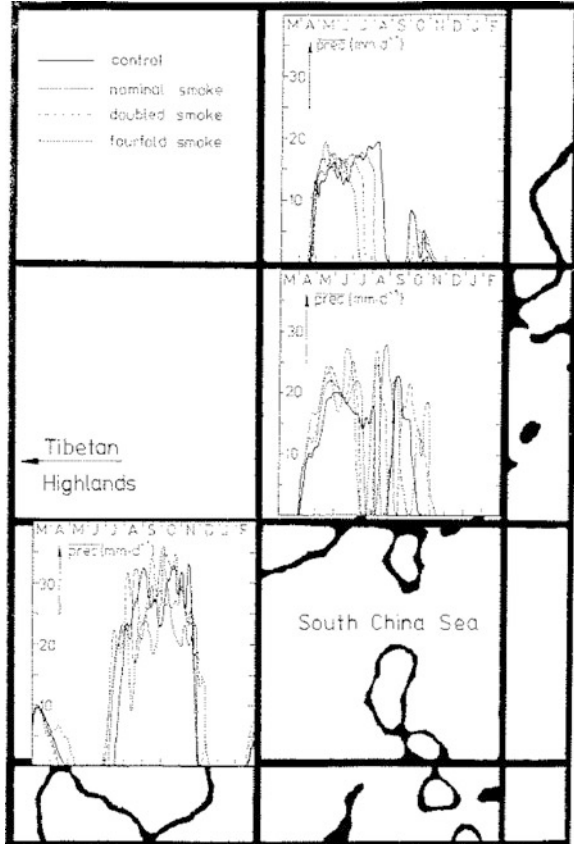
Fig. 47.4 Hydrological response to Kuwait oil fire scenarios (Carl 1991a,b; alias as in Fig. 47.3)—control run (*thick line*), KOWF1 (*thin*), KOWF2 (*dashed*), KOWF4 (*dotted*); *left panel*: Changing lower tropospheric water vapour contents over the northern hemisphere (NH; mixing ratio in g/kg); *center panel*: hemispherically averaged precipitations (in mm/d); *right panel*: Indian summer monsoon precipitations (in mm/d) (Source: Carl (1991b))

pronounced with increasing smoke amounts in the higher scenarios (Fig. 47.3; alias “HH” refers to the precursor manuscript of the study Bakan et al. 1991). The response of the model’s water cycle, and notably of its Asian monsoon system(s), to the smoke emission scenarios is shown in Figs. 47.4 and 47.5. The water vapour contents of the northern troposphere increases substantially with the smoke amount, but not symmetrically to the seasonal march of the control run (Fig. 47.4, left panel). Build-up of the extra water budget proceeds earlier, whereas its ‘mining’ in autumn remains largely unchanged. The precipitation response (center panel) clearly hints at ever higher excited intraseasonal dynamics of an interhemispherically organized, planetary system—the global monsoon. The right panel of Fig. 47.4 shows corresponding changes in the Indian summer monsoon (ISM), including earlier onset and higher intraseasonal activity with more pronounced break(s).

Whereas the GCM’s Southeast Asian summer monsoon (SEASM; Fig. 47.5) appears to be largely controlled by the South Asian branch (similarity with ISM structure and response, Fig. 47.4), the East Asian summer monsoon (EASM) shows substantially different behaviour in accordance with its (observed and modelled) undisturbed dynamics. There is no premature GCM response here of the pre-monsoon (“Mei-Yu”) phase, but it becomes increasingly shortened with the amount of smoke injected. For Northern China this bears substantial loss of water during the season indeed, whilst the South experiences increasing EASM activity. The earlier termination there of the Mei-Yu season gives way to heavy rainspells, with ever shorter breaks as the smoke amount increases. This raises the risk of flooding—as was the case in summer 1991, when the Yangtse valley suffered from a series of severe monsoon spells and catastrophic inundation.

That the remote hydrological impact described of smoke immissions over Kuwait is part in this GCM of circumglobal dynamical change, demonstrates Fig. 47.6.

Fig. 47.5 SEASM and EASM response to Kuwait oil well fire scenarios: control (*thick lines*), KOWF1 (*thin*), KOWF2 (*dashed*) and KOWF4 (*dotted*) (Source of figure: [Carl \(1991c\)](#))



Given the high intraseasonal variability known from the real system (and the somewhat lower than observed excitation of the control run's monsoon dynamics), the four simulation results have been used to form a preliminary composite. It clearly displays fundamental features of observed intraseasonal monsoon dynamics ([Krishnamurti and Subrahmanyam 1982](#); [Krishnamurti et al. 1985](#); [Chen et al. 1988](#)).

A 'civilian' study using the same GCM led to a hypothesis on the dynamic constitution of the global monsoon system ([Carl 1992](#); [Carl et al. 1998](#)) which has been further substantiated and worked out as sketched in [Carl \(2013a\)](#) and is referred to in Sect. 47.6. A comprehensive summary presentation is given in [Carl \(2013c\)](#). As a 'natural' (not astronomically driven) oscillator in the 40–60 days band, with interacting regional branches, this GCM's boreal summer monsoon rules a distinct global climate regime of the season ([Carl 1994](#); [Tschentscher et al. 1994](#)); cf. also top panels of Fig. 47.7. The GCM's undisturbed seasonal march of rainfall, for grid cells representing the South and East Asian summer monsoon branches respectively

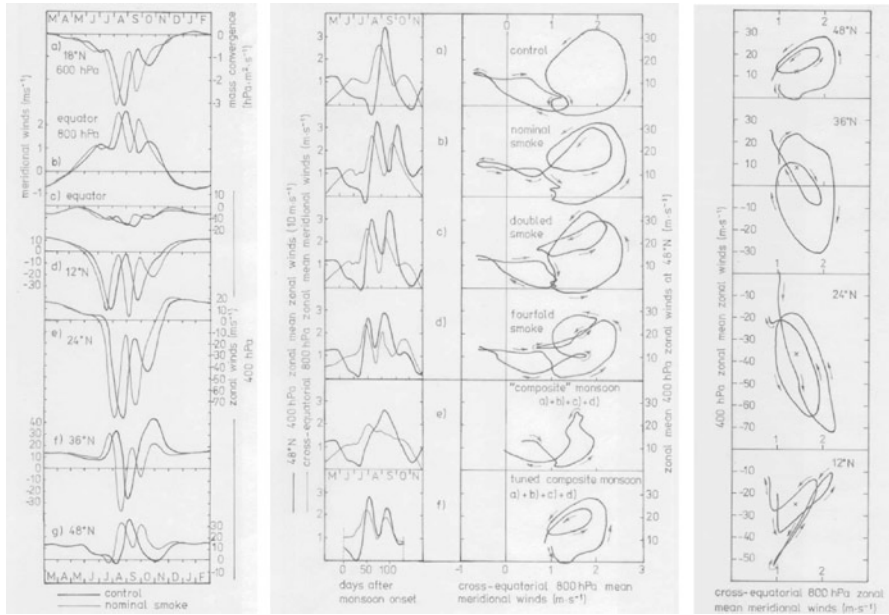


Fig. 47.6 Zonally averaged GCM response to lower tropospheric smoke immission scenarios of the Kuwait oil well fire study (Carl 1991a,b); *left panel*: Change of circulations in the ‘nominal smoke’ case (KOWF1, *thin line*) as compared with the control run (*thick line*) for (top to bottom) (a) mid-tropospheric (600 hPa) mass convergence (in hPa m²/s), (b) lower tropospheric (800 hPa) equator crossing meridional winds, (c–g) upper tropospheric (400 hPa) zonal winds at the equator and at 12 °N, 24 °N, 36 °N, 48 °N, respectively (all winds in m/s); *center panel*: 48 °N 400 hPa zonal winds (in 10 m/s) vs. cross-equatorial 800 hPa meridional winds (in m/s) as time series (*left column*) and phase plots (*right column*) for (top-to-bottom) (a) control run, (b–d) scenarios KOWF1, KOWF2, and KOWF4, respectively, (e) ‘calendar average’ of cases (a–d), (f) ‘tuned composite’ of cases (a–d), adjusted to the date of the GCM’s monsoon onset each; *right panel*: ‘tuned composite’ circulation phase plots as before, but for four northern latitudes (top-to-bottom): 48 °N, 36 °N, 24 °N, 12 °N (Source of figures: Carl (1991c))

(Carl 1994), is shown in comparison with observations (Krishnamurti and Bhalme 1976; Lau et al. 1988) in the bottom part of Fig. 47.7. Though the simulated East Asian rainfall amounts to about half the climatological level there, whereas the Indian monsoon rains are stronger than observed (a model version was used in this case with three activity spells per season, as observed (Webster et al. 1998)), the structural features of both are striking. This lends credence to the suspicion that worldwide hydrological extremes of the boreal summer season 1991, in the first instance the early typhoon over the head Bay of Bengal and the catastrophic course the East Asian monsoon has taken, were remote results of the occurrences at the Kuwaiti oil fields.

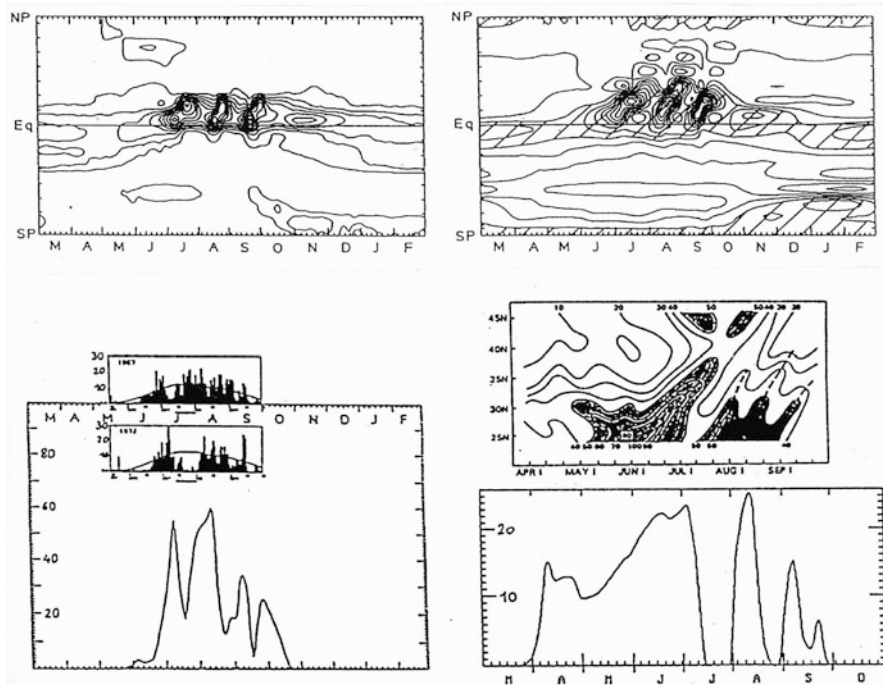


Fig. 47.7 “Summer monsoon solution” of the coarse resolution GCM under climatological forcing (Carl 1992): Seasonal march of global rainfall and upper troposphere zonal winds (*top*) as well as regional rainfall over the Indian subcontinent (*bottom left*) and Southeast Asia (*bottom right*) (Carl 1994) vs. observation (Krishnamurti and Bhalmé 1976; Lau et al. 1988) (Source of figure: Carl (2013c))

47.4 Man’s Economic Activity: Oil & Gas Production

In a fossil energy–driven world the oil and gas production reflects man’s economic activity. Figure 47.8 shows monthly outputs from May 1982 to August 1997 (OGJ 1982–1992; OGI Data book 1984–1998), centered around the period of interest here. Against the backscene since the turn of the 1980s of a major economic transition due to disintegration of an empire, the exceptional impacts the early 1990s witnessed also stamped their marks on the world economy. The intended “doomsday” type ‘retaliation strike’ ended in flat environmental, economic and political crime, but the two perturbations of different scale should have went down into the climate record as detectable and separable signals during the study period.

Features of the production curves which are visible to the naked eye include: (i) stagnation in the worldwide oil and gas outputs during the first half of the 1990s, largely caused by decline of the (former) Soviet Union (FSU) production and parallel recovery in Kuwait’s oil sector, (ii) sharp setback in the Middle East (ME) oil production after Iraq’s Kuwait invasion, followed by Saudi

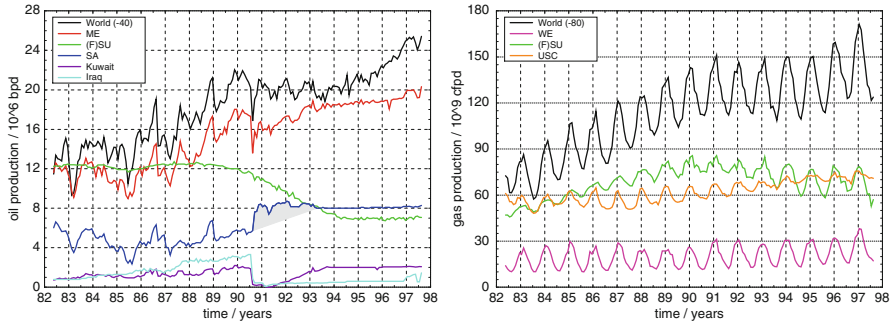


Fig. 47.8 Monthly oil (in Mbd; *left panel*) and gas output (in bcf/d, i.e. 10^9 cubic feet per day, $1 \text{ cf} = 0.028317 \text{ m}^3$; *right panel*) worldwide, and of the major producers: ME—Middle East, FSU—(former) Soviet Union, SA—Saudi Arabia, USC—United States and Canada, WE—Western Europe; the shaded area beneath the SA oil production curve marks the crisis mode replacement production after Iraq’s Kuwait invasion (world production curves shifted as indicated in the insets); data period 05/1982–08/1997

Arabian replacement production—which stayed on stream after liberation, (iii) very smooth ME oil stream after about 1993 as compared with the 1980s, and (iv) increasing (decreasing) seasonality in FSU (USC) gas production, also since about 1993.

Stabilization of ME oil production mainly resulted from the fact that Saudia Arabia (SA) could seize the chance of reaching outputs that were not negotiable before under OPEC regime. An environmental effect of this quick response to the situation (within less than a month) might result from activating wells in a crisis mode which were already closed or held for later production. At least initially, part of them should have been run using incomplete or outdated equipment and/or insufficiently trained personnel. Earlier peaks in SA production took months to reach their maxima (cf. Fig. 47.8). For the (F)SU, the loss of embargoed Iraqi oil (as a balance of debts) fed back negatively on the economic transformation, when COMECON trade rules gave space to the market, leading to new balances in the FSU oil & gas sector. Intensifying seasonality of FSU gas production toward the end of the record shown was certainly caused by increased export to Western Europe. Concurrent loss of seasonality in worldwide oil production, where it was most pronounced around 1988–1993 and almost completely ceased to exist, probably reflects a lasting change in northern midlatitude winter heating systems.

Quantitative studies are required to clarify potential impacts of oil and gas production on atmospheric trace gas loads and climate. Time series of Fig. 47.8 have been analyzed to this end by means of (i) iterative Singular-System Analysis (SSA; Vautard et al. 1992), (ii) the Wavelet Transform (WT; Torrence and Compo 1998), and (iii) the Matching Pursuit approach (MP; Mallat and Zhang 1993) to sparse data approximation (cf. Appendix). In the latter case a frequency-modulated (FM) ‘Gabor atom’ has been used as analysing waveform, extending the signal space (and thus the adaptive capability of the method) by three dimensions this way. For

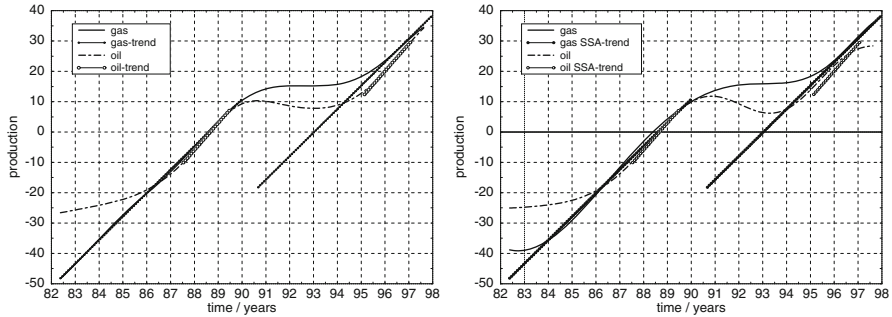


Fig. 47.9 Slow components in worldwide monthly oil (in 0.2 Mbd) and gas production (in bcf/d) as obtained by iterative SSA (*left panel* (Carl 1998)) and MP-FM (*right panel*), respectively; linear SSA trends before stagnation are shift-copied to demonstrate their match after the episode, and are mirrored in the MP-FM figure for comparison (05/1982–08/1997)

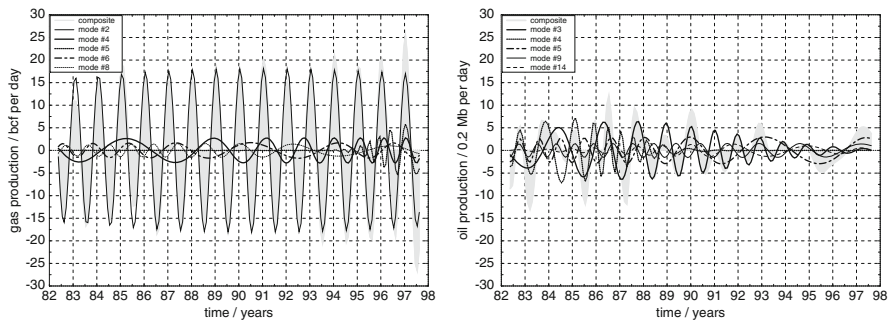


Fig. 47.10 Seasonal composites and their contributing MP-FM modes in monthly worldwide gas (in bcf/d; *left panel*) and oil production (in 0.2 Mbd; *right panel*); 05/1982–08/1997

the world production series of Fig. 47.8, the Figs. 47.9 and 47.10 show slow and seasonal components, respectively, as obtained by SSA and MP-FM (Fig. 47.9) or MP-FM alone (Fig. 47.10).

Iterative SSA has a filtering effect which is dispensed with in the MP-FM approach. The right panel of Fig. 47.9 shows composites of the two leading slow MP-FM modes each, i.e. an approximation of the slow part of oil & gas production by these two unmixed modes. To demonstrate reasonably good capture, the SSA trends are retained at their original positions.

Figure 47.11 shows the leading five modes each of monthly worldwide gas and oil production of Fig. 47.8, and Table 47.6 presents MP-FM “structure books” providing concise quantification of all the modes displayed. This illustrates MP-FM approximations and demonstrates the high flexibility of the “Gaussian logon”. MP-FM spectrograms, i.e. time–frequency (TF) representations, of monthly worldwide gas and oil production are presented in Fig. 47.12 (due to an ‘uncertainty relationship’ in signal processing, the thickness of traces representing individual

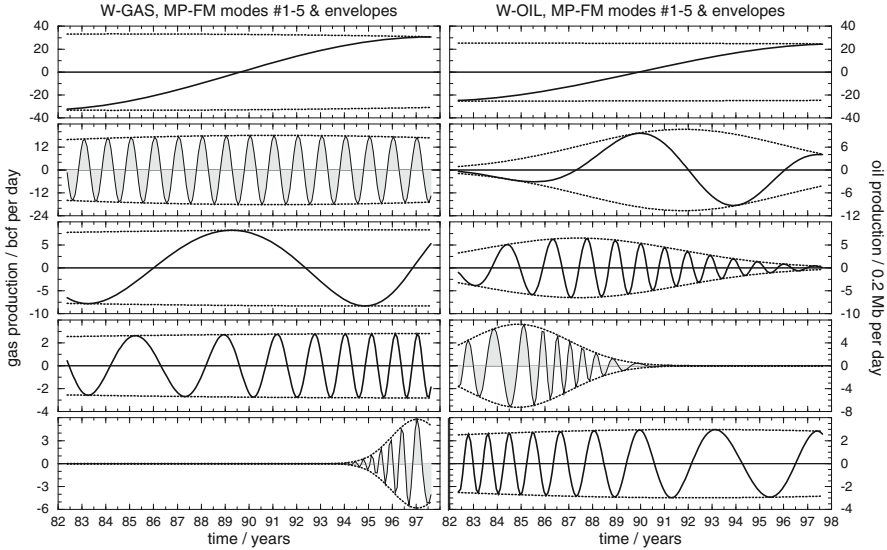


Fig. 47.11 Leading MP-FM components, and their signal envelopes, of worldwide monthly gas (in bcf/d; *left column*) and oil production (in 0.2 Mbp/d; *right*); 05/1982–08/1997

modes is inversely related to their scale s ; further, sequences of spots merely result from plot resolution and are to be read as the continuous traces they mimic). An eye-catching quasi-quadiennial (QQ) modulation and a slower yet deeper mode of ‘subharmonic’ FM (ca. 8 years) in the gas production series call for confirmation and explanation. Toward the end of the record shown, a ‘gas rush’ (mode #5) is clearly represented as an isolated feature. Fading volatility in the oil production during the same period is nicely represented by the loss of higher-frequency components.

As proxies of man’s economic activity, leading MP-FM modes of both time series might have left their signatures in other data of the system. Though the climate study (Carl 2013b) uses annual aggregates and cannot provide clearcut connections, the leading MP-FM mode of the North Atlantic Oscillation (NAO) and the second one of the Southern Oscillation (SO) are both drifting across the period range of ~ 8 years during the timespan under scrutiny (Carl 2011, 2013b). Anyway, the data first to look at are atmospheric trace gases.

47.5 Atmospheric Trace Gas Loads: CH₄, CO₂

Of the gaseous emissions blamed for man-made climate change, notably CO₂ and CH₄ (Fig. 47.13), methane is directly linked to oil and gas outputs via venting at the wellheads (of oil associated gas) and leakage rates in production, transport and consumption. Other major anthropogenic contributors include livestock and

Table 47.6 MP-FM structure books of worldwide gas and oil production (05/1982–08/1997); centered analyses, performed in monthly steps (start 1, step 1); to correctly interpret the u_k values given, transform the time axis from monthly to yearly (as done with the figures) by $t_y := (t_m + 3.5)/12 + 82$; f, \tilde{f} in cycles per month (cpm)

k	α_k	s_k	u_k	f_k^a	ϕ'_k	\tilde{f}_k	β_k	$\tilde{\phi}'_k$
Worldwide gas production (in bcf per day)								
1	293.43	1,024	24	0.0023	-2.450	0.00049	0.28	-0.393
2	168.03	512	105	0.0923	-0.051	0.00107	8.54	3.142
3	78.29	1,024	156	0.0274	1.024	0.00116	18.26	-2.553
4	26.01	1,024	180	0.0599	-3.118	0.00288	14.10	-0.589
5	17.83	32	177	0.1424	-1.814	0.01105	8.76	1.963
6	16.02	512	108	0.0503	1.224	0.00343	8.77	3.142
7	14.63	128	119	0.2102	2.091	0.02026	2.86	-0.589
8	12.91	256	79	0.0549	-1.302	0.00408	9.14	1.374
9	11.84	256	91	0.2500	0.815	0.00748	25.40	0.785
10	10.35	256	93	0.2611	3.000	0.01058	17.01	-1.571
Worldwide oil production (in Mb per day)								
1	-44.88	2,048	11	0.0024	0.570	0.00056	0.23	-1.963
2	14.07	128	114	0.0089	-2.075	0.00127	2.85	-1.374
3	8.55	128	61	0.0549	0.497	0.00374	8.77	-1.374
4	6.74	64	31	0.1098	1.192	0.01372	3.69	-2.356
5	5.52	512	120	0.0776	1.371	0.00232	25.83	2.749
6	4.44	128	53	0.1693	0.815	0.00507	29.38	3.142
7	3.79	128	61	0.1693	-2.520	0.00781	10.01	1.178
8	3.22	128	60	0.2195	-0.676	0.00781	5.99	-1.178
9	2.94	512	85	0.0599	-2.620	0.00253	18.26	0.982
10	2.77	128	75	0.2611	-1.438	0.00852	15.26	1.767

^aIn the structure books heretoforth component k of carrier frequency f_c is written f_k

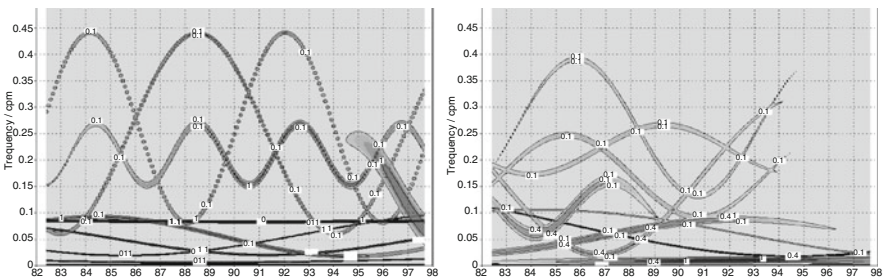


Fig. 47.12 MP-FM spectrograms (modes #1–10 each) of monthly worldwide gas (*left panel*) and oil production (*right*); 05/1982–08/1997; frequency unit: cycles per month (cpm)

agriculture, coal mining, landfills etc., whereas temperature or water table fluctuations and wildfire feed natural emissions. To the extent that signal structures are discernible and separable, production related trace gas loads might be identified by means of sparse approximation. There is reasonable confidence that MP-FM bears this power (Carl 2011, 2013b), but alternative methods may broaden the perspective.

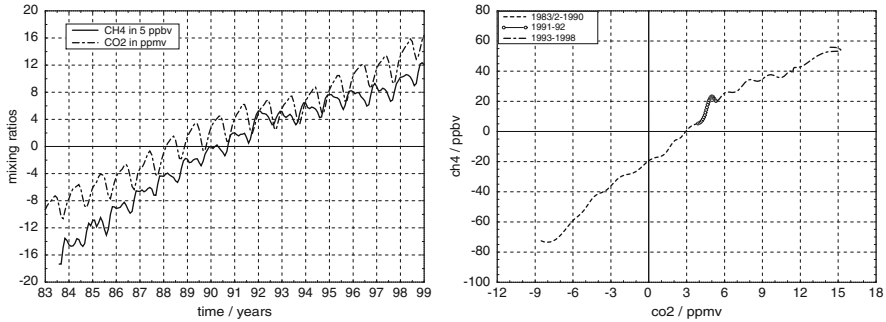


Fig. 47.13 *Left panel:* Time series, centered over their respective data periods, of CH₄ (07/1983–12/1998; in 5 ppbv) and CO₂ (01/1979–12/1998; in ppmv); *right panel:* phase plot CH₄ vs. CO₂ (07/1983–12/1998; all slow MP-FM modes each)

47.5.1 The Methane Fluctuation at the Early 1990s

Figure 47.13 shows for 1991 a CH₄ load increase that reflects an exceptional growth rate fluctuation which challenged conceptual insights into atmospheric trace gas loads and their relation to climate variability and change (Dlugokencky et al. 1994a,c; Hogan and Harriss 1994; Dlugokencky et al. 1994b; Lowe et al. 1997; Lelieveld et al. 1998; Dlugokencky et al. 1998). Concurrent anomalies appeared to extend over the atmospheric carbon cycle (Dettinger and Ghil 1998, e.g.). The SSA based study of Carl (1998) confirms a quasi-biennial pulse in the de-seasonalized CH₄ growth rate (Dlugokencky et al. 1998, e.g.) which suggests a general role in the CH₄ balance of the Tropospheric (quasi-) Biennial Oscillation (TBO; Meehl 1997)—and its amplification into the 1991–1992 event. Figure 47.14 presents the detailed growth rate analysis (Carl 1998) which sheds a specific (iterative SSA based) glance at climate dynamics in the back.

Figure 47.14a decomposes the de-seasonalized CH₄ growth rate approximation into quasi-biennial (‘TBO’) and quasi-quadrennial (‘QO’) modes. Seasonality is addressed in Fig. 47.14b, where the envelope of the basic seasonal cycle (SC) mode, i.e. the signal energy in the SC, is shown to synchronize with the CH₄ event of Fig. 47.14a, reflecting internal phase–amplitude synchrony of the time series. Remarkably, the envelope of the semiannual cycle (and similarly of higher harmonics, 1/3 a, 1/4 a; not shown) exhibits a decrease in (inverse) analogy to the slow evolution of worldwide oil & gas output (Fig. 47.9). This might hint at a simplifying SC structure of the CH₄ growth rate with the increasing anthropogenic impact of the data period.

Figure 47.14c combines SC, TBO and QO dynamics in a normalized view that unveils temporary phase synchronies toward the end of 1991 (SC & TBO) and at mid-1992 (TBO & QO). The (detrended) SC envelope reflects takeover by the QO during the CH₄ event, i.e. an apparent dynamic regime transition at the beginning of the 1990s. Figure 47.14d shows a further TBO decomposition that

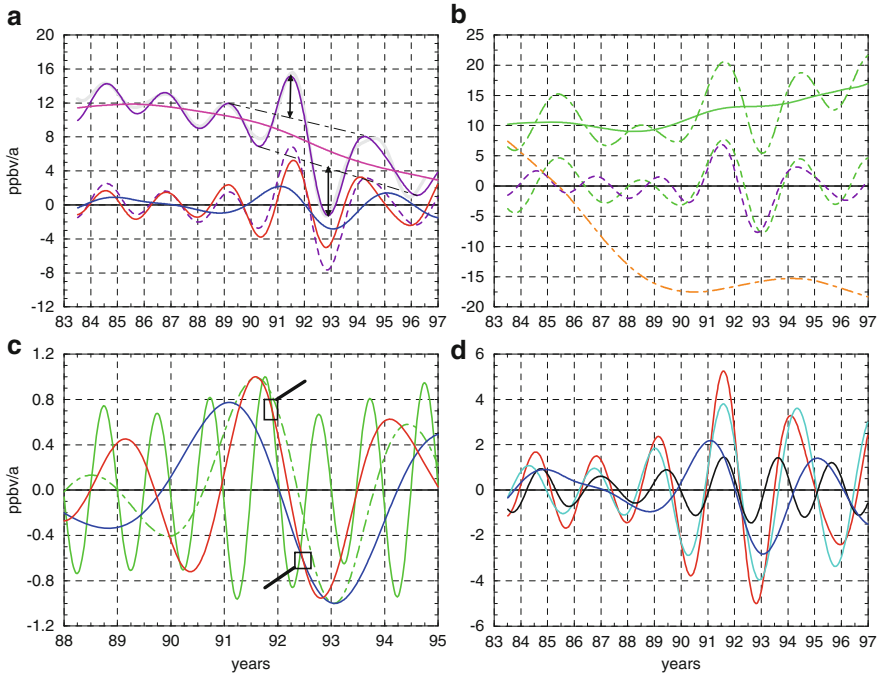


Fig. 47.14 Iterative SSA-based analysis of the signal at the early 1990s in the CH₄ growth rate (period of analysis 07/1983–12/1997 here; from Carl (1998)): (a) slow approximation of the deseasonalized time series (violet) in comparison with the NOAA analysis (grey (Dlugokencky et al. 1998)); arrows mark the upward/downward swings, both departing from ‘normal’ up to ~5 ppbv/a; removal of the nonlinear trend (pink) gives the dotted violet curve which may be further decomposed into a quasibiennial mode (TBO, red) and a slower, ‘quasi-quadrennial’ one (QQO, blue); (b) seasonality analysis in terms of envelopes of the seasonal cycle (SC) mode (dot-dashed green) and of the semiannual one (dot-dashed orange; both vertically displaced); removal of the nonlinear SC envelope trend gives the dotted green curve; (c) normalized view of phase relationships between SC (full green line), detrended SC envelope, TBO and QQO (as in (a) and (b)); phase coincidences emphasized; (d) further TBO decomposition into two modes which develop into a more strictly biennial (black, showing QQO phase synchrony during the event) and a quasi-triennial one (turquoise)

points to splitting toward the turn of the 1980s into a more strictly biennial mode and a quasi-triennial one (‘QTO’). The latter starts dominating with the event in question, whereas the former directly shapes the signal for almost one year via QQO phase synchrony. The combined result describes the obvious slowing down of climate dynamics in the back as a TBO/QTO–QTO/QQO transition.

CH₄ load spectrograms of the leading 10 MP-FM modes and of the Wavelet Transform (WT) are shown in Fig. 47.15. The MP-FM modes are displayed in detail in Fig. 47.16 and Table 47.7. This CH₄ load view does not directly confirm the SSA based (growth rate) findings, but a TBO may be borne in MP-FM modes #5, 6 and 8 altogether; its signature might thus emerge from drifting modes—which also

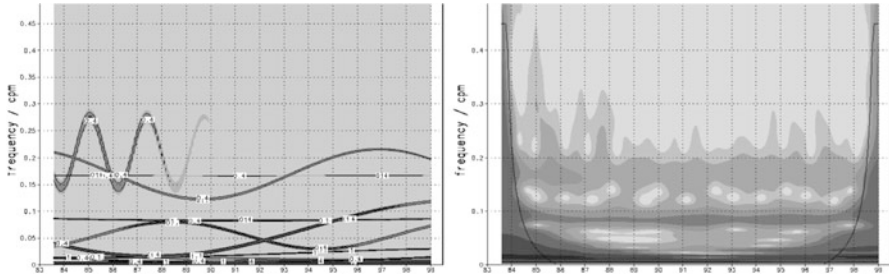


Fig. 47.15 MP-FM (modes #1–10; *left panel*) and WT spectrograms (Morlet; *right*) of monthly global CH₄ load; 07/1983–12/1998; frequency unit: cycles per month (cpm)

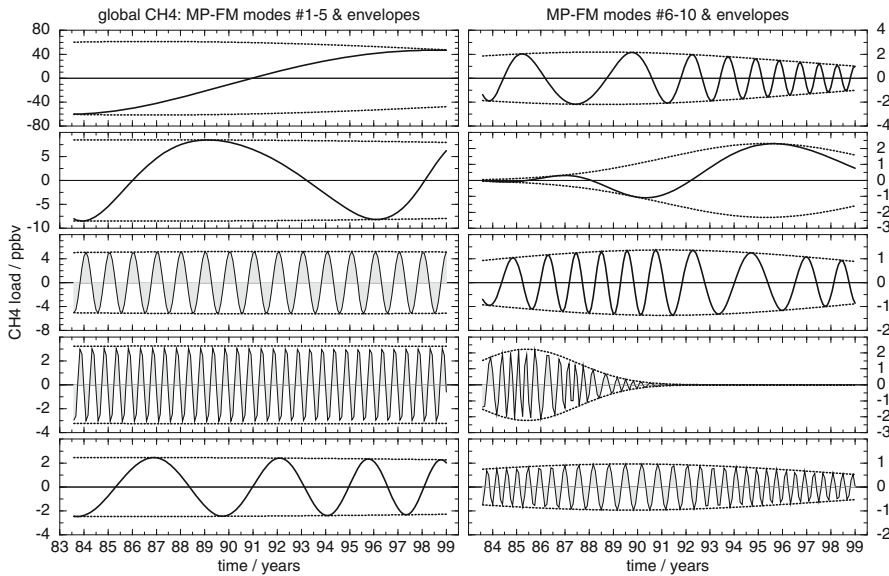


Fig. 47.16 Leading 10 MP-FM modes and their signal envelopes of the global monthly CH₄ load (in ppbv); 07/1983–12/1998

cooperate in generating the 1991/1992 event. Indeed, modes #6 and 8 are crossing each other in-phase just at the height of the (load) pulse around the beginning of 1992 (Fig. 47.15, left panel), and mode #5 plus the basic SC mode #3 contribute to the apparent resonance that makes up the event (another such cooperative effect at the beginning of the record shown generates a similar but negative excursion).

As confirmed by the WT magnitude spectrogram (Fig. 47.15, right panel), for the 1991–1993 event there is no sign of a corresponding singularity in the signal energy. A TBO signature during the 1980s in the CH₄ load is found in the frequency modulation of MP-FM mode #9 (Fig. 47.15, left panel). The WT phase spectrogram (Fig. 47.17, left panel) underlines the dynamic causation of the event: Showing only

Table 47.7 MP-FM structure books of modes #1–10 of monthly global CH₄ load and growth rate (07/1983–12/1998), centered analyses (transform time from monthly to yearly according to $t_y := (t_m + 6)/12 + 83$); f, \tilde{f} in cycles per month (cpm)

k	α_k	s_k	u_k	f_k	ϕ'_k	\tilde{f}_k	β_k	$\tilde{\phi}'_k$
Global CH ₄ load (in ppbv)								
1	516.06	512	39	0.0072	0.256	0.00051	9.55	2.749
2	80.37	1,024	37	0.0405	0.099	0.00121	29.38	2.749
3	49.88	1,024	110	0.0884	-1.937	0.00204	2.90	-2.945
4	31.23	2,048	92	0.1768	-2.476	0.00079	13.23	3.142
5	23.49	1,024	23	0.0221	-1.465	0.00253	3.54	3.142
6	18.17	256	59	0.0682	1.163	0.00329	16.04	-2.945
7	16.35	128	142	0.0356	0.389	0.00107	29.38	2.945
8	11.66	256	91	0.0549	-2.049	0.00686	3.69	1.374
9	10.05	64	23	0.2102	-0.967	0.03559	1.85	0.982
10	8.12	256	74	0.1693	1.601	0.00577	8.10	3.142
Global CH ₄ growth rate (in ppbv/a)								
1	381.30	2,048	7	0.1768	-0.214	0.00086	12.13	2.749
2	305.31	512	86	0.0653	-0.708	0.00061	29.70	0.000
3	172.36	64	24	0.2726	1.859	0.03263	3.06	2.356
4	141.15	512	19	0.2500	1.064	0.01205	0.83	0.785
5	87.79	256	97	0.3242	-0.470	0.00391	2.56	-0.785
6	82.06	256	96	0.1928	2.760	0.02026	4.39	2.945
7	71.40	256	135	0.2293	1.477	0.01154	15.36	0.785
8	65.85	4	3	0.2102	0.060	0.21953	0.84	0.982
9	59.62	128	61	0.2847	-1.615	0.00716	19.54	2.945
10	57.26	256	87	0.0846	2.092	0.01013	3.86	1.374

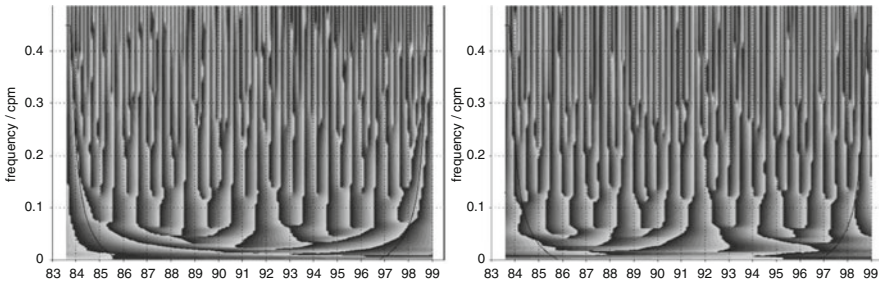


Fig. 47.17 WT based phase spectrograms of monthly global CH₄ load (*left panel*) and growth rate (*right*), 07/1983–12/1998; frequency unit: cycles per month (cpm)

a slight drift from the shortest to the longer periods, there is a rare, deep phase coincidence across the whole frequency domain down to, and including, the biennial to quadriennial range. In the analogous growth rate phase spectrogram (Fig. 47.17, right panel), the coincidence appears a couple of months earlier, toward the end of 1991 (recall Fig. 47.14c), and extends even deeper into the longer-period range.

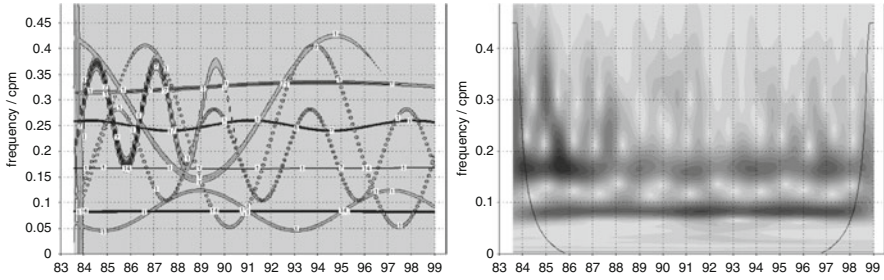


Fig. 47.18 MP-FM (#1–10; *left panel*) and WT spectrograms (Morlet; *right*) of monthly global CH_4 growth rate; 07/1983–12/1998; frequency unit: cycles per month (cpm)

For more direct comparison with the SSA study (Carl 1998), MP-FM and WT magnitude spectrograms of the CH_4 growth rate are given in Fig. 47.18. Among MP-FM modes #1–10 (not individually displayed) there is no slower time domain motion; the spectrogram is dominated by the seasonal, semiannual and higher SC-harmonic modes. This means that the adaptive capacity and precision of deseasonalization may be crucial to correct detection of the TBO and slower modes. The WT spectrogram (right panel) exhibits a weak, more localized signal that culminates toward the second half of 1991 and extends from the seasonal cycle mode toward the slower quasibiennial range—where it arises in early 1992. However, time localization of longer-period signals is uncertain in the WT which bears unfavourable ‘uncertainty’ properties in the TF plane (cf. Appendix). Note that the resonance effect near the left-hand boundary is represented in the MP-FM spectrogram (left panel) as an isolated, localized signal—but it is the vicinity to the boundary of the data period here that makes its representation uncertain as well.

However, this MP-FM spectrogram bears a real surprise, namely frequency modulations which resemble those found in the gas production time series (Fig. 47.12, left panel). The question thus arises whether these MP-FM and SSA based growth rate approximations might not provide hints indeed at the nature of anthropogenic impacts on climate dynamics. A supplementary discussion is given in Sect. 47.6. Beforehand, a glance has to be shed on potential effects of crisis and war in the Gulf on the global methane load and growth rate.

47.5.2 CH_4 Scenario of the Gulf Crisis and War

Figure 47.19 provides a simple “Middle East CH_4 scenario” (Carl 1998) that roughly takes the success of fire extinction and control over wild wells into account. No doubt disputable, it may illustrate a potential gross effect. Oil translates into atmospheric CH_4 via its associated gas, which contains about 80 % CH_4 (90 % CH_4

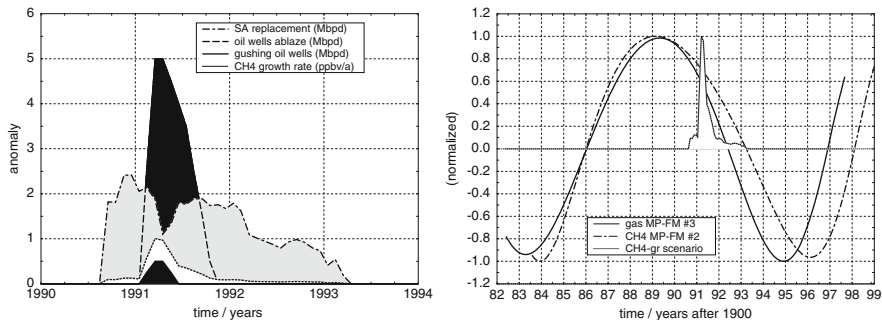


Fig. 47.19 *Left panel:* Middle East CH₄ growth rate scenario (white; dotted line), fed by burning (black; long-dashed) and gushing oil wells (black; full line) as well as SA replacement production (grey; dash-dotted); *right panel:* Normalized MP-FM modes #3 of world gas production (full line) and #2 of the global CH₄ load (dash-dotted) & growth rate scenario of the left panel

are a good estimate for natural ‘dry’ gas). The “gas to oil ratio” (GOR) of a reservoir is available in some cases. Kuwait’s Burgan field has a GOR of 464, i.e. 464 cf gas are associated with each barrel of oil (Husain 1994a). With a specific weight of 0.7157 kg/m³ for CH₄ and a conversion factor 0.3614 ppbv/Tg for its global mole fraction (cited in Dlugokencky et al. (1998)), complete loss—as assumed here for gushing wells—would rise the globally averaged CH₄ mixing ratio by ~2.719 pptv per Mb of Burgan oil (pptv—parts per trillion by volume). 5 % escape at the wellheads may be assumed for those ablaze, adding to further 2 % that may have survived incomplete combustion.

For the Saudi Arabian crisis production a doubled venting/flaring rate of associated gas is taken, even though the normal rate is already high in the Middle East (~30 %). Assuming 20 % unburnt escape, i.e. 6 % of the gas associated with that excess production, the instantaneous CH₄ growth rate scenario completes as shown in the left panel of Fig. 47.19. GOR 500 was taken for Kuwaiti and GOR 400 for Saudi Arabian oil, the replacement production was adopted from Fig. 47.8 as indicated there, and peak values of 0.5 (5.0) Mbpd for gushing (burning) oil were blended with a monthly [Feb.–May] filter of [0.5/1/1/0.5] for gushing wells, and a [Feb.–Oct.] filter of [0.5/1/1/0.9/0.8/0.7/0.5/0.3/0.1] for burning ones.

Though one should not overstrain imperfect coincidences, the right panel of Fig. 47.19 shows a normalized view of two conspicuously similar MP-FM modes, namely #3 of worldwide gas production (Fig. 47.11) and #2 of the global CH₄ load (Fig. 47.16), together with the growth rate scenario of the left panel. To say the least, it does not contradict the hypothesis of a discernible impact on the global CH₄ load from the Middle East occurrences. At the apparent end of the emission anomaly, early in 1993, CH₄ lags behind gas production by ~9.5 months, as compared with ~2 months at its beginning.

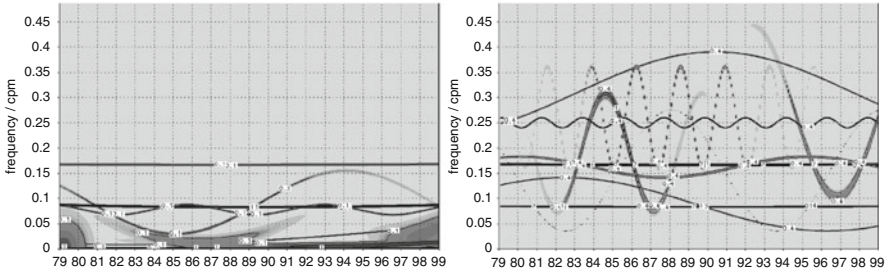


Fig. 47.20 MP-FM spectrograms of CO₂ mixing ratio (in ppmv; *left panel*) and growth rate (in ppmv/a; *right*); 01/1979–12/1998; frequency unit: cycles per month (cpm)

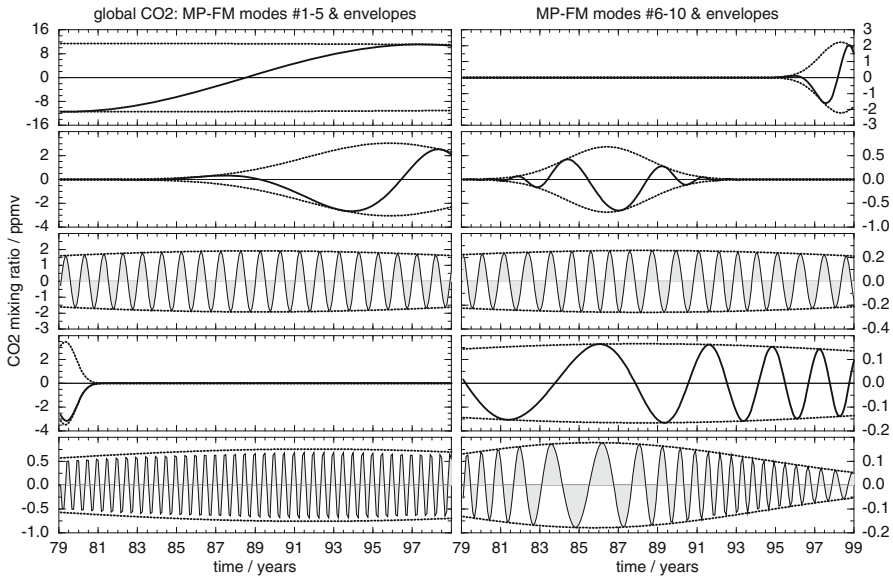


Fig. 47.21 Leading 10 MP-FM modes and their signal envelopes of the global monthly CO₂ load (in ppmv); 01/1979–12/1998

47.5.3 Carbon Dioxide in Perspective

Turning to CO₂, Fig. 47.20 shows MP-FM spectrograms of the global mixing ratio (left panel; cf. also Fig. 47.21 and Table 47.8) and its growth rate (right), again of the leading 10 modes. Whereas a technical boundary effect might partially be blamed for the leftmost slow-mode patch in the mixing ratio (mode #4 in Fig. 47.21), the other patches (modes #2, 6, 7) are traced back in the growth rate figure (right panel) to a change between modulated modes, carrying the MP-FM view on a regime transition just at the beginning of the 1990s—as also seen in the iterative SSA study (Fig. 47.22) (Carl 1998).

Table 47.8 MP-FM structure books of modes #1–10 of monthly global CO₂ load and growth rate (01/1979–12/1998), centered analyses (transform time from monthly to yearly according to $t_y := t_m/12 + 79$); f , \tilde{f} in cycles per month (cpm)

k	α_k	s_k	u_k	f_k	ϕ'_k	\tilde{f}_k	β_k	$\tilde{\phi}'_k$
Global CO ₂ load (in ppmv)								
1	128.72	2,048	21	0.0021	-2.782	0.00049	0.33	-0.393
2	19.78	128	202	0.0405	3.023	0.00121	29.38	-2.749
3	19.81	512	122	0.1051	-0.613	0.00082	27.30	3.142
4	9.52	16	4	0.0058	2.689	0.00000	0.00	0.000
5	7.75	512	155	0.1768	2.592	0.00063	16.43	-2.945
6	6.99	32	232	0.0884	0.671	0.00465	14.71	-2.553
7	3.28	64	89	0.0964	2.461	0.00288	29.38	3.142
8	2.68	512	111	0.0776	3.078	0.01154	0.86	2.160
9	1.71	512	110	0.0372	-0.103	0.00151	19.07	-2.553
10	1.56	256	81	0.0923	1.602	0.00465	13.50	-2.945
Global CO ₂ growth rate (in ppmv/a)								
1	131.34	1,024	123	0.0923	1.539	0.00063	14.36	3.142
2	94.69	512	120	0.1768	2.252	0.00066	15.73	3.142
3	28.39	1,024	15	0.2500	2.834	0.03881	0.26	-2.945
4	13.00	64	75	0.1928	2.512	0.01632	7.06	0.785
5	10.98	64	214	0.2726	-2.877	0.00929	18.30	3.142
6	10.83	256	127	0.1621	1.791	0.00552	3.74	-2.356
7	8.73	512	115	0.3105	1.422	0.00288	27.74	-0.393
8	8.19	512	135	0.0884	-1.912	0.00301	17.53	1.767
9	7.72	128	107	0.2611	0.624	0.03559	2.81	-1.767
10	7.54	2,048	226	0.1552	0.675	0.00748	16.04	-0.785

WT of the CO₂ growth rate (Carl 1998) shows branching at the turn of the 1980s of the low-frequency range into 3–4 and 5–6 year variability. Enforced frequency localization (by iterative SSA) generates the drifting and weakening QQ/QT mode of Fig. 47.22 to which the QQO in CH₄ temporarily synchronizes. A TBO in the CO₂ growth rate, roughly in quadrature with its CH₄ counterpart, changes phase during 1988/1989 to take the lead from the latter. The QTO in the CO₂ record has been attributed to Eastern Pacific sea surface temperatures, the QQO to the terrestrial biosphere (Dettinger and Ghil 1998).

However, the discernible QQO–QTO transition in CO₂ since the 1980s (Fig. 47.22) parallels the QTO emergence in the CH₄ growth rate after the 1991–1992 event, flanked by the weaker biennial lobe (Fig. 47.14d). These CH₄ evolutions should relate to the transition found in Dlugokencky et al. (1994c) from counter-to co-evolution between the hemispheric growth rates. Both the CO₂ and CH₄ records appear to hint at a change in the dynamic interaction between boreal and austral monsoons, in concert with a jump at the turn of the 1980s (signalled by the strong 1988/1989 La Niña event) in the interplay between ocean–atmosphere and atmosphere–land dynamics (Carl 1998). Although of great interest in the present context, in-depth scrutiny of the climatic backscene would lead away from the path and scope of this paper (cf. Sect. 47.6.1).

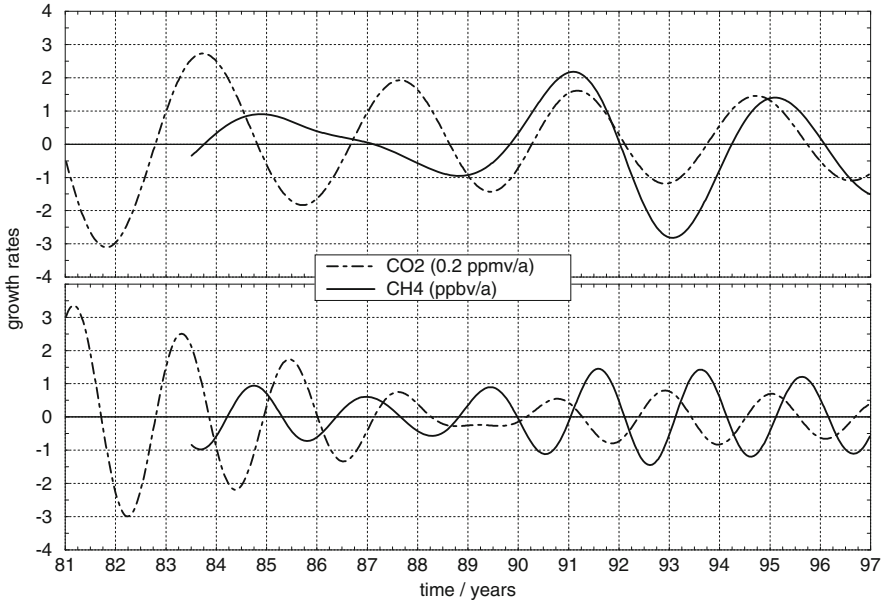


Fig. 47.22 QOO/QTO and TBO growth rate variability of CO₂ (in 0.2 ppmv/a; dash-dotted) and CH₄ (in ppbv/a; full line) as obtained via iterative SSA (Carl 1998)

47.6 Synthesis and Conclusions

It is an established method in physics to draw conclusions on a dynamic system from its response to perturbations. Tailored experiments may help identifying the system's dynamical status and mechanisms that govern its motion in the vicinity of the disturbed state. As cynical as it might sound, since such an 'experiment' with the climate system has been suffered by all involved parties, including the worldwide public (although under substantial protest), drawing climatic insights from the drama and testing modelling capabilities (Husain 1994b) is the least to be done after facing the failure of efforts to prevent it. A concluding endeavour is indicated to synthesize the results obtained, with a focus on lessons administered by, and learned from, the 1990/1991 Gulf crisis and war and its disastrous results. Apart from methodological issues, which are addressed in the Appendix, these lessons and conclusions belong to three major areas at least:

- (i) Background climate dynamics of the occurrences,
- (ii) Man's economic activity and its climatic signature,
- (iii) Policy implications with respect to anthropogenic climate change.

More general political aspects (e.g., His Majesty King Hussein 1990; Deutscher Bundestag 1991), economic, legal and security lessons (Seacor 1994, e.g.), as well as the apparent 'failure of science' in countenance of catastrophe-bearing developments of this type, are entangled with the environmental theme but were largely omitted from this study.

47.6.1 *Climate Dynamics: The Backscene*

The most important physical result of the research presented concerns the low-dimensional dynamic organization found at this occasion of the GCM's boreal summer monsoon system (Carl 1991b,c, 1992, 1994; Tschentscher et al. 1994; Carl et al. 1995; Carl 2013a). From these archetypal dynamics, a broad range of conclusions may be drawn on those of the real system (Carl 2013c). Considering the seasonal cycle (SC) of the climate system as a dynamic object of limit cycle type, driven by the annual external forcing, the system undergoes topological change(s) in summer which temporarily inflate this object into a torus segment, where the minor circumference is made up of the intraseasonal 40–60 days oscillation that carries the major monsoon activity cycle. The sensitive model response to smoke load scenarios, based on an undisturbed GCM climate that shows essential features of observed monsoon dynamics, is to be taken seriously. Simplified physical conditions under which the model has been run, including prescribed climatological lower boundary conditions, fixed insolation (solar constant), and invariable, globally averaged trace gas loads (taken as CO₂ equivalent), call for more advanced studies using this GCM studies. Nevertheless, the conceptual progress achieved allows conclusions about the climatic response at issue.

Monsoon retreat in autumn from the toroidal phase space object, i.e. re-adjustment of intraseasonal dynamics to the annual pace, is such a key aspect. It may proceed along three pathways, in essence: (i) from dormant monsoon, running smoothly into the externally forced SC; (ii) from active monsoon, bearing an excess load of atmospheric mass over the northern hemisphere (NH) and running into an “Indian Summer” type autumn climate, with anomalous autumn trajectories in both tropics and NH extratropics; (iii) from monsoon revival, leaving a largely symmetric forcing—with circulation anomalies in autumn confined to the tropics/subtropics—that may trigger a latent warm event (El Niño) in the tropical Pacific.

Real world analogues to cases (ii) and (iii) may have set the stage in autumn 1990 and 1991 for the CH₄ anomaly. Though the Southern Oscillation (SO), i.e. the atmospheric component of the El Niño–Southern Oscillation (ENSO) system, was prepared for El Niño to occur, a decidedly ‘uncooperative’ monsoon withdrew from its active phase into a pronounced Indian Summer type autumn in 1990, with northwards displaced tropical convection and tropospheric zonal jets, and a strong Pacific blocking, all enduring until November (Mo 1993). This type (ii) retreat met the actual state of the TBO thus enhancing its asymmetric SC anomaly that inhibited evolution of the (symmetric, largely equatorial) SO into El Niño. The frustrated SO, in turn, retarded the normal mining of the excessive NH mass load left in autumn 1990. Consistently, the winter monsoon developed below normal in NH precipitation, poleward advance over Australia and intraseasonal activity.

In contrast to 1990, a monsoon retreat of type (iii) matches the 1991 NH autumn patterns. A band of enhanced convection stretched from Southeast Asia into the Central Pacific (Janowiak 1993) and a related lower troposphere westerly wind event (Philips 1995) fanned the evolving El Niño for weeks. As outlined in Carl (1998),

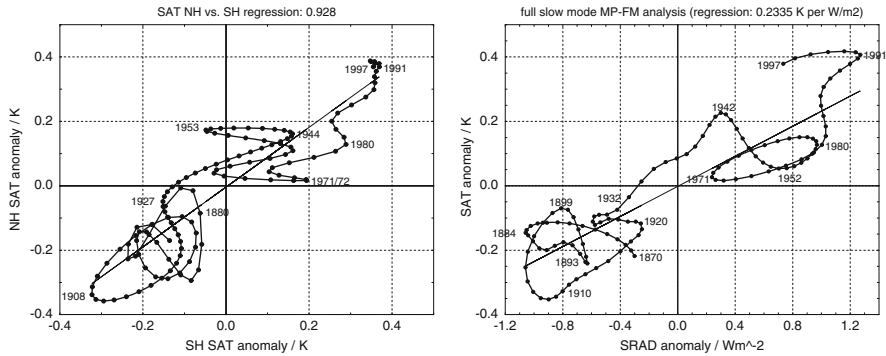


Fig. 47.23 MP-FM slow mode perspective on global warming (1870–1997); *left*: NH vs. SH SAT (in K); *right*: global SAT (in K) vs. insolation (SRAD; in W/m^2), anomaly analyses in annual resolution; *straight lines*: linear regressions (Source of figure: [Carl \(2013b\)](#))

an enhanced TBO, a type (iii) monsoon retreat and a typical western/central Pacific dipole structure evolved, just as in the prelude to the strong 1982/1983 El Niño (the moderate 1986/1987 event was preceded by a type (i) retreat). The climatic background thus favoured an enhanced TBO signal as reflected in the CH_4 record ([Carl 1998](#)). The methane burst from the Middle East should have strengthened the upward swing in the growth rate, moreover, whereas the cooling effect attributed to Mt. Pinatubo's eruption may be blamed in part for the strength of the subsequent downward swing (cf. Fig. 47.14a). The CH_4 growth rate scenario of Fig. 47.19 perfectly matches the rising 1991 TBO/QTO flank of Fig. 47.14d and makes up about two third of this biennial mode flank (or one fourth of the steep QTO rise).

Figure 47.23 ([Carl 2013b](#)) shows another climatic evolution of interest in the present context: A phase plot of annual hemispheric surface air temperatures (SAT; 1870–1997, left panel) exhibits thermal stagnation of the global climate system from the turn of the 1980s until 1997, the end of the record analysed there. It was accompanied by a longer-term decline of insolation (at top of the atmosphere, i.e. uninfluenced by the volcano eruption; right panel). This turning point in the climate system's long-term evolution just around the beginning of the 1990s renders it even more difficult to separate the anthropogenic trace gas signals. Moreover, sunspot cycle #22 started terminating, with a steep flank, just early in 1992 when the CH_4 growth rate showed its maximum decline—ironically coinciding with the terminating tail of the growth rate scenario of Fig. 47.19 (left panel). Note also in passing that the 1982/1983 El Niño followed a large volcano eruption (El Chichon), as with Mt. Pinatubo that preceded the 1992/1993 Pacific warm event.

Obviously, in this complex setting qualitative reasoning does not much help to disentangle man-made from natural effects in the global trace gas budget. As one of the opportunities, a set of detailed and specifically initialized GCM experiments would be desirable, using an advanced trace gas scheme. To substantiate this idea, Fig. 47.24 (left panel) shows the GCM's typical monsoon retreat variability which

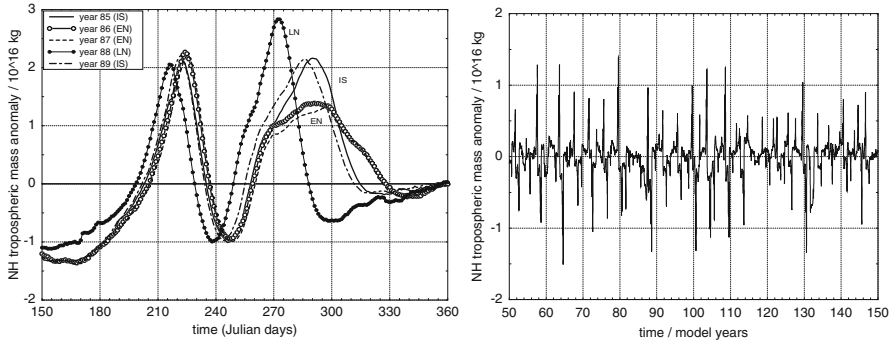


Fig. 47.24 *Left panel:* Monsoon retreat behaviour of the GCM, displayed as NH tropospheric mass anomaly (in 10^{16} kg), showing the three different types of retreat of which the “Indian summer” type (IS) exerts asymmetric pressure gradient forcing; *right panel:* 100 year segment of a control run showing substantial interannual variability at various scales (365 days average) (Sources of figure: Carl (2013a,c))

bears various interannual scales, not to the least the biennial one (Carl 2013a,c). A new set of experiments might be started from carefully chosen GCM states which approximate the 1990/1991 situation—replacing the annual mean state chosen in the early experiments (Sect. 47.3). These initial states may be taken from a longer control run as displayed in Fig. 47.24 (right panel; also comprising the example of the left panel).

47.6.2 Signatures of Man’s Economic Activity

Quantitative comparison of modal structures is a second promising approach. It may be used to estimate sensitivities and transfer rates between anthropogenic emissions and atmospheric budgets of CH_4 , and should be supported by time series analyses using scenario estimates like that of Fig. 47.19. A preliminary example of such an assessment of direct and indirect ‘translations’ between emissions and atmospheric methane growth rates is provided in Carl (1998) for man’s economic activity: Stalling oil and gas production may have slowed down the instantaneous CH_4 growth rate during 1991–1993 by ~ 2.5 ppbv/a², of which the direct contribution was certainly about one third. Counterbalanced by climate effects and Middle East emissions, these evolutions could not prevail in the global CH_4 record before 1992, however.

The estimate goes as follows: Adopting a mean venting/flaring loss of 5.7% and a consumption loss of 2.5%, worldwide gas production would change the global CH_4 growth rate by ~ 0.1125 ppbv/a² per bcf/d production change. Comparing the seasonal cycles (SCs) in both gas production and the CH_4 growth rate yields ~ 0.3 ppbv/a per bcf/d. The annual rise in production before the 1990–1994

stagnation amounted to ~ 7.75 bcf/d for gas and ~ 1.785 Mbd for oil (Fig. 47.9). Assuming GOR 300, the growth rate would thus have directly increased by ~ 0.932 ppbv/a², gas accounting for $\sim 90\%$. Indirect estimation using QTO cycles confirms the ‘climatic amplification’ found in the SC of the CH₄ growth rate, resulting in a ~ 2.5 ppbv/a² decline due to stagnation of worldwide oil and gas production. The anthropogenic effect may thus be roughly confined between the two limiting figures given. The uncertainty range can certainly be narrowed by modal structure analyses of accordingly modified time series. As with the Middle East CH₄ scenario, it goes without saying that this calls for series of carefully tailored data experiments, however, which have to be left for another study.

A range of further tasks and opportunities can be identified to reduce uncertainties in the estimation of man-made impacts on climate dynamics at the turn of the 1980s and the early 1990s. These include (i) a time series based comprehensive climate study in monthly resolution (to fit the oil and gas production data), in analogy to the annually resolved study (Carl 2013b), aimed to uncover the active modal structure network of the period and the status of internal synchronization at this timescale; (ii) incorporation of river runoff into such a climate study, as a result of natural spatial aggregations within the terrestrial hydrological cycle; (iii) in-depth and broad scrutiny of measurements at the oil fields concerning their external conditions, objectives, methods etc., with a view on sound CH₄ scenario development and related data experimentation; (iv) detailed study of seasonality effects ((sub-)structure and timing of the SC); (v) methodological advancement, notably extension of the MP-FM dictionary by an analysing waveform that directly captures impulse–response situations in order to better grasp perturbations.

47.6.3 Minutes on Climate Policy in a Nonlinear World

A fundamental lesson of relevance to climate policy reads: The world climate has sensitive spots where man’s activity may influence the system’s pathway more effectively than elsewhere; it does therefore matter, where and when emissions take place. As a political conclusion, the rules of emission trade (as ineffective as they might work at the time being) must become adjusted to this knowledge, which in turn has to be further substantiated and broadened. Only worldwide oil and gas productions have been considered here. The same analysis should be conducted for each major producer, and data bases on other anthropogenic emissions should enter a new round of investigations.

At the other side of this medal an opportunity emerges which also might enter negotiations on the mitigation of climate change: Having identified ‘hot spots’ of anthropogenic impacts on climate dynamics, notably the Middle East with its exposed location in relation to the boreal summer monsoon system, technical and technological measures to reduce emissions may focus on the regional low-pressure systems of production and transport. Specifically targeted investments may easier

come into effect than those required to solve the global emission problem. They are an alternative and supplement, at least, and may help gaining the time needed to reach the latter goal. It would be a matter of negotiation to arrive at a fair cost sharing scheme.

Another fundamental but more disputable theme is the way how to deal with risks. It reflects a strange self-consciousness of politics (and of interested circles in the back) if pressure is exerted to withheld data, for example (Seacor 1994, e.g.)—and likewise of representatives of the scientific community, if risks are either minimized or exaggerated (where there are simply gaps of knowledge). The Scientific Committee on Problems of the Environment (SCOPE) of the International Council of Scientific Unions (ICSU) launched a remarkable initiative in the early 1980s when the environmental risks of nuclear war had been discovered: A completely open, worldwide process of research to which every serious contribution was welcome. It resulted in an authoritative statement on the problem by the world scientific community (Pittock et al. 1986; Harwell et al. 1985) which reflected the state of knowledge and its uncertainties but did not refrain from drawing conclusions—a fateful hour of science en face of torrential global risks (even though it came after a bidecadal period of silence (Carl et al. 2008, e.g.)).

Appendix: Methods and Data

Three general remarks are in order before briefly drawing attention to the methods used in this study: (i) A methodical challenge is borne in the relatively small contributions that may be assigned to slow CH₄ growth rate processes; that is, the ‘art of de-seasonalization’ appears to be crucial with a view on the search for causal effects; (ii) in following the idea of sparse approximation, which the MP-FM approach stands for here, one implicitly addresses the dimensionality of the problem at hand; minimization of the ℓ^0 norm, i.e. of the number of modes that may suffice to approximate a time series with pre-given accuracy, thus touches a fundamental issue of the analysis of complex systems; (iii) ‘post mortem’ data analyses as usually conducted (also here) should be supplemented by impulse-response analyses to address the instantaneous, causal response of the system; as a compromise, the MP-FM dictionary could be supplemented in a future study by a corresponding analysing waveform.

Three methods of time series analysis have been used in the present study: Singular–system Analysis (SSA, originally termed “Singular Spectrum Analysis”; Vautard et al. 1992), the Wavelet Transform (WT; Torrence and Compo 1998) and the Matching Pursuit technique (MP; Mallat and Zhang 1993). Just like measuring instruments in experimental and field research, these methods have their own, individual features each and provide different views of the study object. Speaking in terms of linear operator theory, they transform the data according to their eigen- (or more generally, singular) systems which consist of fundamental modes and their respective contributions to the data object as obtained by means of projection. The

very nature of this task is inversion of a signal transduction system

$$\chi(t) = \mathcal{T}\{\check{\chi}\}(t) \equiv \int_T \kappa(t, t') \check{\chi}(t') dt', \quad (47.3)$$

where $\chi(t)$ is the time series as obtained by a measuring operation \mathcal{T} (written as integral operator with a certain kernel κ) from the ‘true’ data object $\check{\chi}(t)$. T is the time support, i.e. the length of the time series. A concise yet fairly complete background discussion may be found in [Carl and Behrendt \(2008\)](#).

Singular–System Analysis (SSA)

SSA belongs to the family of Principal Component Analyses and provides thus a statistical decomposition of the data $\chi(t)$ ([Carl and Behrendt 2008](#), e.g.). It emulates the delay coordinate approach to dynamic systems analysis from time series and has been invented just to extract dynamic modes from short, noisy data ([Vautard and Ghil 1989](#)). The expansion exploits dependence in second–order statistics and is complete and optimal in the sense of captured variance. The SSA eigenvalue problem is an integral equation of convolution type,

$$\mathcal{T}^{SSA}\{\phi_i\}(t) := \frac{1}{\theta} \int_{\theta} C_{\chi}(t - \tau) \phi_i(\tau) d\tau = \lambda_i \phi_i(t), \quad (47.4)$$

where κ in (47.3) is replaced with the normalized autocovariance function of χ at lag τ , $C_{\chi}(t - \tau)/\theta$. Each λ_i has the physical meaning of a variance; θ is a time window. SSA decomposition, that is, the attempt to reconstruct individual modes that reflect the diverse impacts which might have generated the data object $\check{\chi}$, proceeds via $\chi(t, \tau) = \sum_{i=1}^N \chi_i(t + \tau) = \sum_{i=1}^N \xi_i(t) \phi_i(\tau)$, where the projection coefficients (“principal components”) ξ_i become time-dependent due to the windowed approach. SSA modes are finally reconstructed to full time series length via $\chi_i(t) = \frac{1}{\vartheta} \int_{\vartheta} \xi_i(t - \tau) \phi_i(\tau) d\tau$ ($\vartheta = \theta$, except at the boundaries). Certain freedom in the choice of N (or θ) relates to embedding.

A problem with the application of SSA in the analysis of complex systems results from its variance criterion which tends to mix dynamically discernible modes. To overcome this shortage, the SSA modal structure has been re-sorted into two components of which one carries the ‘mode’ of interest (identified by its Fourier peak), and the other one the residue. Both are treated by SSA again and re-sorted until the Fourier Transform (FT) provides a sufficiently clean mode. This mode is extracted from the time series then, and the procedure starts anew in order to extract the next mode, and so forth. This stepwise (“greedy”) decomposition is common practice today and has a predecessor in the ‘pre-whitening’ approach—which in general focused on a ‘clean’ residual statistic, though.

Proceeding this way, it turned out that certain Fourier peaks could not be isolated as pure modes, leading to the conclusion that frequency modulation (FM) must play a role in the data at hand. One of the FT traps is just its misleading FM representation which may pretend a signal energy distribution that has nothing to do with reality (generation of spurious spectral peaks or suppression of real ones, e.g.). Note also that the recommended Toeplitz structure of the covariance matrix C bears the presumption of stationarity and is not useful here since it produces, after lengthy iteration, nothing but the result of the FT (after all, it confirmed correct coding at least). A lagged form of C has therefore been used in the iterative SSA study of Carl (1998).

Wavelet Transform (WT)

As a ‘fractional’ time–scale transform, the WT yields a 2D result. The time–scale plane is subdivided to this end into tiles of equal area, a choice that bears an ‘uncertainty relationship’ of signal processing. In the larger scale–range the tiles cover longer time segments and thus have a bad temporal (but a good scale) resolution. For shorter scales, in contrast, the time resolution is higher at the expense of a worse scale resolution. Singularities, which settle in the shortest scale–range, are precisely localized in time by the WT.

Unlike the SSA, both FT and WT have recourse to a data model. Whereas the FT maps a time series $\chi(t)$ onto its basis of infinitely extended harmonic signals ($\cos(\omega t)$, $\sin(\omega t)$), the WT provides analysing signals of finite scale (“wavelets”), which all result from a “mother” wavelet via compression or stretching and translation along the time axis. A natural extension of the harmonic FT basis is the “Morlet”, a harmonic with Gaussian envelope, $\psi_M(t) = g(t) \exp(i\omega t)$. Its “daughter” wavelets formally equal the “Gabor atom” of signal processing (Gabor 1946) (“Gabor wavelet”):

$$\psi_\gamma(t) = \frac{1}{\sqrt{s}} g\left(\frac{t-u}{s}\right) e^{i\omega t}. \quad (47.5)$$

Signal space index $\gamma = (s, u, \omega)$ comprises the signal attributes scale s , translation u (i.e. position of maximum signal energy), and frequency $\omega = 2\pi f$, the Gaussian time window normalizes the signal energy of these basis functions: $g(\tau) = \sqrt[4]{2} \exp(-\pi \tau^2)$.

Like the FT, the WT is defined as inner product between $\chi(t)$ and a basis function $\psi(t)$ ($e^{i\omega t}$ with the FT), written here as daughter wavelet:

$$\mathcal{T}_\psi^{WT}\{\chi(t)\}(u, s) = \frac{1}{\sqrt{s}} \int_{-\infty}^{\infty} \chi(t) \bar{\psi}\left(\frac{t-u}{s}\right) dt \quad (47.6)$$

($\bar{\psi}$ is the complex conjugate of ψ). This yields for the Morlet ψ_M , in complete analogy to the FT:

$$\mathcal{T}_{\psi_M}^{WT}\{\chi(t)\}(u, s) = \frac{1}{\sqrt{s}} \int \chi(t) g\left(\frac{t-u}{s}\right) e^{-i\omega t} dt. \quad (47.7)$$

As problem specific as various wavelets might be defined, they have a common restriction (aside of other ‘admissibility conditions’) in their fixed relationship between scale and frequency—which is the basis, however, of any WT application as a TF method. It removes the argument ω in (47.6) which becomes redundant also in γ with the transition $\psi_\gamma \Rightarrow \psi_M$. This makes the difference between Morlet and Gabor atom. Throughout the present paper, the Morlet has been taken as analysing wavelet.

Matching Pursuit (MP)

The MP technique combines a “greedy” procedure (as also used in the iterative SSA application) with the data model approach. To cope with frequency modulation (FM), a specific dictionary of analysing wavelets is used: An MP-FM “mode” as defined here is the projection of the actual best-fitting “Gaussian logon” (47.8) on the time series (or its respective residual after the initial step of extraction). This new elementary signal,

$$\psi_{r\tilde{\gamma}}(t) = \frac{1}{\sqrt{s}} g\left(\frac{t-u}{s}\right) \cos(\omega_c(t-u) + \phi' + \tilde{\varphi}(t-u)), \quad (47.8)$$

spans a 7D signal space $\tilde{\gamma} = (s, u, \omega_c, \phi, \beta, \tilde{\omega}, \tilde{\phi})$: $\omega_c = 2\pi f_c$ is the angular carrier frequency, ϕ the phase constant of the carrier mode, $\beta = \delta\omega/\tilde{\omega}$ the modulation index ($\delta\omega$ is peak deviation from ω_c), $\tilde{\omega} = 2\pi \tilde{f}$ the modulation angular frequency, and $\tilde{\phi}$ the phase constant of harmonic phase modulation, $\tilde{\varphi}(\tau) = \beta \sin(\tilde{\omega}\tau + \tilde{\phi}')$. The explicit use of phase constants unties the signal’s phase(s) from its energy localization u (phase constants $\phi' = \phi + \omega_c u$ and $\tilde{\phi}' = \tilde{\phi} + \tilde{\omega} u$ earmark this independence on location u). The ‘double harmonic Gabor atom’ thus raises all the restrictions this way that are imposed by construction to the WT—at the expense of a much higher demand for computational resources, notably runtime (due to the high signal space resolution required; MP-FM bears a generic massively parallel task).

Though the decomposition is linear, the Gaussian logon may match highly nonlinear waveforms for each individual mode. Convergence has been proved for long (Mallat and Zhang 1993), i.e. summing up the modal structure approximates the time series to any desired accuracy. In contrast to the SSA or customary TF representations, like windowed FT or WT, the MP-FM “structure book” precisely describes the modal structure of a time series in terms of eight parameter values per

mode. Besides the 7D signal space location, it contains a projection coefficient α_k that quantifies the part of signal energy captured by mode k . Seven-dimensionality of the MP-FM signal notwithstanding, only amplitude (the Gaussian envelope) and phase (or its time-derivative, frequency) bear time-dependence in the Gaussian logon. The traces that all modes of a time series $\chi(t)$ describe in the signal space may thus be projected on the TF plane if the (Gaussian) amplitude modulation is displayed as intensity (isolines); the result is an MP-FM spectrogram of $\chi(t)$. MP-FM performance has been discussed in a broad study into synchronous motions hidden in customary climate data (Carl 2013b), which the interested reader is referred to.

Data Sources

Monthly oil and gas production data have exclusively been taken from the Oil & Gas Journal (OGJ 1982–1992) and its Data Books (OGJ Data book 1984–1998). Details used for the scenarios of Kuwait fire GCM experiments have been found in diverse sources as cited, scattered over the literature. CH₄ data of the Carbon Cycle Group (CCG) of the National Oceanic and Atmospheric Administration, Climate Monitoring and Diagnostics Laboratory (NOAA-CMDL), were initially used as available at June 12, 1998, in postscript format via ftp (update of August 12, 1997; Dlugokencky et al. 1998). They could partially be replaced later by original time series kindly provided by the authors (cf. Acknowledgements). The climate data used for illustration may be found in Jones (1994) (SAT; unfortunately provided in deseasonalized form) and Lean et al. (1995) (SRAD).

Acknowledgements This report refers to studies conducted (from time to time) over more than two decades and has recourse to results obtained with the indirect help of many authors. Detailed descriptions of the methods used, namely SSA (Vautard and Ghil 1989), WT (Torrence and Compo 1998) and MP (Mallat and Zhang 1993), were especially important for own code developments. Graphics tools XvGr (Turner 1992) and GrADS (Doty 1992) have extensively been used and are referred to with due respect and gratitude. Invaluable data sources as cited are gratefully acknowledged, and a generous support has to be mentioned with special thanks: To enable direct comparison and to avoid mistakes due to their reconstruction from published PostScript figures, Ed Dlugokencky once provided the time series of deseasonalized CH₄ and CO₂ growth rates as obtained by the Carbon Cycle Group of the NOAA Climate Monitoring and Diagnostics Laboratory.

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Chapter 48

Fuzzy Generalized Fractal Dimensions for Chaotic Waveforms

R. Uthayakumar and D. Easwaramoorthy

48.1 Introduction

The classical Euclidean geometry works with objects which exist in integer dimensions, whereas fractal geometry deals with objects in non-integer dimensions. A “*Fractal*” is generally a rough or fragmented geometric shape that can be split into parts, each of which is (atleast approximately) a reduced-size copy of the whole, a property called self-similarity. In 1975 the word Fractal was coined by Benoit Mandelbrot, the Professor Emeritus of Mathematical Sciences, in his fundamental essay and was derived from the Latin word, *fractus* meaning broken or fractured to describe objects that were too irregular to fit into a traditional geometrical setting. In his original article, Mandelbrot mathematically defined a Fractal to be a set with Hausdorff dimension strictly greater than its topological dimension (Mandelbrot 1983).

Roughly speaking, a fractal set is a set that is more “irregular” than the sets considered in classical geometry. Karl Weierstrass gave an example of a function with the non-intuitive property of being everywhere continuous but nowhere differentiable, called Weierstrass Function, whose graph would today be considered as fractal (Barnsley 1993; Falconer 2003). The complexity and irregularity that can be found in many physical and biological non-linear systems naturally and which

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has been analyzed by the tools of fractal theory and computed by the measure called Fractal Dimension. The Fractal Dimension refers to a non-integer or fractional dimension of a geometric object.

Among all the non-linear techniques, the correlation dimension measurement is more accessible in dealing with experimental systems. The absolute value of the estimated correlation dimension does not represent complexity of the data especially since it is only one scalar value from the system of fractal dimension spectrum. The single valued dimensional quantity is insufficient to characterize the nonuniformity or inhomogeneity of the chaotic waveforms. Generally, chaotic attractors are inhomogeneous. Such an inhomogeneous set is called a Multifractal and is characterized by Generalized Fractal Dimensions (GFD) or Renyi Fractal Dimensions. The usage of the whole family of fractal dimensions should be very useful in comparison with using only some of the dimensions (Grassberger 1983; Hentschel and Procaccia 1983; Lakshmanan and Rajasekar 2003). So far the chaotic nature of the non linear signals has been analyzed by the multifractal measure called Generalized Fractal Dimensions (Easwaramoorthy and Uthayakumar 2010a,b,c, 2011; Uthayakumar and Easwaramoorthy 2012).

In this paper, we have developed a fuzzy multifractal theory in order to define the Fuzzy Generalized Fractal Dimensions by introducing fuzzy membership function in classical Generalized Fractal Dimensions method. It was shown that, the defined Fuzzy GFD method accurately classifies the complexity of the chaotic waveforms such as Weierstrass functions by comparing graphically with the classical GFD method. Hence the fuzzy multifractal analysis performs significantly than the classical multifractal analysis. Also the designed Fuzzy GFD is a generalized method of the classical GFD. The organization of the paper is as follows: in Sect. 48.2 the mathematical part includes Renyi entropy and Generalized Fractal Dimensions for chaotic signals are described. Also fuzzy Renyi entropy and Fuzzy Generalized Fractal Dimensions for signals are defined. In Sect. 48.3, the details of synthetic Weierstrass sine and cosine waveforms are given. The obtained computational results are discussed clearly in Sect. 48.4. Finally, concluding remarks are presented in Sect. 48.5.

48.2 Mathematical Analysis

48.2.1 Renyi Entropy

Renyi entropy (Renyi 1955; Shannon 1998) played a significant role in the information theory. Renyi entropy, a generalization of Shannon entropy, is one of the family of functionals for quantifying the diversity, uncertainty or randomness of a given system. It was introduced by Alfred Renyi (1955). Renyi entropy is also known as generalized entropy of a given probability distribution.

The *Renyi entropy* of order q , where $q \geq 0$ and $q \neq 1$, of the given probability distribution is defined as

$$RE_q = \frac{1}{1-q} \log_2 \left(\sum_{i=1}^N p_i^q \right) \quad (48.1)$$

where $p_i \in [0, 1]$ is the probability of the random variable which takes the value x_i for $i = 1, 2, \dots, N$.

If the probabilities are all the same then all the Renyi entropies of the distribution are equal, with $S_q = \log_2 N$. Otherwise the entropies are decreasing as a function of q .

48.2.2 Fuzzy Renyi Entropy

Similar to the definition of Renyi entropy, we define the *Fuzzy Renyi Entropy* of order q , where $q \geq 0$ and $q \neq 1$, on the given set S as

$$FRE_q = \frac{1}{1-q} \log_2 \left(\sum_{i=1}^N \left(\sum_{x \in S_i} \mu(x) \right)^q \right) \quad (48.2)$$

where $\mu : S \rightarrow [0, 1]$ is the fuzzy membership function on the set S with N -Partitions S_1, S_2, \dots, S_N .

Some Particular Cases

- If $q = 0$, then

$$FRE_0 = \log_2 N$$

which is called the *Fuzzy Hartley entropy* of the given fuzzy membership function.

- Note that if q approaches 1, it can be shown that FRE_q converges to FRE_1 , which is defined as

$$FRE_1 = - \sum_{i=1}^N \left(\sum_{x \in S_i} \mu(x) \log_2 \left(\sum_{x \in S_i} \mu(x) \right) \right)$$

which is called the *Fuzzy Shannon entropy* of the given fuzzy membership function.

48.2.3 Multifractal Analysis

The Renyi entropies are important in non-linear analysis and statistics as indices of uncertainty or randomness. They also lead to a spectrum of indices of Fractal Dimension (Renyi Fractal Dimensions or Generalized Fractal Dimensions). Grassberger (1983) and Hentschel and Procaccia (1983) systematically developed the multifractal theory, which is based on the measure called Generalized Fractal Dimensions (GFD). In this section, we describe the GFD Method (Easwaramoorthy and Uthayakumar 2010a,b,c, 2011; Grassberger 1983; Hentschel and Procaccia 1983; Uthayakumar and Easwaramoorthy 2012) and introduce the Fuzzy GFD Method.

Generalized Fractal Dimensions for Chaotic Signals

Now we define a probability distribution of a given fractal waveforms by the following construction.

The total range of the signal is divided into N intervals (bins) such that

$$N = \frac{V_{max} - V_{min}}{r}$$

where V_{max} and V_{min} are the maximum & the minimum values of the signal received in the experiments, respectively; and r is the uncertainty factor, that may be depend on the measuring device used to record the signals.

Now the probability that the signal passes through the i th interval of length r is given by

$$p_i = \lim_{N \rightarrow \infty} \frac{N_i}{N}, \quad i = 1, 2, \dots, N$$

where N_i is the number of times the signal passes through the i th interval of length r .

Then, the *Renyi Fractal Dimensions or Generalized Fractal Dimensions (GFD)* of order $q \in (-\infty, \infty)$ for the known probability distribution, denoted by D_q , can be defined as

$$D_q = \lim_{r \rightarrow 0} \frac{1}{q-1} \frac{\log_2 \left(\sum_{i=1}^N p_i^q \right)}{\log_2 r}. \quad (48.3)$$

Here D_q is defined in terms of generalized Renyi entropy. Note that $D_q = D_0$, for all q for a self-similar signal with probabilities $p_i = 1/N$, for all i . Also observe that $D_q = D_0 = 0$, for all q for a constant signal because all probabilities except one equal to zero, whereas the exceptional probability value is one. For all q , we have $D_q > 0$. It can be shown that if $q_1 < q_2$, $D_{q_1} \geq D_{q_2}$ such that D_q is a monotone decreasing function of q .

Some Special Cases

1. If $q = 0$, then

$$D_0 = - \frac{\log_2 N}{\log_2 r}$$

which is nothing but the *Fractal Dimension*.

2. As $q \rightarrow 1$, D_q converges to D_1 , which is given by

$$D_1 = \lim_{r \rightarrow 0} \frac{\sum_{i=1}^N p_i \log_2 p_i}{\log_2 r}.$$

This is called as *Information Dimension*.

3. If $q = 2$, then D_q is called the *Correlation Dimension*.

48.2.4 Fuzzy Multifractal Analysis

Here we introduce the Fuzzy Generalized Fractal Dimensions (F-GFD) for quantifying the fuzziness of multifractal signals.

Fuzzy Generalized Fractal Dimensions for Chaotic Signals

Now we define the Fuzzy Generalized Fractal Dimensions for a given fractal waveforms by the following construction.

The total range of the signal S is divided into N intervals (bins) S_1, S_2, \dots, S_N such that

$$N = \frac{V_{max} - V_{min}}{r}$$

where V_{max} and V_{min} are the maximum & the minimum values of the signal received in the experiments, respectively; and r is the uncertainty factor, that may be depend on the measuring device used to record the signals.

Define a fuzzy membership function, $\mu : S \rightarrow [0, 1]$, on the set of signal values S partitioned by N intervals S_1, S_2, \dots, S_N .

Then, the *Fuzzy Renyi Fractal Dimensions or Fuzzy Generalized Fractal Dimensions (F-GFD)* of order $q \in (-\infty, \infty)$ for the given fuzzy membership function on the set of signal values S , denoted by FD_q , can be defined as

$$FD_q = \lim_{r \rightarrow 0} \frac{1}{q - 1} \frac{\log_2 \left(\sum_{i=1}^N \left(\sum_{x \in S_i} \mu(x) \right)^q \right)}{\log_2 r}. \tag{48.4}$$

Here FD_q is defined in terms of generalized Fuzzy Renyi Entropy.

Some Special Cases

1. If $q = 0$, then

$$FD_0 = -\frac{\log_2 N}{\log_2 r}$$

which is nothing but the *Fractal Dimension*.

2. As $q \rightarrow 1$, FD_q converges to FD_1 , which is given by

$$FD_1 = \lim_{r \rightarrow 0} \frac{\sum_{i=1}^N \left(\sum_{x \in S_i} \mu(x) \log_2 \left(\sum_{x \in S_i} \mu(x) \right) \right)}{\log_2 r}.$$

This is called as *Fuzzy Information Dimension*.

3. If $q = 2$, then FD_q is called the *Fuzzy Correlation Dimension*.

4. If a fuzzy membership function, $\mu : S \rightarrow [0, 1]$, on the set of signal values S partitioned by N intervals S_1, S_2, \dots, S_N , is defined as

$$\mu(x) = 1/N$$

then the Fuzzy Generalized Fractal Dimensions is same as the classical Fuzzy Generalized Fractal Dimensions, i.e., $FD_q = D_q$. In this case, classical GFD is a particular case of the Fuzzy GFD.

48.2.5 Gaussian Fuzzy Membership Function

The symmetric Gaussian fuzzy membership function, $g : S \rightarrow [0, 1]$, on S depends on two parameters namely, mean (\bar{x}) and standard deviation (σ) as given by

$$g(x; \bar{x}, \sigma) = e^{-\frac{(x-\bar{x})^2}{2\sigma^2}} \tag{48.5}$$

48.3 Synthetic Weierstrass Waveforms

Synthetic waveforms are generated using the Weierstrass sine and cosine functions (Barnsley 1993; Falconer 2003), respectively given as follows,

$$f(t) = \sum_{k=1}^M \lambda^{(s-2)k} \sin(\lambda^k t) \tag{48.6}$$

and

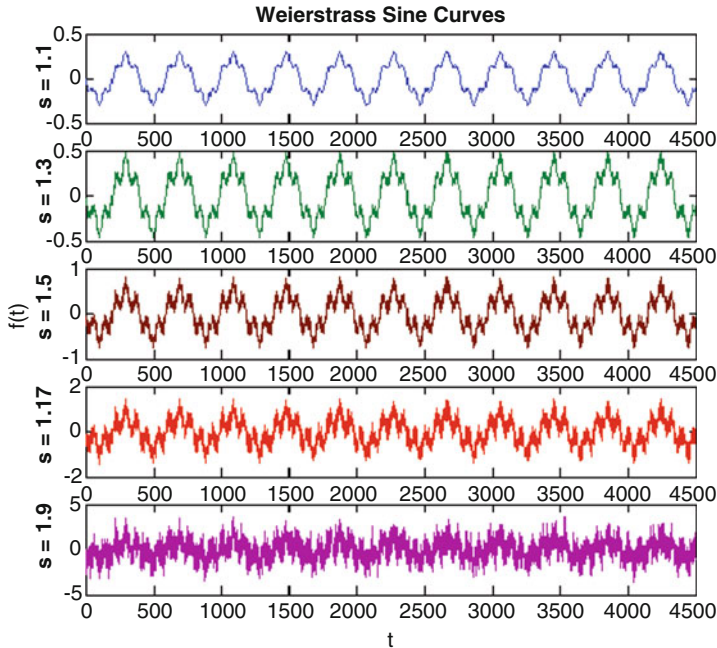


Fig. 48.1 Weierstrass sine curves for $s = 1.1, 1.3, 1.5, 1.7$ and 1.9

$$f(t) = \sum_{k=1}^M \lambda^{(s-2)k} \cos(\lambda^k t). \tag{48.7}$$

where $1 < s < 2$, $\lambda > 1$ and $M \in \mathbb{N}$. Note that this function is everywhere continuous but nowhere differentiable (Falconer 2003).

Now we fixed the parameters as $\lambda = 5$ and $M = 400$ and get the Weierstrass sine and cosine waveforms for $s = 1.1, 1.3, 1.5, 1.7$ and 1.9 as in Figs. 48.1 and 48.2 respectively.

48.4 Results and Discussions

Simulations are carried out in MATLAB software using synthetic signals with different chaotic nature.

The Weierstrass cosine curves with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9 , as described in the Sect. 48.3 of this paper, were taken in this study to analyze the efficiency of developed fuzzy multifractal theory and Fuzzy GFD. The probability distributions of each of the five representative synthetic Weierstrass cosine waveforms were obtained and the corresponding Generalized Fractal Dimensions were also

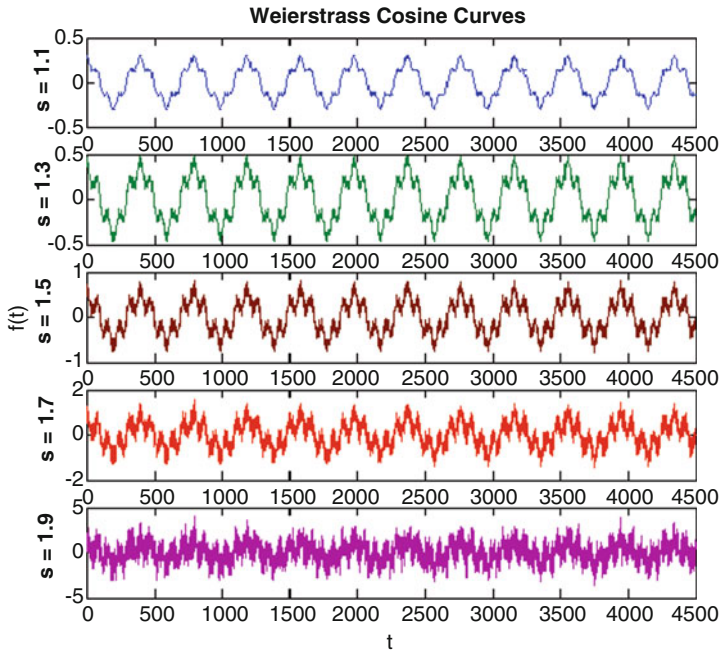


Fig. 48.2 Weierstrass cosine curves for $s = 1.1, 1.3, 1.5, 1.7$ and 1.9

computed for the obtained probability distribution. Likewise, the membership values of each of the five representative signals were obtained by using the Gaussian fuzzy membership function (g). Then Fuzzy Generalized Fractal Dimensions for all five representative waveforms were determined by using obtained Gaussian membership values.

The graph of the Gaussian fuzzy membership function for all five representative Weierstrass cosine waveforms with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9 are depicted in Fig. 48.3. The computed classical GFD values are plotted against its order values q varies from 2 to 100 for all five representative waveforms as in Fig. 48.4. Similarly the determined Fuzzy GFD values are plotted against its order values q varies from 2 to 100 for all waveforms as shown in Fig. 48.5. In addition to that, Box Plots of GFD values and Fuzzy GFD values are plotted for all five representative Weierstrass cosine waveforms with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9 ; and are demonstrated respectively in the Figs. 48.6 and 48.7.

Figure 48.3 shows that, if complexity of the Weierstrass cosine function increases i.e., s increases, then the values of their corresponding membership function have higher variations. For the Weierstrass cosine function with $s = 1.9$ has the higher variation of membership values than the Weierstrass waveforms with $s = 1.1, 1.3, 1.5$ and 1.7 , as demonstrated in Fig. 48.3. In Fig. 48.4, the GFD spectra of

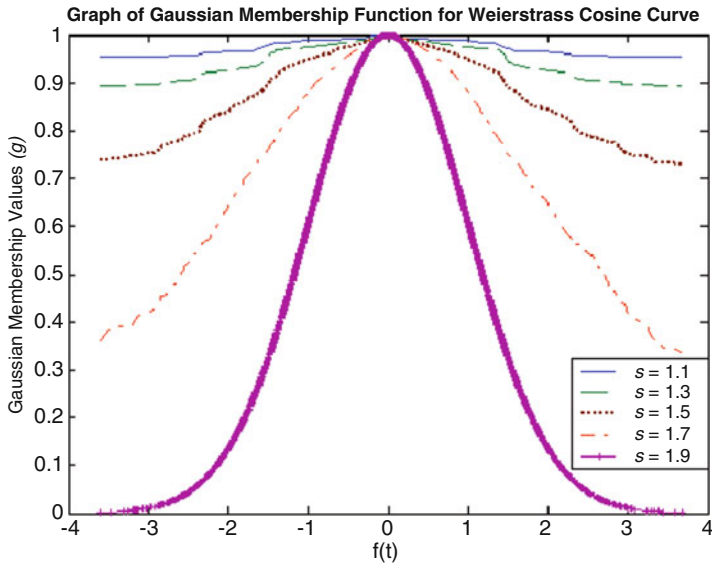


Fig. 48.3 Graph of Gaussian fuzzy membership function for Weierstrass cosine waveforms with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9

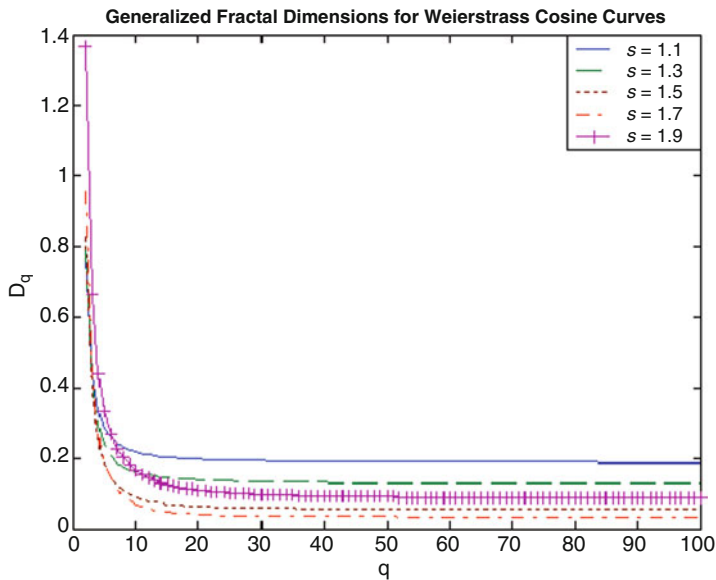


Fig. 48.4 Generalized fractal dimensions spectra for Weierstrass cosine waveforms with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9

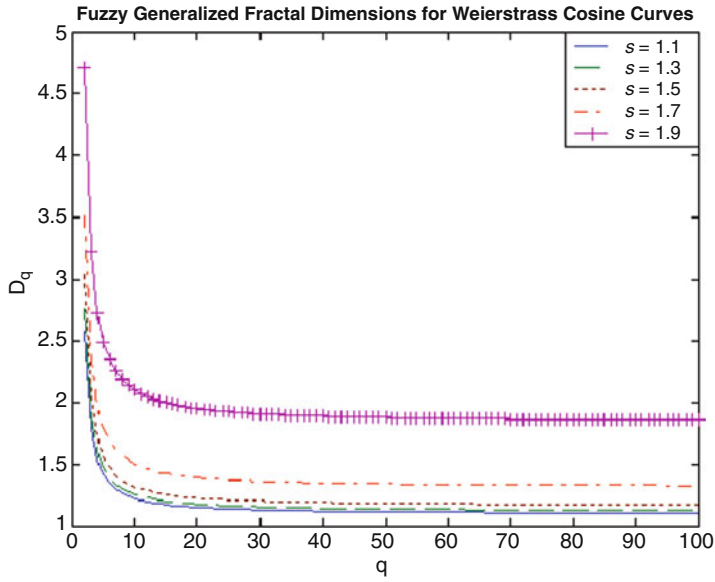


Fig. 48.5 Fuzzy generalized fractal dimensions spectra for Weierstrass cosine waveforms with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9

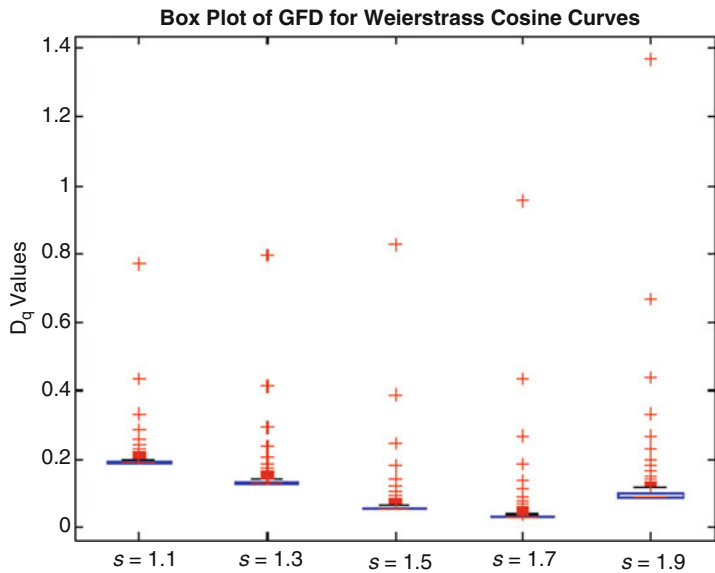


Fig. 48.6 Box plot of GFD for Weierstrass cosine waveforms with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9

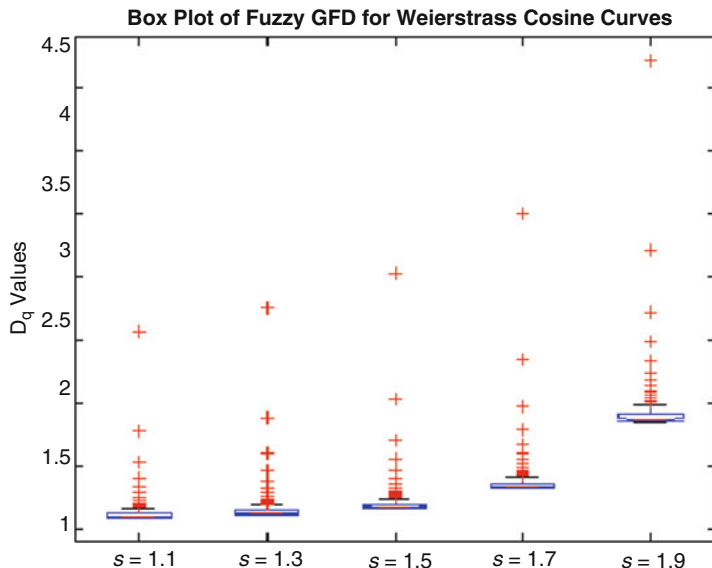


Fig. 48.7 Box plot of F-GFD for Weierstrass cosine waveforms with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9

Weierstrass cosine functions with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9 are not classified correctly in classical multifractal dimension theory. In Fig. 48.5, the Fuzzy GFD spectra of Weierstrass cosine functions with $s = 1.1, 1.3, 1.5, 1.7$ and 1.9 are accurately classified by using fuzzy multifractal dimension theory.

The Fuzzy GFD values of Weierstrass cosine functions increases accordingly as s increases from 1.1 to 1.9, i.e., the Fuzzy GFD values increases gradually as the complexity of the waveforms increases. But the same could not happened in the classical GFD method as clearly shown in Fig. 48.4. Especially, the values of Fuzzy GFD for Weierstrass cosine function with $s = 1.9$ are significantly greater than the values of Fuzzy GFD for the waveform with $s = 1.1, 1.3, 1.5$ and 1.7 . But in the GFD case, the GFD values for Weierstrass cosine function with $s = 1.9$ are less than the values of GFD for $s = 1.1$ and 1.3 . In addition to that, the Box Plots for both GFD and F-GFD methods supports that the Fuzzy GFD accurately classifies the Weierstrass waveforms with different range of complexities.

Hence, Figs. 48.3–48.7 are the evidence that the fuzzy multifractal analysis plays an efficient role in the quantification of complexity of chaotic waveforms by using Fuzzy Generalized Fractal Dimensions than the classical GFD method. Especially, the special case 4 in the Sect. 48.2.4 shows that Fuzzy GFD is a generalized version of the classical GFD by choosing the suitable fuzzy membership function.

48.5 Conclusion

In this study, we have developed a fuzzy multifractal theory in order to define the Fuzzy Generalized Fractal Dimensions (F-GFD) by introducing fuzzy membership function in classical Generalized Fractal Dimensions method. It was shown that, the defined Fuzzy GFD method accurately classifies the complexity of the chaotic waveforms such as Weierstrass functions by comparing graphically with the classical GFD method. Hence the fuzzy multifractal analysis performs significantly than the classical multifractal analysis. Also the defined Fuzzy GFD is a generalized method of the classical GFD.

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Chapter 49

Nonlinear Forced Convective Hydromagnetic Flow of Unsteady Biomagnetic Fluid Over a Wedge with Convective Surface Condition

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Nomenclature

Bi	Biot number
C_f	Skin friction coefficient
c_p	Specific heat at constant pressure
Ec	Eckert number
f	Dimensionless stream function
h	Induced magnetic field parameter
h_f	Heat transfer coefficient
H^*	Induced magnetic field intensity
H	Dimensionless H^*
H_0	Applied magnetic field intensity
H_w	Induced magnetic field
j	Micro-inertia per unit mass
K	Unsteadiness parameter
M	Magnetic field parameter
m	Velocity exponent
N	Dimensionless microrotation
Nu	Local Nusselt number
n	Microrotation parameter
P	Pressure

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Pm	Magnetic Prandtl parameter
Pr	Prandtl number
q_w	Surface heat flux
Re	Local Reynolds number
S	Coefficient of vortex viscosity
t	Time
T	Temperature within boundary layer
T_f	Temperature at the bottom
T_w	Temperature at the surface
T_∞	Temperature of the ambient fluid
u	Velocity along x -axis
U	Free stream velocity
U_0	Characteristic velocity
U^*	Nondim. free stream velocity
v	Velocity along y -axis
X	Characteristic length
x	Coordinate along the surface
y	Coordinate normal to surface

Greek Symbols

ρ	Density of the fluid
β	Wedge angle parameter
δ	Length scale
μ	Dynamic viscosity
μ_e	Magnetic permeability
ν	Kinematic viscosity
ν_s	Spin-gradient viscosity
Δ	Vortex viscosity parameter
ξ	Micro-inertia parameter
ω	Microrotation
σ	Fluid electric conductivity
ψ	Stream function
κ	Thermal conductivity
η	Similarity parameter
τ_w	Shear stress
λ	Nondim boundary layer thickness
λ_1	Dimensionless displacement thickness
λ_2	Dimensionless momentum thickness
θ	Dimensionless temperature
$\Delta\eta$	Step size

Subscripts

- w Surface condition
- ∞ Boundary layer edge

49.1 Introduction

Biofluid that exists in a living creature whose flow is influenced by the presence of a magnetic field termed as biomagnetic fluid. The most famous biofluid is the blood which holds the properties of a magnetic fluid because of the existence of iron oxides in the hemoglobin molecule at the mature red blood cells. The influence of the magnetic field on the flow of biofluids is extensively investigated because of various applications in bioengineering and medicine (Ruuge and Rusetski 1993; Plavins and Lauva 1993; Haik et al. 1999; Tzirtzilakis and Tanoudis 2003). Modeling of bio-heat transfer in arteries and other physiological systems has become a popular area of research involving the study of conduction heat transfer in tissues (Pennes 1948) and convection in blood flows (Charm et al. 1968). Charny (1992) and Rubinsky (1999) have presented excellent reviews of progress in theoretical and numerical modeling of bio-heat transfer.

The afore-mentioned studies are all confined to Newtonian blood flow models. Many studies however incorporate non-Newtonian fluid models to study viscoelasticity of cells, hematocrit influence on rheological properties, shear-thinning and microrotational effects (Skalak and Chien 1982; Srivastava 2003; Anad and Rajagopal 2004; Choi and Barakat 2005). The rheological models however do not incorporate micro-structural effects i.e. they cannot simulate rotary motions and also gyration of fluid micro-elements which characterize suspensions in blood (e.g. erythrocytes). Eringen (1966) formulated the micropolar fluid model to simulate micro-structural effects and subsequently many researchers have applied micropolar rheological theory to simulate blood flow in many scenarios (Arimen et al. 1974; Eringen and Kang 1976; Hogan and Henriksen 1989; Atefi and Moosaie 2005; Rahman 2011a).

The thermal boundary layer flows for different variations of temperature and heat flux over various geometries are well established and widely used in industrial and engineering applications. Falkner and Skan (1931) first introduced two-dimensional flow of a viscous incompressible fluid over a wedge. Similarity transformation technique was developed which reduced the governing partial differential boundary layer equation to an ordinary differential equation that was later solved numerically. Since then flows over wedge shaped bodies with or without heat transfer have been extensively studied by many researchers (Hartee 1937; Stewartson 1954; Na 1979; Rajagopal et al. 1983; Lin and Lin 1987; Watanabe 1990; Kafoussias and Nanousis 1997; Yih 1998; Anjali Devi and Kandasamy 2001; Kuo 2005; Kandasamy et al. 2005; Rashad and Bakier 2009; Rahman and Eltayeb 2011) over the decades due

to their numerous engineering applications. All of these studies however were confined to the steady state flows. Recently, Sattar (2011) studied unsteady two-dimensional boundary layer flows over a wedge. A new set of transformations was developed which allow finding local similarity solutions for two-dimensional unsteady problems. He noticed that sufficiently strong unsteadiness may trigger separation of the boundary layer even for an accelerated flow.

Heat transfer due to surface convection over various geometries has received considerable attention (Bataller 2008; Aziz 2009; Ishak 2010; Yao 2011) because of its potential applications in several engineering and industrial processes like transpiration cooling process, material drying, etc. The general conclusion of these studies is that temperature at the surface of the body increases with the increase of the surface convection parameter.

The objective of the present work is to extend the work of Rahman (2011a) analyzing the heat transfer characteristics of unsteady two-dimensional hydromagnetic boundary layer flows of biomagnetic fluids over a wedge using micropolar fluid model with convective surface taken into account the induced magnetic field effect. The resulting nonlinear coupled governing equations are solved numerically for local similar solutions applying very robust computer algebra software Maple 13. Graphical results for non-dimensional velocity, temperature and microrotation of the blood corpuscles including boundary layer thickness, momentum thickness, energy thickness, skin friction coefficient and Nusselt number are presented for a range of values of the parameters characterizing the flow and temperature fields. The accompanying discussion provides physical interpretations of the results.

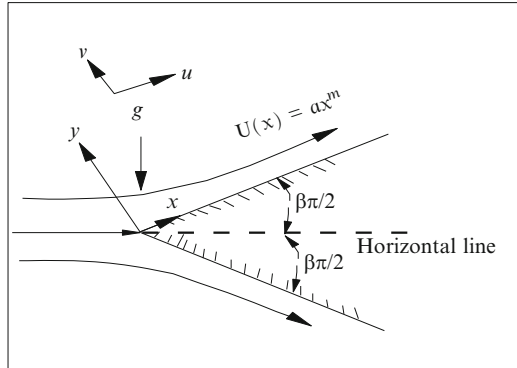
49.2 Formulation of the Problem

49.2.1 Governing Equations

We consider an unsteady two-dimensional laminar flow of a viscous biomagnetic fluid of constant density ρ , dynamic viscosity μ , and temperature T_∞ moving over an electrically non-conducting surface of a wedge, directed along the positive x -axis, with a potential velocity $U(x,t)$ driven by the pressure gradient of the corresponding inviscid flow solution, in the presence of an applied uniform transverse magnetic field, as illustrated in Fig. 49.1. The total angle of the wedge is given by $\beta\pi$. It is assumed that the lower surface of the wedge is heated by convection from a hot fluid at temperature T_f which provides a heat transfer coefficient h_f . A uniform magnetic flux, H_0 , is applied parallel to the y -axis so that it saturates the biomagnetic fluid.

All fluids are compressible to some extent. However, in many situations the changes in pressure and temperature are sufficiently small that the changes in density are negligible. If a flow has low Mach number (flow speed is insignificant

Fig. 49.1 Flow configurations and coordinate system



everywhere compared to the speed of sound of the medium), the fluid will behave as being incompressible i.e. at constant density. The speed of sound in blood is approximately $1,540\text{ m/s}$ and typical blood velocity in medium to large sized vessels is of the order of magnitude of $1\text{--}100\text{ cm/s}$. The Mach number being very small, blood flow can be modeled as an incompressible flow.

Within the framework of the above-noted assumptions, the convective flow of an unsteady incompressible biomagnetic fluid neglecting body forces and Joule heating, can be described by the following conservation equations (Rahman 2011a; Rahman and Sattar 2006; Chaudhary and Sharma 2006):

Continuity equation:

$$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0, \tag{49.1}$$

Momentum equation:

$$\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} + v \frac{\partial u}{\partial y} = -\frac{1}{\rho} \frac{\partial P}{\partial x} + \left(v + \frac{S}{\rho} \right) \frac{\partial^2 u}{\partial y^2} + \frac{S}{\rho} \frac{\partial \omega}{\partial y} + \frac{\mu_e H_0}{\rho} \frac{\partial H^*}{\partial y}, \tag{49.2}$$

Energy equation:

$$\frac{\partial T}{\partial t} + u \frac{\partial T}{\partial x} + v \frac{\partial T}{\partial y} = \frac{\kappa}{\rho c_p} \frac{\partial^2 T}{\partial y^2} + \frac{v}{c_p} \left(\frac{\partial u}{\partial y} \right)^2 + \frac{1}{\rho c_p \sigma} \left(\frac{\partial H^*}{\partial y} \right)^2, \tag{49.3}$$

Angular momentum equation:

$$\frac{\partial \omega}{\partial t} + u \frac{\partial \omega}{\partial x} + v \frac{\partial \omega}{\partial y} = \frac{v_s}{\rho j} \frac{\partial^2 \omega}{\partial y^2} - \frac{S}{\rho j} \left(2\omega + \frac{\partial u}{\partial y} \right), \tag{49.4}$$

Magnetic induction equation:

$$\frac{\partial H^*}{\partial t} + u \frac{\partial H^*}{\partial x} + v \frac{\partial H^*}{\partial y} = \frac{1}{\mu_e \sigma} \frac{\partial^2 H^*}{\partial y^2} + H^* \frac{\partial u}{\partial x} + H_0 \frac{\partial u}{\partial y}, \quad (49.5)$$

where u, v are the velocity components along x, y co-ordinates respectively, t is the time, $\nu = \mu/\rho$ is the kinematic viscosity, μ is the dynamic viscosity, S is the microrotation coupling coefficient (also known as the coefficient of gyro-viscosity or the vortex viscosity), ω is the microrotation component normal to the xy -plane, j is the micro-inertia per unit mass, T is the temperature of the fluid in the boundary layer, c_p is the specific heat of the fluid at constant pressure, κ is the fluid thermal conductivity, H^* is the induced magnetic field component along the surface, μ_e is the magnetic permeability, σ is the electrical conductivity.

The micro-rotation component ω , is coupled to the linear momentum Eq. 49.2 through the angular velocity gradient term, $(S/\rho)\omega_y$. Very strong coupling exists between the translational velocity components, u and v , in Eq. 49.4 through the convective acceleration terms, $u\omega_x$ and $v\omega_y$. Furthermore, there is a second coupling term linking the angular velocity with the x -direction velocity gradient, in Eq. 49.4: $-(S/\rho j)(2\omega + u_y)$. The spin-gradient viscosity ν_s is defined by $\nu_s = (\mu + S/2)j$ (Ahmadi 1976). We note that in the viscous shear diffusion term, $(\nu + S/\rho)u_{yy}$, the Newtonian kinematic viscosity is now supplemented by the Eringen micropolar vortex viscosity, S . For $S = 0$, the micropolar effect disappears. In the present work, we assume that the micro-inertia per unit mass j is a constant.

49.2.2 Boundary Conditions

i. On the surface of the wedge ($y = 0$):

$$u = 0, v = 0, -\kappa \frac{\partial T}{\partial y} = h_f (T_f - T), \omega = -n \frac{\partial u}{\partial y}, H^* = H_w. \quad (49.6a)$$

ii. Matching with the free stream ($y \rightarrow \infty$):

$$u = U(x, t), \omega = 0, T = T_\infty, H^* = 0 \quad (49.6b)$$

The value of the microrotation parameter $n = 0$ results $\omega = 0$ which represents no-spin condition i.e. the microelements in a concentrated particle flow-close to the wall are not able to rotate. The case $n = 0.5$ physically implies the vanishing of the anti-symmetric part of the stress tensor and represents weak concentrations of the micro-elements of the micropolar fluid at the solid surface. For this case

microelements are able to sustain rotary motions (although non-vigorous) in the vicinity of the surface. The case corresponding to $n = 1$ is representative of the turbulent boundary layer flows. This is ignored in the present work which deals with laminar flow only.

The external flow velocity $U(x,t)$, and pressure gradient (P_x) are given by (Sattar 2011)

$$U(x,t) = \nu x^m / \delta^{m+1}, \quad (49.7)$$

$$-\frac{1}{\rho} \frac{\partial P}{\partial x} = \frac{\partial U}{\partial t} + U \frac{\partial U}{\partial x} = \frac{\nu(m+1)x^m}{\delta^{m+2}} \frac{d\delta}{dt} + \frac{\nu^2 m x^{2m-1}}{\delta^{m+2}}, \quad (49.8)$$

where δ is a time dependent length scale as

$$\delta = \delta(t). \quad (49.9)$$

The exponent m is a function of the wedge angle parameter (or Hartee pressure gradient parameter) β such as

$$m = \beta / (2 - \beta) \geq 0. \quad (49.10)$$

The wedge angle parameter β is a measure of the pressure gradient, and so a positive value of β indicates a negative (or favorable) pressure gradient. It is to be mentioned that β may be negative in which case the flow is considered to be decelerated. In the present paper we considered only the accelerated flows i.e. $\beta > 0$.

49.3 Nondimensionalization

To obtain the solutions of the governing Eqs. 49.1, 49.2, 49.3, 49.4, and 49.5 together with the boundary conditions Eqs. 49.6a, and 49.6b we introduce the following similarity transformation

$$\eta = y \sqrt{\frac{m+1}{2} \frac{x^{m-1}}{\delta^{m+1}}}, \quad \psi = \sqrt{\frac{2\nu^2 x^{m+1}}{(m+1)\delta^{m+1}}} f(\eta). \quad (49.11)$$

$$\frac{T - T_\infty}{T_f - T_\infty} = \theta(\eta), \quad \omega = \sqrt{\frac{m+1}{2} \frac{\nu^2 x^{3m-1}}{\delta^{3m+3}}} N(\eta), \quad H^* = \sqrt{\frac{(m+1)\rho}{2\mu_e}} \frac{\nu x^m}{\delta^{m+1}} H(\eta) \quad (49.12)$$

where ψ is the stream function and f , N , H and θ are the non-dimensional stream function, microrotation, induced magnetic field and temperature respectively.

Since $u = \psi_y$ and $v = -\psi_x$ we have from Eq. 49.11

$$u = U(x, t) f' \text{ and } v = -\sqrt{\frac{m+1}{2} \frac{\nu^2 x^{m-1}}{\delta^{m+1}}} \left(f + \frac{m-1}{m+1} \eta f' \right), \quad (49.13)$$

where prime denotes differentiation with respect to η .

Now substituting Eqs. 49.8, 49.9, 49.10, 49.11, 49.12, and 49.13 into Eqs. 49.2, 49.3, 49.4, and 49.5 we obtain the following nonlinear differential equations

$$\begin{aligned} & \left[\frac{U_0^{m-1}}{\nu^m} \delta^m \frac{d\delta}{dt} \right] [\eta f'' + 2f' - 2] \\ & + Re^{m-1} \left[(1 + \Delta) f''' + ff'' + \beta (1 - f'^2) + \Delta N' + MH' \right] = 0, \end{aligned} \quad (49.14)$$

$$\begin{aligned} & \left[\frac{U_0^{m-1}}{\nu^m} \delta^m \frac{d\delta}{dt} \right] \eta \theta' \\ & + Re^{m-1} \left[\theta'' + Pr f \theta' + Pr Ec \left\{ (f'')^2 + \frac{1}{Pm} \frac{1}{2-\beta} (H')^2 \right\} \right] = 0, \end{aligned} \quad (49.15)$$

$$\begin{aligned} & \left[\frac{U_0^{m-1}}{\nu^m} \delta^m \frac{d\delta}{dt} \right] [3N + \eta N'] + Re^{m-1} \left[(1 + \Delta/2) \xi N'' - \right. \\ & \left. - (2 - \beta) \Delta (2N + f'') + \xi \{ f N' + (1 - 2\beta) N f' \} \right] = 0, \end{aligned} \quad (49.16)$$

$$\begin{aligned} & \left[\frac{U_0^{m-1}}{\nu^m} \delta^m \frac{d\delta}{dt} \right] [2H + \eta H'] \\ & + Re^{m-1} [H'' + Pm f H' + (\beta - 1) Pm \eta H f'' + (2 - \beta) Pm M f''] = 0 \end{aligned} \quad (49.17)$$

where $Re = U_0 x / \nu$ is the local Reynolds number, U_0 is some reference velocity, $Ec = (U_0 U_*)^2 / c_p (T_f - T_\infty)$ is the local Eckert number, $U_* = U / U_0$ is the nondimensional free stream velocity, $Pr = \mu c_p / \kappa$ is the Prandtl number, $Pm = \mu_e \sigma \nu$ is the magnetic Prandtl number, $\Delta = S / \mu$ is the vortex viscosity parameter, $\xi = j U_0 U_* / \nu x$ is the local spin gradient viscosity parameter, $M = (\mu_e x / \mu U_0 U_*)^{1/2} H_0$ is the local magnetic field parameter.

Equations 49.14, 49.15, 49.16, and 49.17 are similar in time except for the term $\left[\frac{U_0^{m-1}}{\nu^m} \delta^m \frac{d\delta}{dt} \right]$ where t appears explicitly. Thus the similarity condition requires that it must be a constant. Hence following the work of Sattar (2011) and the references therein, one can try a class of solutions of Eqs. 49.14, 49.15, 49.16, and 49.17 by assuming that

$$\left(U_0^{m-1} / \nu^m \right) \delta^m \frac{d\delta}{dt} = K(\text{constnat}). \quad (49.18)$$

Now integrating Eq. 49.18, one obtains

$$\delta = \left[K (m + 1) U_0^{1-m} \nu^m t \right]^{\frac{1}{m+1}} \quad (49.19)$$

where the constant of integration is determined through the condition that $\delta = 0$ when $t = 0$. For $m = 1$ and taking $K = 2$, Eq. 49.19 becomes

$$\delta = 2\sqrt{vt}. \tag{49.20}$$

The value $m = 1$ represents the condition for a flat plate through which the flow is termed as Himenz (1911) stagnation point flow. It appears from Eq. 49.20 that the length scale is consistent with the usual length scale considered for various unsteady boundary layer flows (Schlichting 1968). Since δ is a scaling factor as well as a similarity parameter, any value of K in Eq. 49.19 would not change the nature of the solutions except that the scale would be different.

Following the arguments of Sattar (2011) and using Eqs. 49.18, 49.14, 49.15, 49.16, and 49.17 becomes ordinary differential equations as follows

$$K [\eta f'' + 2f' - 2] + Re^{m-1} \left[(1 + \Delta) f''' + ff'' + \beta(1 - f'^2) + \Delta N' + MH' \right] = 0, \tag{49.21}$$

$$K [\eta \theta'] + Re^{m-1} \left[\theta'' + Prf\theta' + PrEc \left\{ (f'')^2 + \frac{1}{Pm} \frac{1}{2-\beta} (H')^2 \right\} \right] = 0, \tag{49.22}$$

$$K [3N + \eta N'] + Re^{m-1} \left[(1 + \Delta/2) \xi N'' - (2 - \beta) \Delta (2N + f'') + \xi \{ fN' + (1 - 2\beta) Nf' \} \right] = 0, \tag{49.23}$$

$$K [2H + \eta H'] + Re^{m-1} \left[H'' + PmfH' + (\beta - 1) Pm \eta Hf'' + (2 - \beta) PmMf'' \right] = 0. \tag{49.24}$$

Thus by using Eqs. 49.11, and 49.12 boundary conditions Eqs. 49.6a, and 49.6b respectively become

$$f = f' = 0, \theta' = \sqrt{2 - \beta} Bi [\theta - 1], N = -nf'', H = \sqrt{2 - \beta} h \text{ at } \eta = 0, \tag{49.25a}$$

$$f' = 1, \theta = 0, N = 0, H = 0 \text{ as } \eta \rightarrow \infty, \tag{49.25b}$$

where $Bi = (h_f/\kappa)(xv/U_0U_*)^{1/2}$ is the surface convection parameter (or Biot number) and $h = (H_w/U_0U_*)(\mu_e/\rho)^{1/2}$ is the induced magnetic field parameter.

49.4 Important Physical Parameters

The parameters of physical interest for the present problem are the skin friction coefficient (rate of shear stress), the Nusselt number (rate of heat transfer), the boundary layer thickness, the displacement thickness, and the momentum thickness.

49.4.1 Shear Stress and Rate of Heat Transfer

The equation defining the wall shear stress is

$$\tau_w = (\mu + S) \left(\frac{\partial u}{\partial y} \right)_{y=0} + S(\omega)_{y=0} = \mu [1 + (1-n)\Delta] \left(\frac{\partial u}{\partial y} \right)_{y=0}. \quad (49.26)$$

The local skin friction coefficient is defined by

$$C_f = \tau_w / \rho U_0^2 = (2 - \beta)^{-1/2} [1 + (1-n)\Delta] Re^{-1} U_* X^{\frac{m+1}{2}} f''(0), \quad (49.27)$$

where $X = x/\delta$ is termed nondimensional characteristic length.

We may define a non-dimensional coefficient of heat transfer, which is known as Nusselt number as follows:

$$Nu = \frac{xq_w(x)}{\kappa (T_w - T_\infty)}, \quad (49.28)$$

where

$$q_w(x) = -\kappa \left(\frac{\partial T}{\partial y} \right)_{y=0} \quad (49.29)$$

is the quantity of heat transferred through the unit area of the surface.

The rate of heat transfer, in terms of the dimensionless Nusselt number is given by

$$Nu = -(2 - \beta)^{-1/2} X^{\frac{m+1}{2}} \left(\frac{T_r - 1}{T_r^* - 1} \right) \theta'(0), \quad (49.30)$$

where $T_r = T_f/T_\infty$, and $T_r^* = T_w/T_\infty$. It is worth mentioning that for a heated surface ($T_f > T_w > T_\infty$), which means $T_r > T_r^* > 1$ always. Throughout the simulations the values of $T_r = 2$ and $T_r^* = 1.5$ are kept as constant.

49.4.2 Boundary Layer, Displacement and Momentum Thicknesses

The nondimensional boundary layer thickness (λ), displacement thickness (λ_1) and the momentum thickness (λ_2) can be obtained from the following:

$$\lambda = \eta_{99\%}, \text{ where } f'(\eta_{99\%}) = 0.99, \quad (49.31)$$

$$\lambda_1 = \int_0^{\infty} (1 - f') d\eta, \quad (49.32)$$

$$\lambda_2 = \int_0^{\infty} f' (1 - f') d\eta. \quad (49.33)$$

The displacement thickness measures the distance through which stream lines just outside the boundary layer displaced by the action of viscosity within the boundary layer whereas momentum thickness measures the loss of momentum in the boundary layer as compared with the potential flow.

49.5 Method of Solutions

The set of Eqs. 49.21, 49.22, 49.23, and 49.24 are highly nonlinear and coupled and therefore the system cannot be solved analytically. Thus, the Eqs. 49.21, 49.22, 49.23, and 49.24 with boundary conditions Eq. 49.25 are solved numerically using computer algebra software Maple 13. For a detailed Maple code see Rahman (2011a).

49.6 Numerical Experiments

In this paper, nonlinear forced convective heat transfer in an unsteady biomagnetic fluid flow over a wedge with convective surface in the presence of induced magnetic field has been investigated numerically using computer algebra software Maple-13. The solutions are affected by the unsteadiness parameter K , Reynolds number Re , wedge angle parameter β , Prandtl number Pr , magnetic Prandtl number Pm , magnetic field parameter M , vortex viscosity parameter Δ , spin gradient viscosity parameter ξ , microrotation parameter n , Eckert number Ec , Biot number Bi and induced magnetic field parameter h .

Here we considered human blood as the biomagnetic fluid. At $T = 310K$ (human body temperature); the values of ρ , μ , c_p , and κ are equal to $1.05 \times 10^3 kg/m^3$, $3.2 \times 10^{-3} kg/m s$, $14.65 J/kg K$, and $2.2 \times 10^{-3} J/m s K$, respectively. Thus, the value of the Prandtl number becomes $Pr = \mu c_p / \kappa = 21$ (Chato 1980; Valvano et al. 1994). A typical arteriole of having diameter $3 \times 10^{-5} m$ and blood velocity $7.78 \times 10^{-3} m/s$ results $Re = \frac{U_0 x}{\nu} = \frac{7.78 \times 10^{-3} \times 3 \times 10^{-5}}{3.047 \times 10^{-6}} \approx 0.08$. Since experimental data of all the physical parameters are not available therefore in the numerical simulations the choice of the values of the parameters was dictated by the values chosen by

Table 49.1 Comparison of $f''(0)$ for a steady viscous fluid flow without heat transfer

K	β	Re	Sattar (2011)	Present
0.0	1.0	2	1.232608	1.232587
0.1	1.0	2	1.174650	1.174614
0.5	1.0	2	0.923431	0.923204
0.3	0.5	2	0.525792	0.525689
0.3	1.0	2	1.053159	1.053067
0.3	1.6	2	1.503828	1.503816
2.0	1.6	4	1.506788	1.506775
2.0	1.6	16	1.521293	1.521284
2.0	1.6	32	1.521497	1.521485

Table 49.2 Results of the Falkner-Skan boundary layer equation when $\beta = 0$

η	$f(\eta)$		$f'(\eta)$	
	Present	White (Kays and Crawford 1987)	Present	White (Kays and Crawford 1987)
0.0	0.000000	0.000000	0.000000	0.000000
0.4	0.037549	0.037555	0.187605	0.18761
0.8	0.149674	0.14967	0.371963	0.37196
1.0	0.232990	0.23299	0.460632	0.46063
2.0	0.886796	0.88680	0.816694	0.81669
3.0	1.795568	1.79557	0.969054	0.96905
4.0	2.783886	2.78388	0.997770	0.99777
5.0	3.783234	3.78323	0.999935	0.99994

the previous investigators. In the simulations the default values of the parameters are considered to be $\Delta = 2.0$, $\xi = 1.0$, $n = 0.5$, $Ec = 10^{-4}$, $Bi = 0.5$, $K = 0.05$, $Re = 0.05$, $\beta = 1/4$, $M = 1.0$, $Pm = 10^{-4}$ and $h = 1.0$ unless otherwise specified.

49.6.1 Code Verification

It is to be mentioned that for $K = 0$ the problem becomes steady, as a result Eqs. 49.21, 49.22, 49.23, and 49.24 coincide exactly with Eqs. 49.12, 49.13, 49.14, and 49.15 of Rahman (2011a). It is also to be mentioned that for a Newtonian fluid ($\Delta = 0$) and in the absence of heat transfer and magnetic effect Eq. 49.21 exactly coincide with Eq. 49.14 of Sattar (2011). Thus, to check the validity of the present code we calculated the values of $f''(0)$ for a Newtonian fluid for different values of K , Re , and β in the absence of the heat transfer, and the magnetic field. We also calculated the values of $f(\eta)$ and $f'(\eta)$ in the absence of heat transfer for a Newtonian fluid for the Falkner-Skan boundary layer equation when $\beta = 0$ for different values of η . From Tables 49.1 and 49.2 we see that the data produced by the Maple code and those of Sattar (2011) and White (Kays and Crawford 1987) are in excellent agreement, and these give us confidence to use the present code.

49.7 Results and Discussion

For the physical interpretations of the numerically calculated results the non-dimensional velocity, temperature, and microrotation of the blood corpuscles (i.e. microelements) are presented within the boundary layer for different values of the unsteadiness parameter K , local Reynolds number Re , wedge angle parameter β , magnetic field parameter M , induced magnetic field parameter h , and Biot number Bi keeping $\Delta = 2.0$, $\xi = 1.0$, $n = 0.5$, $Pr = 21$, $Pm = 10^{-4}$ and $Ec = 10^{-4}$ fixed.

49.7.1 Computational Results for Nondimensional Velocity

In Figs. 49.2, 49.3, 49.4, 49.5, 49.6, and 49.7 we have displayed nondimensional velocity of the biomagnetic fluid within the boundary layer for different material parameters. Figure 49.2 shows the effect of the unsteadiness parameter on the nondimensional velocity of the biomagnetic fluid. The results correspond to $K = 0$ represent steady state solutions. From Fig. 49.2 we notice that velocity of the biomagnetic fluid decreases throughout the boundary layer with the increase of the unsteadiness parameter. It is also noticed that strong unsteadiness trigger separation of the flow in the vicinity of the surface of the wedge. Thus, for some $K > K_{critical}$ (not precisely determined) back flow occurs close to the surface of the wedge. This is due to the fact that as K intensifies the kinematic viscosity of the biomagnetic fluid decreases to its ambient value which results in the back flow. This result is consistent

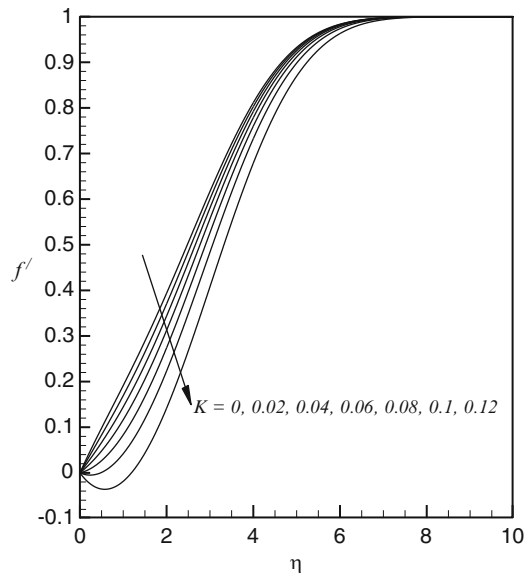


Fig. 49.2 Velocity profiles for different values of K

Fig. 49.3 Velocity profiles for different values of Re for $0 \leq \beta < 1$

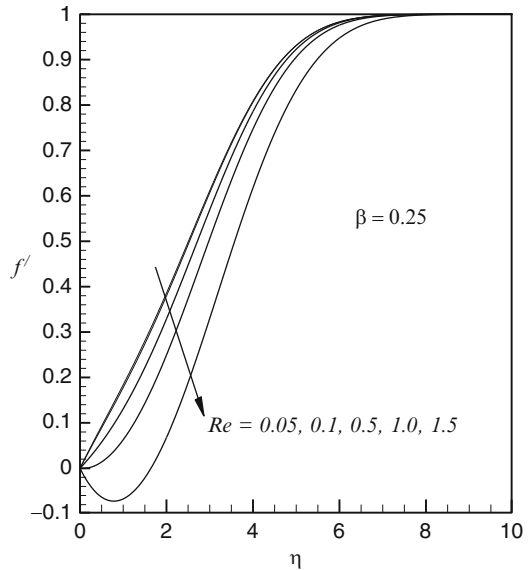
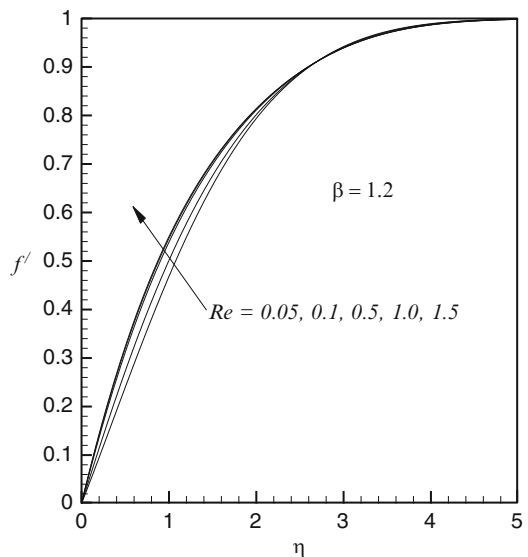


Fig. 49.4 Velocity profiles for different values of Re for $1 < \beta < 2$



with the result of Sattar (2011) who studied the flow of an unsteady Newtonian fluid over a wedge. Thus, a back flow phenomenon in an unsteady problem is very natural irrespective of the types of fluids.

In Figs. 49.3, and 49.4 we have presented nondimensional velocity of the biomagnetic fluid for different values of the Reynolds number Re for $0 \leq \beta < 1$, and $1 < \beta < 2$. From Fig. 49.3 it is noticed that effect of Reynolds number is very

Fig. 49.5 Velocity profiles for different values of β

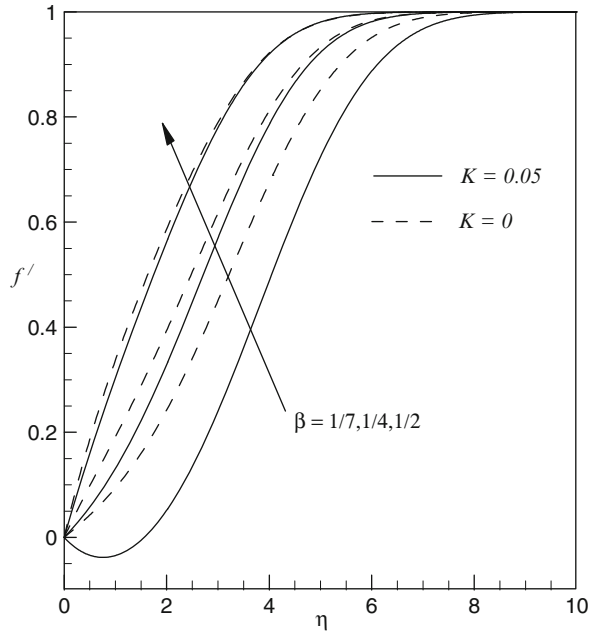


Fig. 49.6 Velocity profiles for different values of M

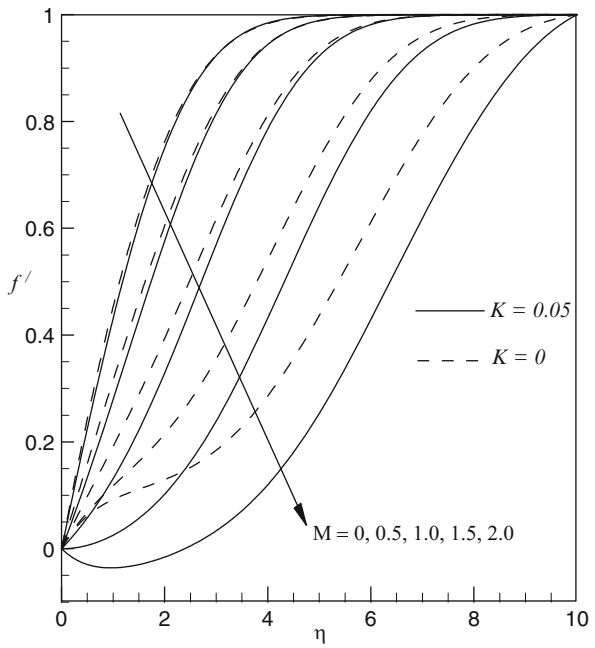
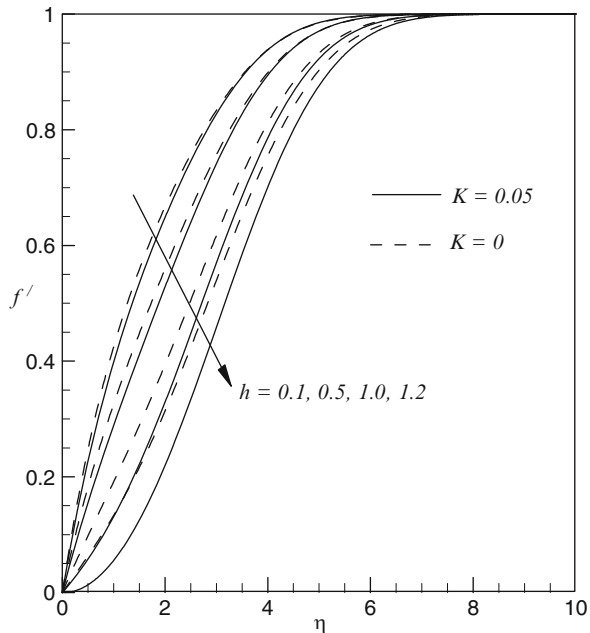


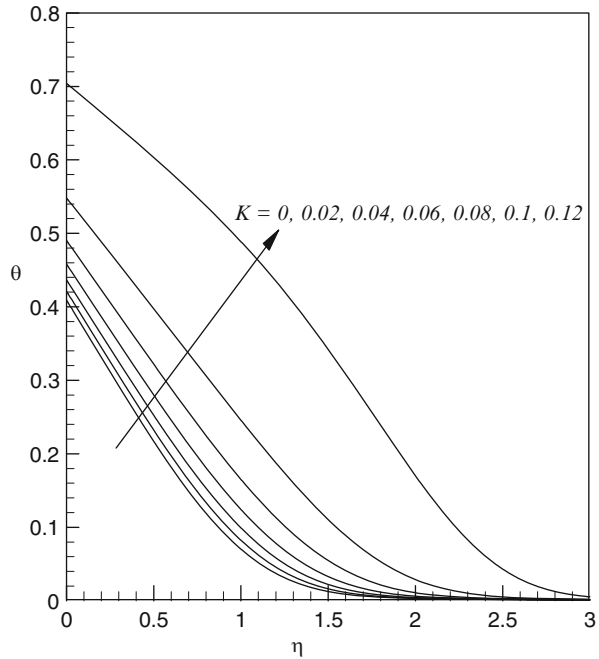
Fig. 49.7 Velocity profiles for different values of h



similar to the unsteadiness parameter K when $0 \leq \beta < 1$. In Eqs. 49.21, 49.22, 49.23, and 49.24 we notice that Re appears as a power of $m - 1$. For $0 \leq m < 1$ i.e. for $0 \leq \beta < 1$ Reynolds number acts like the unsteadiness parameter. From Fig. 49.4 we find that velocity of the biomagnetic fluid increases with the increase of the Reynolds number within some domain $\eta \leq \eta_{critical}$. But far away from the surface of the body ($\eta > \eta_{critical}$) this situation breaks down and the consequence is that velocity profile decreases. The effects of larger Reynolds number (Re) on the velocity profiles diminishes.

The effect of changes in the wedge angle parameter β on the dimensionless velocity function f' within the boundary layer is shown in Fig. 49.5. The solid lines represent unsteady solutions whereas the broken lines represent steady solutions. The general characteristic of these solutions is the increase of the biomagnetic fluid velocity with the increase of β . From this figure we also notice that separation of the fluid velocity occurs for very small non-negative values of β (or m) for the unsteady solutions. The results also show that the velocity profiles became steeper for the larger values of the wedge angle parameter β . The wedge angle parameter is a measure of the pressure gradient, and so a positive value of β indicates a negative (or favorable) pressure gradient. Rahman (2011a) reported that for accelerated flows, velocity of steady motions (broken lines) squeezed closer and closer to the surface of the wall, and overshoot or backflow phenomena did not occur. But in unsteady case backflow phenomena for the biomagnetic fluid occur for very small wedge angle parameter $\beta < \beta_{critical}$ (not precisely determined).

Fig. 49.8 Temperature profiles for different values of K



Physically this means that unsteady boundary layer is not able to support a small acceleration without separation. This is consistent with the work of Sattar (2011).

The effect of the applied magnetic field on the biomagnetic fluid velocity is displayed in Fig. 49.6 for some representative values of the magnetic field parameter M . From Fig. 49.6 we see that velocity profiles decrease with the increase of the magnetic field parameter which indicates that magnetic field acts like a string which retards the fluid motion. There is a clear evidence that for strong magnetic effect back flow may occur near the surface of the wedge for both steady (broken lines) and non-steady flows.

In Fig. 49.7 the effect of the induced magnetic field on the velocity field is depicted for the unsteady solutions in comparison with the steady solutions. It is found that fluid velocity decreases significantly with the increase of the induced magnetic field parameter.

49.7.2 Computational Results for Nondimensional Temperature

The effects of the pertinent parameters on the nondimensional temperature of the biomagnetic fluid within the boundary layer are presented in Figs. 49.8, 49.9, 49.10, 49.11, 49.12, 49.13, and 49.14. In these figures the solid lines represent unsteady

Fig. 49.9 Temperature profiles for different values of Re and $0 \leq \beta < 1$

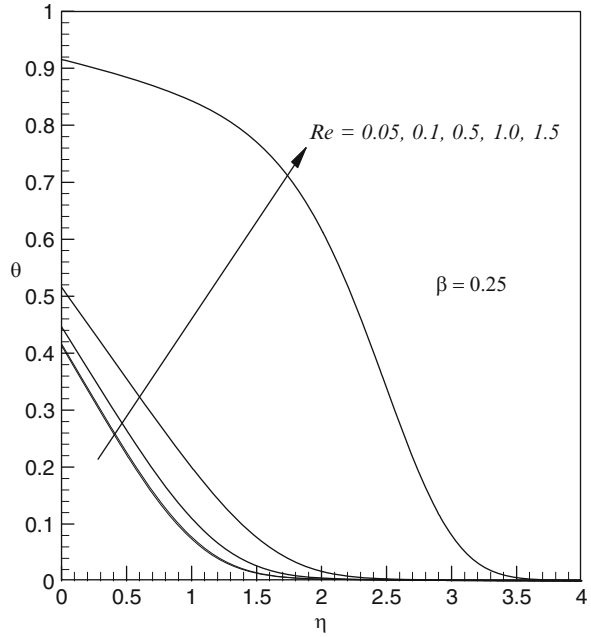


Fig. 49.10 Temperature profiles for different values of Re and $1 < \beta < 2$

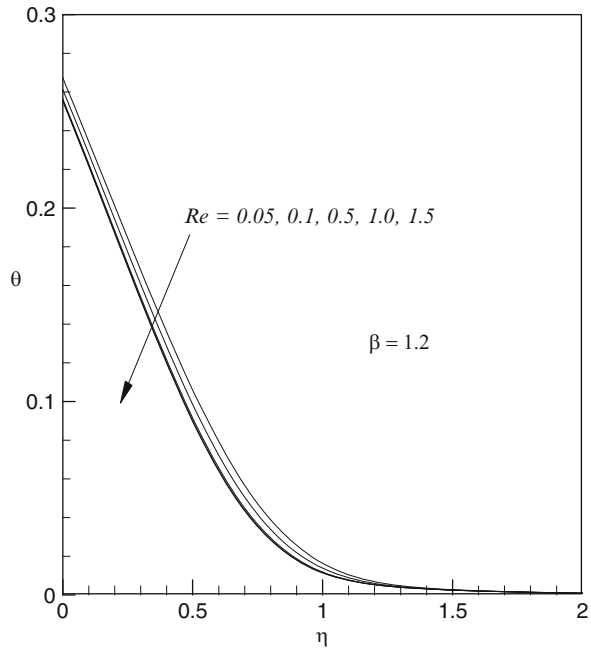


Fig. 49.11 Temperature profiles for different values of β

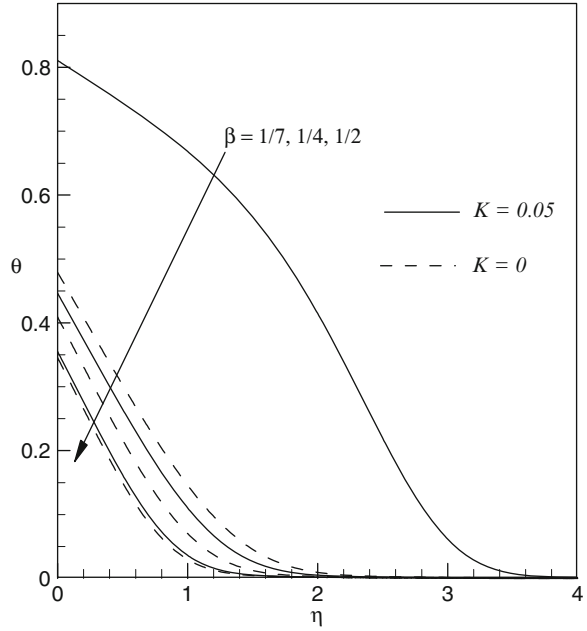


Fig. 49.12 Temperature profiles for different values of M

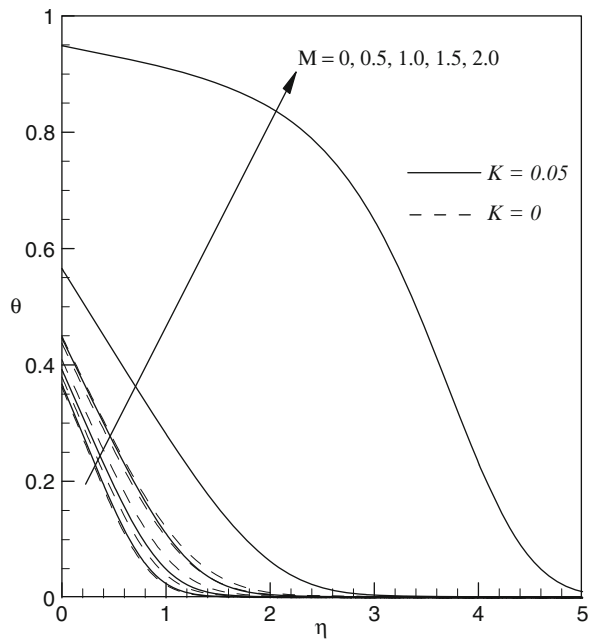


Fig. 49.13 Temperature profiles for different values of h

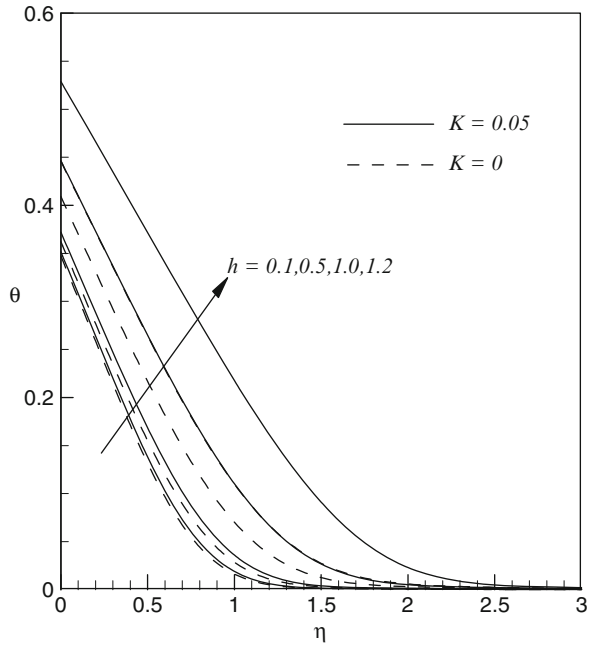
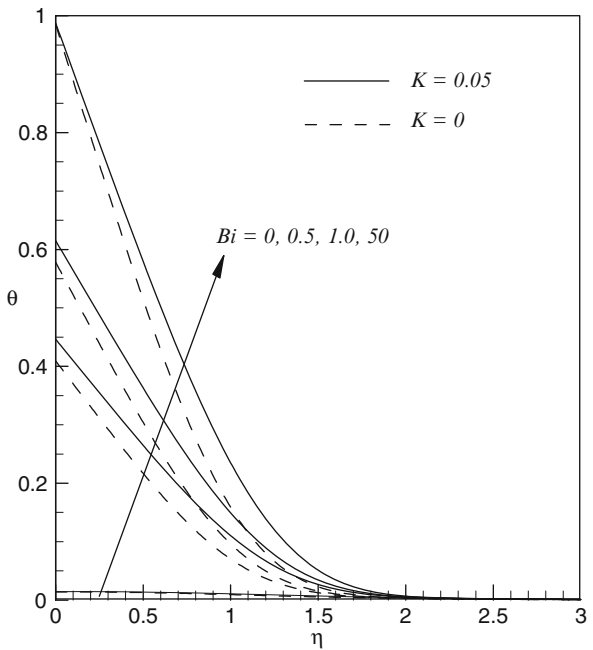


Fig. 49.14 Temperature profiles for different values of Bi



solutions whereas the broken lines for the steady solutions. Figure 49.8 shows that nondimensional temperature of the biomagnetic fluid increases significantly with the increase of the unsteadiness parameter. The value $K = 0$ corresponds to steady state solution. This figure clearly indicates that temperature of the biomagnetic fluid for unsteady case is higher than the steady case.

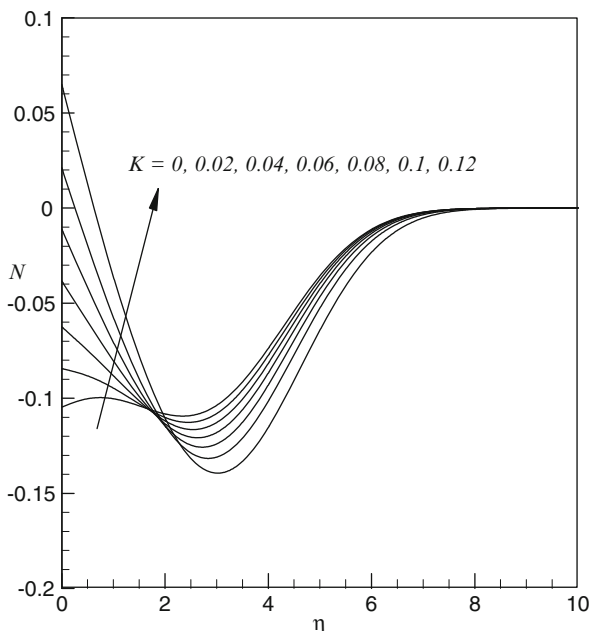
Figures 49.9, and 49.10 show nondimensional temperature within the boundary layer for different values of the Reynolds number for $0 \leq \beta < 1$ and $1 < \beta < 2$, respectively. Figure 49.9 shows that effect of Re on the temperature distribution is similar to the effect of K on it when $0 \leq \beta < 1$. On the other hand an opposite behavior is observed when $1 < \beta < 2$ (see Fig. 49.10).

The effect of the wedge angle parameter β on the nondimensional temperature distribution is displayed in Fig. 49.11. It is found that temperature profiles decrease with the increase of η . It is also noticeable that higher temperature of the fluid can be found for smaller β and lower temperature for larger β . This may be explained as for increasing non-zero values of β the driving force of the fluid motion intensifies which then accelerates the fluid flow and carries more heat from the surface of the wedge to the fluid. Consequently, the surface temperature of the wedge decreases.

Figure 49.12 shows the variation of the temperature of the biomagnetic fluid within the boundary layer for different values of the magnetic field parameter. It is found that temperature of the biomagnetic fluid increases with the increase of M . Due to the act of the Lorentz force fluid velocity within the boundary layer decreases as a consequence heat transfer from the surface of the wedge to the fluid intensifies. The effect of the induced magnetic field parameter on the nondimensional temperature distribution is similar to the effect of M on it as can be seen from Fig. 49.13. Thus, for modeling biomagnetic fluid the effect of the induced magnetic field may be taken into account.

Figure 49.14 presents nondimensional temperature of the biomagnetic fluid within the boundary layer for various values of the Biot number (surface convection parameter) Bi . Figure 49.14 shows the substantial effect of Bi on the temperature profiles. For each curve the vertical intercept gives the wedge surface temperature. The wedge surface temperature increases with the increase of Bi . The surface convection parameter Bi is a ratio of the hot fluid side convection resistance to the cold fluid side convection resistance on a surface. For fixed cold fluid properties and fixed free stream velocity, the surface convection parameter Bi at any x station is directly proportional to the heat transfer coefficient (h_f) associated with the hot fluid. The thermal resistance on the hot fluid side is inversely proportional to h_f . Thus Bi increases, the hot fluid side convection resistance decreases and consequently, the surface temperature increases. For large values of Bi (i.e. $Bi \rightarrow \infty$), the solution approaches to the solution for constant surface temperature. From equation Eq. 49.25, it can be seen that $\theta(0) = 1$ for $Bi \rightarrow \infty$. These results show qualitative agreement with those of Rahman (2011a, b) and Rahman and Eltayeb (2011).

Fig. 49.15 Microrotation profiles for different values of K



49.7.3 Computational Results for Nondimensional Microrotation

The effects of the pertinent parameters on the microrotation of the blood corpuscles within the boundary layer are presented in Figs. 49.15, 49.16, 49.17, 49.18, 49.19, and 49.20. In Fig. 49.15 we have presented the microrotation of the blood corpuscles within the boundary layer for various values of the unsteadiness parameter K . It is found that microrotation of the blood corpuscles increases with the increase of K in the vicinity of the surface of the wedge. But away from the surface of the wedge where kinematic viscosity dominates the flow microrotation profiles overlap and decreases with the increase of K .

The effects of the Reynolds number on the microrotation of the blood corpuscles within the boundary layer are presented in Figs. 49.16, and 49.17 for $0 \leq \beta < 1$ and $1 < \beta < 2$ respectively. From these figures it is found that rotation of the blood corpuscles is significantly influenced by Re . For $0 \leq \beta < 1$, it increases with the increase of Re in the vicinity $\eta \leq \eta_{critical1}$ of the surface of the wedge. Outside of this domain of η reverse behavior of microrotation is found. On the other hand for $1 < \beta < 2$ microrotation of the blood corpuscles decreases with the increase of Re for some $\eta \leq \eta_{critical2}$. Outside of this domain of η microrotation profiles overlap and increases with the increase of Re . It is interesting to note that $\eta_{critical2} < \eta_{critical1}$ and

Fig. 49.16 Microrotation profiles for different values of Re and $0 \leq \beta < 1$

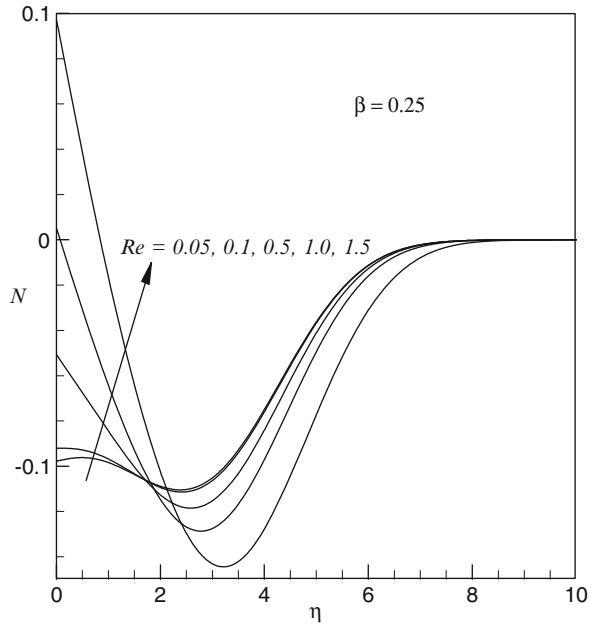


Fig. 49.17 Microrotation profiles for different values of Re and $1 < \beta < 2$

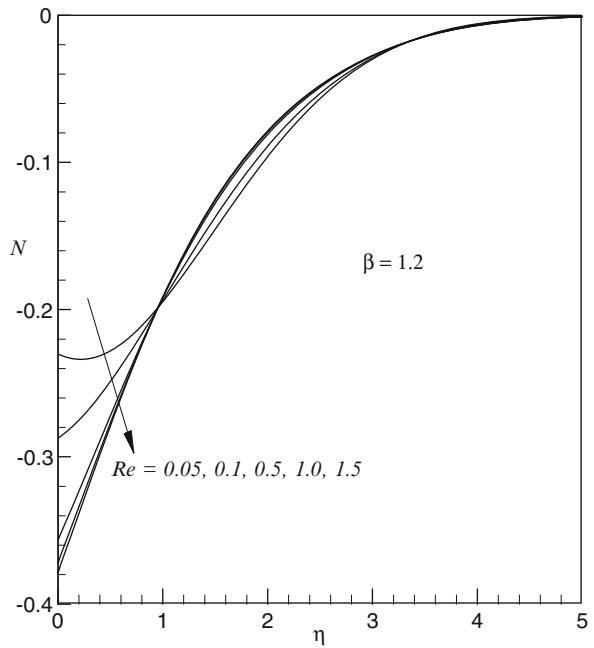


Fig. 49.18 Microrotation profiles for different values of β

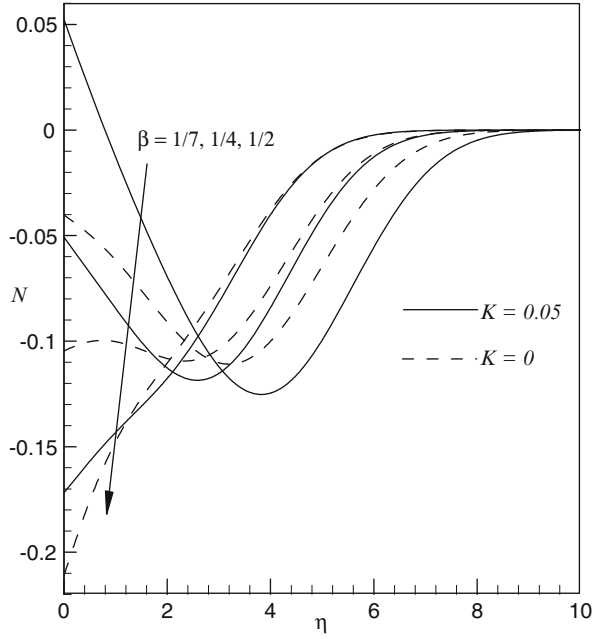


Fig. 49.19 Microrotation profiles for different values of M

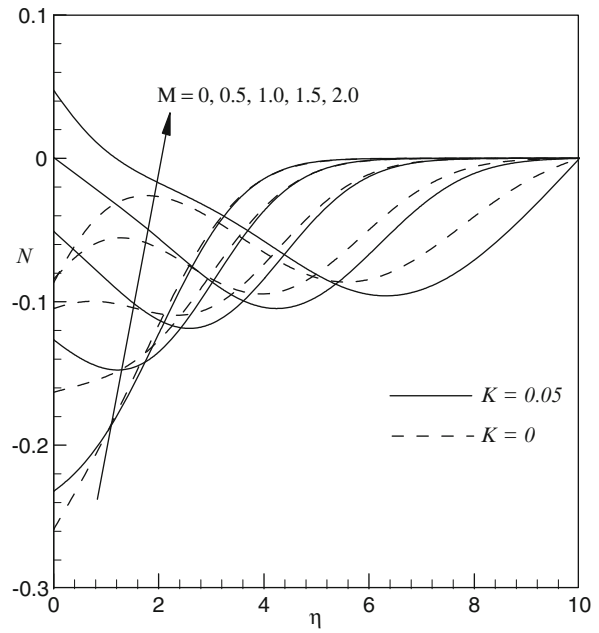
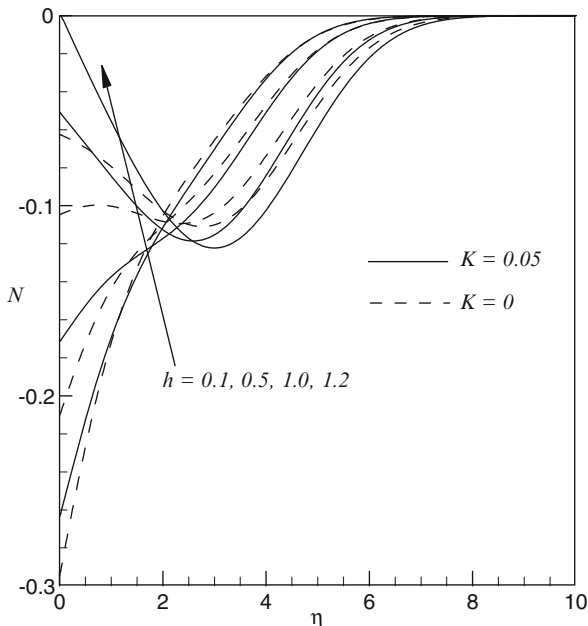


Fig. 49.20 Microrotation profiles for different values of h

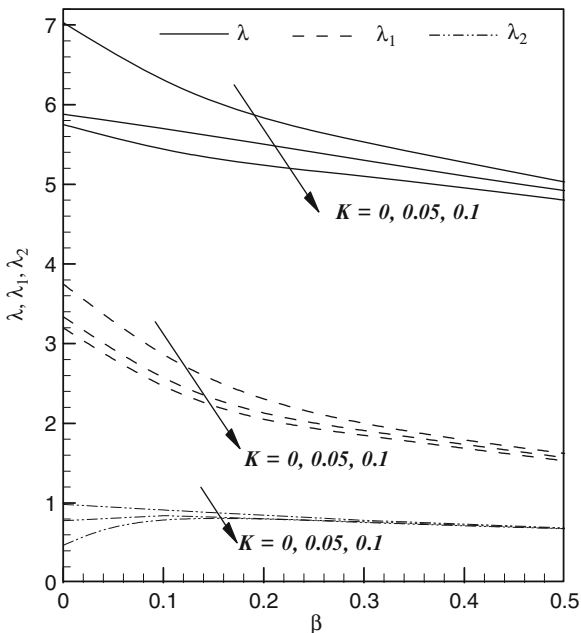


the microrotation of the blood corpuscles remain negative throughout the boundary layer for all values of Re when $1 < \beta < 2$ which is consistent with Fig. 49.4 as $N \propto -f''$ (Eq. 49.25a).

Figure 49.18 reveals that rotation of the blood corpuscles decreases in the region close to the surface of the wedge with the increase of the values of the wedge angle parameter β . Away from the surface of the wedge microrotation profiles overlap and increase with the increase of β . Figure 49.19 displays the effect of the applied magnetic field on the microrotation of the blood corpuscles within the boundary layer. It is to be noted that due to the presence of a strong magnetic field blood corpuscles show oscillatory behavior within the boundary layer. These oscillations are stronger near the surface of the wedge. For our studied parameter values this behavior is found to be a general characteristic for the steady as well as for the non-steady flows.

Figure 49.20 presents microrotation profiles against η for various values of the induced magnetic field parameter h when other parameters values are kept fixed. It is found that microrotation of the blood corpuscles increases with the increase of h in the vicinity of the surface of the wedge. Away from it these profiles overlap and decrease with the increase of h . It is also noted that for strong h microrotation profiles become parabolic in shape. In modeling biomagnetic fluid the effect of the induced magnetic field may be taken into account because of its significant effect on the flow field.

Fig. 49.21 Hydrodynamic thicknesses for different values of K and β



49.7.4 Computational Results for the Physical Parameters

The physical parameters such as boundary layer thickness (λ), displacement thickness (λ_1), and momentum thickness (λ_3) are displayed in Fig. 49.21 for various values of the wedge angle parameter β and the unsteadiness parameter K when all the other parameters values are fixed. From this figure we see that the hydrodynamic boundary layer thickness, displacement thickness, and momentum thickness decreases with the increase of the wedge angle parameter β and the unsteadiness parameter K . These thicknesses are found to be higher for the steady state solutions.

The local skin friction coefficient and the rate of heat transfer in terms of local Nusselt number are displayed in Figs. 49.22, and 49.23 for various values of the unsteadiness parameter K and the wedge angle parameter β . From these figures we see that skin friction coefficient and the Nusselt number decrease with the increase of K whereas they increase with the increase of the wedge angle parameter β . It is also noticeable that for higher values of the unsteadiness parameter the rate of heat transfers increases quite sharply with the increase of the unsteadiness parameter up to a certain value of $\beta = \beta_{critical}$. For $\beta > \beta_{critical}$, the rate of heat transfers increases slowly with the increase of the unsteadiness parameter.

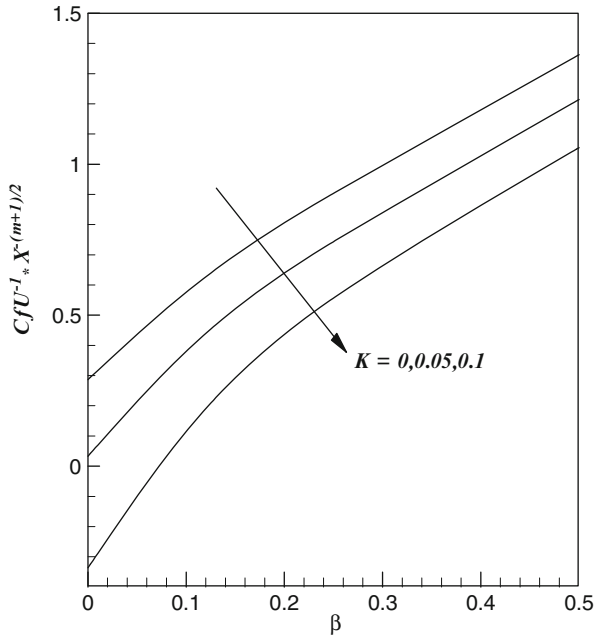


Fig. 49.22 Variations of skin-friction coefficient for different values of K and β

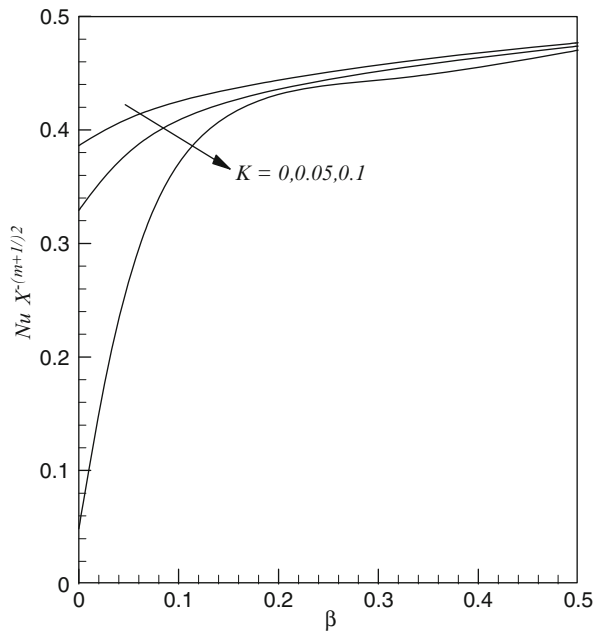


Fig. 49.23 Variations of Nusselt number for different values of K and β

49.8 Conclusions

Nonlinear forced convective hydromagnetic flow of unsteady biomagnetic fluid over a wedge with convective surface in the presence of induced magnetic field has been analyzed theoretically. Similarity analysis and the numerical method were used to determine the fluid velocity, temperature, microrotation of the blood corpuscles, boundary layer thickness, displacement thickness, momentum thickness, skin friction coefficient and the Nusselt number. The influences of the unsteadiness parameter, Reynolds number, magnetic field parameter, wedge angle parameter, Biot number and the induced magnetic field parameter on the flow field are examined. The results are presented in the form of graphs. From the present investigation the following major conclusions can be drawn

- i. Unsteadiness significantly controls the flow and heat transfer characteristics of the biomagnetic fluid.
- ii. Regardless of the types of fluids strong unsteadiness may trigger back flow in the vicinity of the surface of the wedge.
- iii. Rate of shear stress decreases with the increase of the unsteadiness parameter whereas it increases with the increase of the angle of the wedge.
- iv. Rate of heat transfer decreases with the increase of the unsteadiness parameter whereas it increases with the increase of the angle of the wedge.
- v. Boundary layer thickness, momentum thickness and energy thickness decrease with the increase of the unsteadiness parameter as well as with the increase of the angle of the wedge.
- vi. Induced magnetic field has significant effect on the flow, temperature and rotation of the blood corpuscles. Thus, in modeling biomagnetic fluid the effect of the induced magnetic field in the flow domain should be taken into account.
- vii. Reverse flow may occur for strong magnetic effect. The micro-constituents oscillate along the surface of the wedge when the applied magnetic field is strong enough.

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Chapter 50

Advancements on Authentication Methods for Transfer of Stream Data via Chaos Synchronization Techniques

M.R.K. Ariffin and Z. Mahad

50.1 Introduction

Since the inception of chaotic synchronization techniques for communication purposes, active research has been conducted to produce techniques for either:

- i. Secure communication.
- ii. Fast communication (i.e. live streaming of data).
- iii. Enable communication (or secure communication) between newly identified equipment emitting chaotic signals.
- iv. Etc.

Initial research focus was to model an imitation of continuous chaotic maps onto a discrete environment. This was due to the fact that to actually implement a communication scheme (either secure or not) based on continuous chaotic maps, one has to take into consideration the current technology which only provides discrete machines such as the existing computers. Many attempts to design secure communication were cryptanalyzed due to the algebraic structure of the “discretized” chaotic map. Hence, the common belief was that “security features” which existed within the continuous chaotic map (example: the tent map upon the interval $[0;1]$) will “diminish” when it is redefined on a discrete interval.

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Recently, research has moved on to actual “continuous” chaotic data stream. Instead of discretizing existing chaotic maps, “real” chaotic emission from physical devices are observed and “reigned in” in order for communication to occur. These emissions are modeled and their variables manipulated. We describe this “first generation” endeavor as attempts to produce a reliable encoding and decoding mechanism (i.e. a method to enable the equipment emitting the chaotic stream data to “understand” one another; to able to “ping” one another). The reader has to distinguish the terms encoding/decoding and encryption/decryption. The cryptographic terms (i.e. encryption/decryption) are for ensuring confidentiality of data once a “talking connection” between equipments has been made.

The seemingly “seamless chaotic data stream” which is emitted by semiconductor lasers, opens new possible research horizons on this matter. It is an example of available equipment that can be manipulated for communication. Upon enabling communication between two nodes, this work embarks on inducing a cryptographic capability upon it. In well documented literature, it is known that cryptography has four major objectives, namely to ensure confidentiality, integrity, authenticity of data and to disallow repudiation. It is the main objective of this work to induce authentication methods for the “seamless chaotic data stream” emitting from semiconductor lasers. We utilize existing parameters within the model to construct authentication mechanisms.

In this research, we also take into consideration the overall objective that one has when efforts are made to transmit data via high speed semiconductor lasers. That is, to efficiently relay information in hyper speed time. Thus, we make empirical comparison upon existing asymmetric algorithms and also on a new novel asymmetric algorithm in order to gauge the effectiveness of each algorithm so as to not disrupt the seemingly “seamless” relaying of information by the semiconductor lasers.

This article is structured as follows. In Sect. 50.2, we describe a general model to ensure two separate nodes are able to effectively communicate (i.e. a general encoding/decoding model). We also describe the process of selecting the appropriate variable within our communication model in order to produce authentication procedures. Existing well known asymmetric algorithms, namely RSA and ECC, are described in Sect. 50.3. We also describe a new asymmetric algorithm known as the AAb algorithm in this section. A table comparing the complexity order of these three algorithms is also provided. Empirical results on to gauge the speed between all three algorithms is provided in Sect. 50.4. Finally, we conclude in Sect. 50.5.

50.2 Suggested Encoding/Decoding Model for Chaotic Data Stream via Semiconductor Lasers That Would Enable Authentication

To ensure communication between two opposing nodes within a semiconductor laser system is arbitrary. One has to only ensure both nodes have the same synchronization parameter to work with. However, to correctly choose parameters

Table 50.1 A list of probable data authenticity methods

No.	Parameter	Remarks
1	Hash value of common synchronization parameters, H_{CSP}	An asymmetric mechanism should be employed to secure CSP to produce the ciphertext of $CSP: C_{CSP} = E(CSP)$, and C_{CSP} should be appended or injected into the stream data with high probability of change upon C_{CSP} if the stream data is modified. The value H_{CSP} should also be transmitted. Obviously, if there is a change upon C_{CSP} there would be a change on H_{CSP} . Hence, data transmitted should be rejected
2	Hash value of difference between two synchronization values resulting from two different Common Synchronization Parameters, $\Delta_{CSP} = CSP_1 - CSP_2 $ denoted by H	An asymmetric mechanism should be employed to secure the tuple (CSP_1, CSP_2) denoted by (C_{CSP_1}, C_{CSP_2}) and should be appended or injected into the stream data with high probability of change upon (C_{CSP_1}, C_{CSP_2}) if the stream data is modified. The value H_{CSP} should also be transmitted. Obviously, if there is a change upon (C_{CSP_1}, C_{CSP_2}) there would be a change on H_{CSP} . Hence, data transmitted should be rejected. In this case, it is conjectured that “better authenticity” is produced. This method could be extended until n CSP values. However, the speed of the process certainly decreases as n increases
3	Hash value of a data sequence $V = \{v(i)\}_{i=k+1}^{k+j}$ which is extracted between a publicly agreed time interval between t_k and $t_{(k+j)}$ after synchronization, H_V	An asymmetric mechanism should be employed to secure $CSP: C_{CSP} = E(CSP)$ and C_{CSP} should be appended or injected into the stream data with high probability of change upon C_{CSP} if the stream data is modified. The value H_V should also be transmitted. The recipient upon decrypting C_{CSP} and obtaining CSP could synchronize and extract the exact data sequence $V' = \{v(i)\}_{i=k+1}^{k+j}$. A comparison shall be made between the hash value of V' and V ($i.e. H_{V'} = H_V?$)

existing within the scheme to achieve the higher cryptographic objective of ensuring authenticity of data being relayed is an open research problem. As mentioned in Sect. 50.1, this work proposes a certain sequence of data emitting from within the scheme to be utilized. External input to ensure authenticity of data is not advisable since it would certainly incur extra processing time and ultimately delay the transmission of data. And as mentioned in Sect. 50.1 – organizations utilizing semiconductor lasers for transmission of data do so for the obvious reason – high speed data transfer. The following table describes probable parameters that could produce the effect discussed (Table 50.1, Fig. 50.1).

We will now describe an authentication method that enhances the no.3 technique in the list. We denote the discrete output sequence of information produced by each

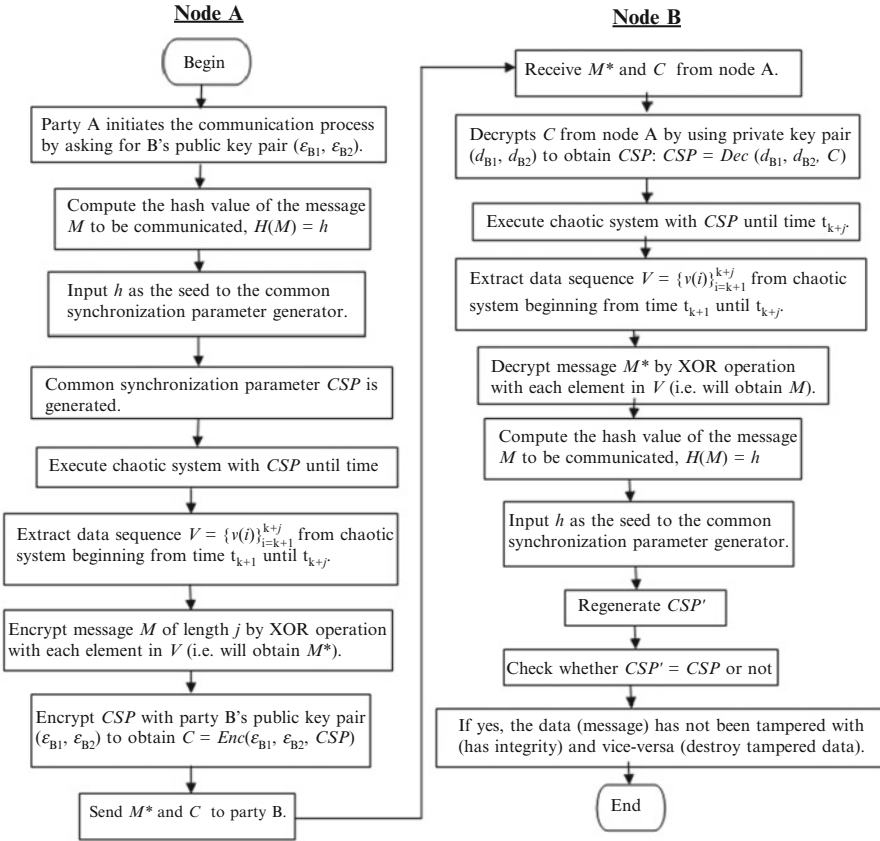


Fig. 50.1 Flowchart of suggested authentication scheme

node independently as $V = \{v(i)\}_{i=k+1}^{k+j}$. We could also view V as a data string to be of length j -bits. The sender of the data would then encode a message M of length j -bits by simply conducting a modulo 2 addition process with V .

50.3 Existing Algorithms

Well renowned asymmetric algorithms such as the RSA and ECC have multitude of literature discussing on the advantages/disadvantages, security/insecurity etc. Due to limited space we will only discuss the newly designed asymmetric scheme – the AAb cryptosystem [3].

Simple and safe.’ (Erçetin 2001, p. 24). The classical physics theory introduced by Newton has directed the science as dominant paradigm for three centuries. The classical physics justifies that everything processes in a regular system, and every

impact causes predictable responses. The immediate raise of science led people to realize more complex, multidimensional systems, social Networks and bigger forms related to the universe. Finally this quest showed that many systems which we think regular consisted complex forms and this had deep patterns which could not be explained by only classical physics.

Flapping of a butterfly's wings in Amazon Forests may result in the breaking of the storm in the United States. In other words, *flapping of a butterfly's wings* can cause a hurricane which can able to walk halfway around the world. Concepts of "precise adherence to its initial state" or "butterfly effect" (Bradley 2010) that Lorenz uses to describe the situation described in this example seems to be an ideal phenomenon to describe the chaos theory which owes its popularity to him. Unlike the name it refers, chaos theory refers to a pattern of irregularity (Shoup and Studer 2010, p. 4). In contrast to mechanistic approach which says; we have nothing important left to be discovered in the nature (Coles 2006, p. 115), chaos theory emphasizes the fact that we are at the beginning of the discovery.

Words, insufficient to explain the concepts of the new world like "impulse response law", "absolute accuracy", "measurability" that classical physics advocated are replaced by more ambitious and analytical discourses like "uncertainty", "complexity" and "chaos". Of course, in everyday language, these concepts can be seen as risky and negative concepts which are completely different (Banerjee 2013, p. 185). The interest to chaos theory that arise after the half of the past century and the findings related to this raise the chaotic situations within an interdisciplinary approach in education.

As well as in other disciplines, many of the concepts described by chaos theory have become apparent in the field of education. As stated by the reputation Ertürk (2012, p. 861), environmental changes trigger the organizational changes as well. Therefore, with changing conjuncture educational institutions should also be in a reconstruction, classical management should be replaced by a more flexible structure which can consider chaotic situation as an opportunity not a risk assess and can create synergy. As Trygestad (1997, p. 10) stated, the pattern of human interaction cannot be understood via linear static and sequential Newtonian mentality. Education, from its most basic system of schools to the highest echelons where policies are produced can be defined as a chaotic structure. There is a common denominator intended from policy-makers to school administrators, teachers and even students; "success". As Ertürk (2012, p. 861) mentioned before, there is not an absolute, certain method for success. At this point, the cause-effect relationship that reveals the success cannot be determined precisely.

In a multidisciplinary field such as education the effects of chaos theory and the chaotic conditions it revealed can be observed at post graduate level as well as all levels of education. Many individuals who can be defined as adults continue master's or doctoral programs. Most of them are married and have their jobs. And in this process most of them face chaotic conditions. The research, conducted with a limited group of post- graduate people, tries to identify the chaotic situations that post-graduate students encountered and tries to produce solutions to them.

50.4 Method

This research which aims to resolve the chaotic situations that graduate students come up with is a descriptive survey model as it targets to describe the existing. In this study, qualitative research was used. The reason of using this method is due to the observation of that qualitative researches, unlike the quantitative methods used for many years, have been used in social sciences researches recently both in Turkey and the world. Accordingly, a study group was composed which consisted of graduate/postgraduate students of universities located in the city of Ankara in this study. While composing the study group, the criteria related to the students' graduate/postgraduate education experience period, their employment status or their marital status were considered. In this direction, 36 students in total from Hacettepe University, Ankara University, Middle East Technical University and Gazi University were included in the study group.

In the process of collecting research data, semi-structured interview form which was prepared by taking the opinions of field experts with the focus group method was addressed. The person who was interviewed was informed about the goal of the study, the content and duration of the interview at the beginning. The persons who were asked their ideas expressed their thoughts, views and perceptions about the topic intimately with starting the first question. The interview ran on a free conversation atmosphere since the order of questions in the interview form was not followed accurately during the meeting. Besides this, the researcher was able to ask new questions circumstantially apart from the ones in the interview form during the interview.

Except for one of 36 students in the study group of research, the others were interviewed. The interviews made with the students in the study group were recorded with a voice recording device. During each interview made with involved persons, coding was used to keep the identities of those secret. Therefore, the universities that involved people enrolled were coded as U1, U2 . . . ; and the students were coded as S1, S2

The data which was obtained during the interview was evaluated by using descriptive data analysis which is one of the qualitative data analysis techniques. In this study, the data obtained with the semi-structured interview forms as a result of the interviews was initially described systematically and clearly considering the research questions, afterwards it was tried to come to some conclusion by interpreting these descriptive definitions.

50.5 Findings and Discussions

In semi-structured interviews held with 35 students in the study group, it's been obvious that the chaotic situations due to 'time deficiency', 'crossing roles', 'the lack of physical and equipment of universities', 'problems about the lecturers',

'bureaucratic problems', 'colleagues' 'attitudes', 'family problems' and 'the lack of the ability of distinguishing scientific data' have been revealed.

S1, who is married and works for state sector, defines these problems as 'sometimes irresolvable situations'. On the other hand, it is observed from the appeals of students that the related problems have some 'unpredictable effects' on graduate/post-graduate education.

Students, who are married and also work in public or private sector, told the chaotic situation they faced as follow:

As a teacher and a graduate student at the same time I think that 24 hours of a day are not enough for me. This situation requires a planning process. Everything becomes more unresolvable when the role of fatherhood is added to this as well. Chaotic condition is experienced necessarily. I can also add many cases such as the problems that school administration creates while taking the lessons, the lack of physical equipment of the university. Actually, chaotic conditions are too many . . . (U1, S3)

I do not understand clearly what the university teachers want from us May-be, this situation is chaos itself. In addition, physical conditions of the school are inadequate. Especially while preparing for a presentation my hands wander on my feet in case a possibility of a breakdown of a device. For this reason I take my personal lap –top to the class (U4, S14)

It is understood from the interviews with married and occupied students that the time matter has a primary position amongst problems they come accross while having graduate/post graduate education. Besides, it can be said that unlike time and family problems, bureaucratic ones are relatively encountered more often when married and occupied students are considered. Underlining the related item of law, some of the interviewed students express that 'it is possible that a teacher who is having a graduate education can be given two half days off provided that they don't neglect their occupation'. But nonetheless they say that they encounter with school administration in practice.

Involved students voice the conditions they meet in this way:

According to the 41st article of Permit Directive of Ministry of National Education, it is stated that a teacher who is having a graduate education can be given two half days off provided that they don't neglect their occupation. The schedules of teachers are planned as giving the opportunity to go on their graduate/post graduate education. Eventually, this is a situation which is determined with legal texts. Education must be considered as a personal right. Whereas, they threaten us whether to implement what the article exactly says or to leave the job. This is the problem that we get disturbed most, meanly the difference between the directive and the practice. (U1, S23)

Chaotic situation is particularly the issue of getting permission from the directors. At the beginning of each term, it is necessary to make an arrangement between my own school schedule and the schedule of university. Sometimes I may have to drop out the lessons. So it doesn't go as we plan . . . (U3, S6)

First of all, I say bureaucratic barriers, meanly the situations caused by the directors, district administration of education, the city education directorate. Secondly, the problem that school emerges since they don't want to arrange my schedule according to the schedule of university. (U3, S12)

In accordance with the views of students stated above, it is understood that the problems graduate/postgraduate students come across are initially related to time and bureaucratic problems. As this issue is considered from the point of marital status of students, it can be said that married ones face the problems which emerge from lack of time in a more 'bitter' and 'intense' way. The related issues and their contents are respectively discussed below.

In any chaotic situation, it is observed that the students get a little support from their spouses, colleagues, school directors or lecturers. On the other hand it is seen these supports are not much well-rounded. They are only temporary and instant ones. S9 and S12 say that their spouses help them but they manage the process themselves.

50.6 Conclusion

Research findings reveal that the students who participated the research face chaotic conditions such as: lack of time, role conflicts, physical structures of the universities, and lack of equipment, problems related to faculty members, bureaucratic problems, the attitude of colleagues, family problems and undistinguished scientific knowledge. In addition, it is seen that students in any chaotic case as a strategy for coping with, more or less they take support of their spouses, colleagues, school administrators or faculty members.

Based on this result:

1. In the name of minimizing the legal, administrative regulations to implement full text that chaotic situations MS/PhD students encountered,
2. To take support from the person concerned to be able to cope with situations in excess of the individual forces and facilitating access to these support mechanisms can be suggested.

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Chapter 51

Efficient Implementation Baptista Type Chaotic Cryptosystem with Encoding Scheme

Z. Mahad, M.R.K. Ariffin, and M.A. Daud

51.1 Introduction

Since 1989, many cryptosystem based on chaotic maps have been proposed for cryptographic implementation. It is based on the facts that chaotic maps are usually noise-like and chaotic systems are very sensitive to initial conditions. Their sensitivity to initial conditions and their spreading out of trajectories over the whole interval seems to be a model that satisfies the classic Shannon requirements of confusion and diffusion (Shannon 1949).

In 1998, Baptista proposed a new cryptosystem based on ergodic property of chaotic systems (Baptista 1998). Since Baptista proposed in 1998, a number of new algorithms based on variation of Baptista's have been published. This type of cryptosystem works with encrypting the message text into a number of iterations needed for a chaotic map to reach a region on a phase space (i.e. a particular section on the range of the map referring to Table 51.1) that corresponds to that text. Baptista

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Table 51.1 Code word table look-up

Number	Binary code
1	1
2	10
3	100
4	1000
5	10000
6	100000
⋮	⋮
$n - 1$	1 $[(n - 1) - 1]$ zeros
n	1 $[n - 1]$ zeros

demonstrated his approach using a simple one-dimensional logistic map given by the following equation:

$$x_{n+1} = bx_n (1 - x_n)$$

where b is the gain and $x_n \in (0, 1)$.

Since this cryptosystem ciphertexts are small integer within 0 and 255, they are suitable to be transmitted over the public digital networks. In order to avoid statistical and differential cryptanalysis, based on his original work, a random number is generated each time the chaotic trajectory has reached the desired region with the condition if it is greater than a threshold η , the current number of iterations will be transmitted as the ciphertext. Otherwise the iteration will continue. This cryptosystem has an interesting feature which is the ability to produce different ciphertext that correspond to the same plaintext. This feature would result in an attacker having problem to predict the ciphertexts correspond to which plaintext.

In 2003, this cryptosystem is breaking as a result in the success of Alvarez’s attack which is known as the One-Time-Pad (OTP) (Alvarez et al. 2004). In between 2008 and 2010, Ariffin attempted to modify the cryptosystem with the theoretical explanation in order to secure it. The work by Ariffin in 2012, they managed to resistant Baptista type cryptosystem towards One-Time-Pad (OTP) attack.

In this paper, we concentrate on the objective to enhance the chaotic cryptosystem scheme proposed by Ariffin in 2012 with utilizing encoding scheme to the cryptosystem scheme. Since the ciphertexts produced are larger in size, this would render the implementation to take large bandwidth. Hence, an efficient encoding scheme to compress such data during relay is important. This is to further enhance the mechanism of relaying such data through networks.

51.2 Background for Encoding Scheme with Lossless Compression

Compression is a process of reducing the original size of a file by doing some alteration technique to its original structure. In real world application, compression is very useful to help the large data to be transmitted over the digital networks. There are two category of compression, known as the lossless and lossy. Lossless compression will encode the data by reducing bits and can be decode back without losing any data. However, lossy compression will encode the data by reducing bits and can be decode back but with losing some of the data (Pathak et al. 2011; Ferreira et al. 2009; Hellebrand and Wurtenberger 2002; Burrows and Wheeler 1994).

Quality of the lossless compression technique is usually depends on the criteria's of total time for compression, total time for reconstruction and size of the compressed data over the size of the original data. These criteria's can be measured via entropy and compression ratio. In this paper, we will utilize the lossless compression technique that models after the dictionary type coding technique to enhance the cryptosystem. It is based on a coding table that has a one-to-one mapping of a list of integers less than a predetermined data size (i.e. $1, 2, \dots, n$) to its corresponding codeword. The algorithm is also proven analytically to be unique, hence overruling the possibility of decoding failure. It is efficient bandwidth space for data transfer.

We begin with observing the following code word. The right column (binary code) is the code word for its counterpart residing within the same row in the left column (number).

51.2.1 Example

Suppose an input string $b_0 = 10011100_2$, $\|b_0\| = 8$ -bits and $b_0 = 156$.

Encoding Process

- (i) Compute $b_1 = (2^{\|b_0\|} - 1) - b_0 = (2^8 - 1) - 156 = 99$ and $\|b_1\| = 7$ -bits.
- (ii) Loop until $0 \leq b_j \leq 3$.
 - (a) Compute $w_1 = \|b_0\| - \|b_1\| = 8 - 7 = 1$.
 - (b) Compute $b_2 = (2^{\|b_1\|} - 1) - b_1 = (2^7 - 1) - 99 = 28$ and $\|b_2\| = 5$ -bits.
 - (c) Compute $w_2 = \|b_1\| - \|b_2\| = 7 - 5 = 2 = 10_2$.
 - (d) Compute $b_3 = (2^{\|b_2\|} - 1) - b_2 = (2^5 - 1) - 28 = 3$ and $\|b_3\| = 2$ -bit.
 - (e) Compute $w_3 = \|b_2\| - \|b_3\| = 5 - 2 = 3 = 100_2$.

Algorithm 1 Encoding process

Prior to the encoding process, to ensure the correctness of decoding process to get the actual size of the original data, n is known to both the encoder and decoder. We denote $\|b_m\|$ as a length of the corresponding data string $b_m = \{0, 1\}^n$ and $\|b\|$ as a length of n -bits block size. For $j = 1, 2, 3, \dots, n$ we define the j -th data string as $b_j = (2^{\|b_{j-1}\|} - 1) - b_{j-1}$. Given a data string input $\|b_m\|$, we will do the following:

- i. Let b_0 be the n -bits integer number.
 - ii. Convert b_0 to its decimal value.
 - iii. Compute, $b_1 = (2^{\|b_0\|} - 1) - b_0$
 - iv. Code the difference between the length of $\|b_0\|$ and $\|b_1\|$ as w_1 (refer Table 51.1).
 - v. Continue the loop $b_j = (2^{\|b_{j-1}\|} - 1) - b_{j-1}$ for $j = 1, 2, 3, \dots, k$ and $k \leq n$ until $0 \leq b_j \leq 3$ (observe that $\|b_m\| = 2$). In each loop a codeword w_j will be produced based on the difference between the length of $\|b_{j-1}\|$ and $\|b_j\|$. Observe that the values of b_j are strictly decreasing, and as soon as they reach $0 \leq b_j \leq 3$ the algorithm will terminate.
 - vi. From the codeword list $\{w_1, w_2, \dots, w_{k-1}, w_k\}$ we will append b_k at the end of the codeword to gain $m = \{w_1, w_2, \dots, w_{k-1}, w_k, b_k\}$. Once again observe that $\|m\| = n$. Then, focus on the last codeword w_k, b_k will be shifted to the left according to the number of zeros in w_k . The result is compressed data denoted by m_c .
 - vii. The sender will then send the compressed data m_c to the recipient. Notice that the zero's within w_k is excluded in the corresponding sequence which constructs m_c . Hence, $\|m_c\| < \|m\|$.
 - viii. Then continues to the next block of n -bits. Repeat step *ii* until *viii*. The process will continue until the whole blocks have been encoded.
-

Algorithm 2 Decoding process

- i. Expand m_c to the original size $\|m\| = n$ by shifting back b_k to the right by padding in zeros until we have $\|m_c\| = \|m\|$. To decode we have to decide where each code begins and ends, since they do not have the same length. During the encoding process we utilized the codeword list as given by Table 51.1. As a result, we only need to scan through the input string of m_c from right to left until we recognize the first codeword. Then, we are able to determine the corresponding value and start looking for the next codeword. Observe that from Table 51.1 all cases will begin with 0 from the right and stop with 1 on the left.
 - ii. Excluding b_k , start by extracting the codeword from the LSB of m_c . Translate the codeword from Table 51.1.
 - iii. Compute $b_{k-1} = (2^{\|p_0\|} - 1) - b_k$, where $\|p_0\| = \|w_k\| + \|b_k\|$.
 - iv. Next, compute $b_{k-2} = (2^{\|p_1\|} - 1) - b_{k-1}$, where $\|p_1\| = \|w_{k-1}\| + \|p_0\|$.
 - v. Continue until $b_{k-i} = (2^{\|p_{i-1}\|} - 1) - b_{k-i+1}$, where $i = 1, 2, 3, \dots, k$ and $k \leq n$. The original block data is b_0 .
-

(iii) Return codeword list $\{w_1 w_2 w_3 w_4\} = 110100_2$.

(iv) Shift codeword list $\{w_1 w_2 w_3 w_4\} = 110100_2$ to the left according the of zeros in w_k , $\{w_1 w_2 w_3 w_4\} = 1101_2$.

(v) Append b_j into codeword list $\{w_1 w_2 w_3 w_4 b_3\} = 110111_2$.

(vi) $m_c = 55$.

Note: For this, the original input string is 8-bits length and encoded string is 6-bits length.

Decoding Process

- (i) Given encoded string m_c .
- (ii) Expand $m_c = 110111_2$ to the original size n -bits by shifting back b_k to the right by padding in zeros until we have $m_c = 11010011_2$.
- (iii) Excluding $b_k = b_0 = 11_2 = 3$.
- (iv) Loop until $p_i = n$ for $i = 1, 2, \dots, n$.
- (v) Compute from LSB of m_c , $b_1 = (2^{p_0} - 1) - b_0 = (2^5 - 1) - 3 = 28$, where $p_0 = \|100_2\| + \|11_2\| = 5$.
- (vi) $b_2 = (2^{p_1} - 1) - b_1 = (2^7 - 1) - 28 = 99$, where $p_1 = \|10_2\| + p_0 = 7$.
- (vii) $b_3 = (2^{p_2} - 1) - b_2 = (2^8 - 1) - 99 = 156$, where $p_2 = \|1_2\| + p_1 = 8$.
- (viii) $m' = m = 156$.

51.3 Efficient Implementation: The Enhancement Baptista Type Chaotic Cryptosystem

51.3.1 Encryption

Preparing a Chaotic Map

- (i) Assume that we construct a look-up table consisting of j ε -intervals.
- (ii) Represent each site with $S_1, S_2, S_3 \dots S_j$.
- (iii) The minimum value of the first interval is 0, and the upper bound of the interval is 1.
- (iv) Choose a one-dimensional chaotic map with the onto property. (In our article we will utilize the logistic map).

Preparing the Matrix Secret Key

- (i) Generate a $k \times k$ matrix ($[A]_{k \times k}$) such that its inverse ($[A]_{k \times k}^{-1}$) exists.

$$A = \begin{pmatrix} M_{11} & M_{12} & \cdots & \cdots & M_{1+k} \\ M_{21} & \cdots & \cdots & \cdots & M_{2+k} \\ \vdots & \cdots & \cdots & \cdots & \vdots \\ \vdots & \cdots & \cdots & \cdots & \vdots \\ M_{k1} & M_{k2} & \cdots & \cdots & M_{kk} \end{pmatrix},$$

The matrix will consist elements only from the set $\{0, 1\}$. This matrix will be the secret key.

Preparing Distorted Plaintext

- (i) Encrypt each plaintext via the Baptista method.
- (ii) The iteration numbers are denoted as C_1 .
- (iii) Group each element of C_1 into matrix of dimension $k \times 1$. Then do the following matrix multiplication.

$$[C_2]_{k \times 1} = [A]_{k \times k} \times [C_1]_{k \times 1}$$

- (iv) $[C_2]_{k \times 1}$ is the ciphertext.
- (v) The ciphertext will be encoded with the above algorithm before being sent to the recipient.

51.3.2 Decryption

Multiply $[A]_{k \times k}^{-1}$ with the Following Ciphertexts ($[C_2]_{k \times 1}$)

- (i) First decode the incoming encoded ciphertext with the above decoding algorithm.
- (ii) Do the following matrix multiplication:

$$[C_1]_{k \times 1} = [A]_{k \times k}^{-1} \times [C_2]_{k \times 1}$$

- (iii) Would result in a list of integers.
- (iv) Use each integer to iterate the logistic map. Start iterating the logistic map until it falls in the corresponding phase space of the first character and continue iterating until the final character to get the original plaintext.

51.4 Example

Let us use a 4-symbol source, $S_4 = \{s_1, s_2, s_3, s_4\}$. For illustrative purposes the key $x_0 = 0.232323$ and parameter $b = 4$ is utilized. The plaintext is given by $P = s_4, s_3, s_1, s_1, s_2, s_4, s_3, s_1$.

Site	Associated interval (phase space)
s_1	[0, 0.25)
s_2	[0.25, 0.5)
s_3	[0.5, 0.75)
s_4	[0.75, 1]

51.4.1 Encryption

(i) Choose $k = 2$.

(ii) Preparing matrix key, let $A = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$.

(iii) For each character P , was encrypt via Baptista cryptography method.

(iv) We have the following ciphertext, $C_1 : 2, 10, 2, 11, 5, 1, 2, 2$.

(v) Do the following matrix multiplication $[C_2]_{2 \times 1} = [A]_{2 \times 2} \times [C_1]_{2 \times 1}$.

(vi) We pair two consecutive values to be points on the Cartesian plane

$$(x_1, y_1) = (2, 10), (x_2, y_2) = (2, 11), (x_3, y_3) = (5, 1), (x_4, y_4) = (2, 2).$$

(vii) Do the matrix multiplication procedure.

$$\begin{aligned} \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 2 \\ 10 \end{pmatrix} &= \begin{pmatrix} 12 \\ 10 \end{pmatrix}, \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 2 \\ 11 \end{pmatrix} = \begin{pmatrix} 13 \\ 11 \end{pmatrix}, \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 5 \\ 1 \end{pmatrix} \\ &= \begin{pmatrix} 6 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 2 \\ 2 \end{pmatrix} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}. \end{aligned}$$

(viii) We have the following ciphertext, $C_2 : 12, 10, 13, 11, 6, 1, 4, 2$.

(ix) Encode C_2 by utilizing new encoding scheme, E_{C_2} .

(x) We transmit E_{C_2} to recipient.

51.4.2 Decryption

(i) Decode E_{C_2} to get C_2 .

(ii) To decrypt we will use the inverse of A .

$$A^{-1} = \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$$

(iii) We have the following ciphertext, $C_2 : 12, 10, 13, 11, 6, 1, 4, 2$.

(iv) Do the following matrix multiplication $[C_1]_{2 \times 1} = [A]_{2 \times 2}^{-1} \times [C_2]_{2 \times 1}$.

(v) We pair two consecutive values to be points on the Cartesian plane

$$\begin{aligned} (x_1^*, y_1^*) &= (12, 10), (x_1^*, y_1^*) = (13, 11), (x_1^*, y_1^*) = (6, 1), \\ (x_1^*, y_1^*) &= (4, 2). \end{aligned}$$

(vi) Do the inverse matrix multiplication procedure.

$$\begin{aligned} \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 12 \\ 10 \end{pmatrix} &= \begin{pmatrix} 2 \\ 10 \end{pmatrix}, \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 13 \\ 11 \end{pmatrix} = \begin{pmatrix} 2 \\ 11 \end{pmatrix}, \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 6 \\ 1 \end{pmatrix} \\ &= \begin{pmatrix} 5 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 4 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}. \end{aligned}$$

(vii) From the inverse matrix multiplication, we have the following ciphertext, C_1 :
2, 10, 2, 11, 5, 1, 2, 2.

(viii) Iterate the chaotic map first 2-times, second 10-times and so on.

(ix) Get the plaintext $P = S_4, S_3, S_1, S_1, S_2, S_4, S_3, S_1$.

51.5 Conclusion

Empirical implementation shows that the new encoding scheme utilized in Baptista can be used to compress and decompress the data transmitted over the network, since the Baptista utilizes integer as its ciphertext. This would result in the actual implementation of the Baptista type encryption scheme to be deployed efficiently. Research on the further enhancing Baptista type chaotic cryptosystem with encoding scheme should be conducted in order to determine the actual size of the n-bit per block can be utilizes for encoding scheme to become more efficiently. Also the actual size of the packets transmitted over the network still under research.

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Chapter 52

Measuring Perceptual Reflections of Employees for Their Executives Intellectual Traits That Effecting Quality of Work Life of Employees and Organizational Change

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52.1 Introduction

Today organizations demand managers who has intellectual features for making change, creating a flexible structure, establishing the dynamic system, building learning organization (Çelik 2000), and making innovation to manage future (Çapcıoğlu et al. 2010). For that reason manager-leader is the new actor that changes organizational environment and demands them by acting and behaving like a leader (Koçel 2003) and also change maker.

Leaders, as the key decision-makers that determine the acquisition, development, and deployment of organizational resources and conversion of these resources into valuable products and services (Zhu et al. 2005). Thus, they are potential sources of managerial rents and hence helping sustained competitive advantage.

Leadership requires special features rather than managerial skills and in organizational context it plays an important role in realizing aims of organizational innovation and learning. They determine visions and strategies by organizing and directing all activities (including intellectual) of human resources an the others (Burns 1978). Leaders create the quality work life employees, influence human ability and also use these process effectively. Charismatic power results from both behavior and mental characteristics of the manager (Sivanathan and Fekken 2002). Leaders encourage their followers to gain self-actualization, developing them

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involving decision-making. They build project and functional teams and focus on quality, service, cost-effectiveness, and productivity (Bass and Avolio 1994). A good example of this type of leadership is transformational leadership has emerged as one of the most widely researched leadership paradigms in organizational psychology (Sivanathan and Fekken 2002).

There are difference between the managers and the leaders. Managers require authority to manage or operate theş employee efficiently at different level of status and responsibility Zaleznik (1977). These two concepts are separately each other but is still debate and discussions in the field of leadership and management practice. However, this two are immutably linked and their processes are distinct they could not effectively work without each other. They were integrative in nature (Booth et al. 2010). More recently, Kent (2005) attempted to revisit the definition of “the processes of leading and managing in a way that enables both the separation and distinction of the concepts for study as well as the integration of the concepts for practical application. In this study, we call this integration of leader and manager concept as a manager-leader.

52.1.1 Literature Review

Leadership literature on “property approaches” considered to begin with Thomas Carlyle (1795–1881) in the late eighteenth century (Dođu 2003). Yukl (1989) suggested that organizational managers need to be both a leader and a manager. The first traditional work about leadership started with the investigation of managers-leadership qualities (Güney 2000). From this emerging literature it is proposed effective leaders are differentiated from other managers through the exercise of a relatively small range of skill or competence areas (Dulewicz and Higgs 2005). Gardner (1990) also saw the connection between leader and manager and identified a distinction between the leader-manager and the routine manager (Booth et al. 2010). Leader-manager who has the best features, can reveal his strength, when utilized in the best way. This features is very important for leaders. It is not possible without a strong personality which inspired by the leaders to achieve new goals (Heim and Chapman 1997). However leader-managers think long term, look beyond the immediate work group to the larger organization and influence others outside the work group (Booth et al. 2010).

Having reviewed the development of thought on the nature of effective management and leadership, in particular, having looked at the literature from a “sense making” rather than discovering perspective it may be said that the personality of the leader plays an important part in the exercise of leadership. The areas of effectiveness the “skills” need to be exercised in a way which is congruent with the underlying personality of the leader (Dulewicz and Higgs 2005). On the other hand leadership role is more charismatic and wiser than manager. Thus, manager needs formal authority in realizing aims of institutions, achieving the limits of responsibility (Burns 1978). Managers-Leaders, as the key decision-makers, determine the acquisition, development, and deployment of organizational resources,

the conversion of these resources into valuable services, and the delivery of value to organizational environment (Zhu et al. 2005). In institutions and organizations, leadership and managerial leadership are frequently used instead of each other.

Managers-Leaders of Entellectual Dimensions

Leaders have often been characterized as being intelligent traits, but not necessarily brilliant and as being conceptually skilled. Kotter states that a “keen mind” (i.e., strong analytical ability, good judgement, and the capacity to think strategically and multidimensionally) is necessary for effective leadership, and that leadership effectiveness requires “above average intelligence,” rather than genius (Kirkpatrick and Locke 1991). Manager-Leadership is defined as motivating his or her employees to reach aims which are created independently by using economic, politic and other forces (Burns 1978; Tabak 2001). In other words, the most important reason of becoming a manager-leader is personal traits. It is supposed that leaders differ from others by their personal traits (Koçel 2003). We designed managers-leader intellectual traits in three dimensions. The first dimension of manager-leader intellectual feature is critical analysis and judgement, the second dimension is vision and imagination and the third dimension is strategic perspective.

Critical Analysis and Judgment

We investigate intellectual traits of managers-leaders as one of the most important qualities affecting quality work life and organizational change. Intellectual traits of managers-leaders are dominant in general meaning. They serve as a critical faculty that probes the facts, identifies advantages and disadvantages and discerns the shortcomings of ideas and proposals (García-Morales et al. 2006). Makes sound judgments and decisions based on reasonable assumptions and factual information, aware of the impact of any assumptions are made. According to Zaleznik (1977), leaders are influencer as “altering moods, evoking images and expectations, and in establishing specific desires and objectives”. They have intellectual features that making critical analysis and judgment.

Vision and Imagination

The second dimension of manager-leader trait is vision and imagination. This dimension is imaginative and innovative in all aspects of one’s work. This trait is to be made sound priorities for future work. Sets clear vision of the future direction of the organization to meet business imperatives. And it foresees the impact of changes on one’s vision that reflect implementation issues and business realities (García-Morales et al. 2006). The manager should be more convinced than anybody to need creative vision that is shared all of employee and not imposed and must analyze the strategic components required to create that vision.

Strategic Perspective

Leaders must gather, integrate, and interpret enormous amounts of information and reveal the knowledge. These demands are greater than ever today because of rapid technological change. Thus, it is not surprising that leaders need to be intelligent enough to formulate suitable strategies, solve problems, and make correct decisions (Kirkpatrick and Locke 1991). In strategic perspective, managers-leaders see the wider issues and broader implications, explore wide range of relationships and balance short and long-term considerations. They are sensitive to the impact of one's actions and decisions across the organization. They identify opportunities and threats, sensitive to stakeholders' needs and the implications of external factors on decision actions.

Quality of Work Life

According to the evaluation of employees working conditions and work experiences, the quality providing an achievement of work life is defined as an expression of pleasing and positive emotional expressions (Testa 1999). Quality of life phenomena explored in early studies included job satisfaction (measured by employee turnover, absenteeism or attitude surveys), organizational climate and the learning of new tasks (Stjernberg 1977). In the literature regarding the definition of job satisfaction, there is a clear consensus further proposes and the form of emotional response from the individuals (Weiss 2002). In the case of job dissatisfaction, employee efficiency and performance declines and also they can be able to sabotage the work and even can be separated from work (Dole and Schroeder 2001; Vecchio 1995).

QWL has also been associated with organizational changes aimed at increasing the levels of job enlargement (greater horizontal task flexibility) and job enrichment (greater vertical task flexibility) including the taking on of new responsibilities and undertaking those formerly supervisory or managerial experience (Huzzard 2003). Crucially, the idea is that of attaining higher levels of participation and thereby motivation by improving the attractiveness of the work itself rather than through improving the terms and conditions of work (Hertzberg et al. 1959) refers QWL. Job satisfaction in the simplest terms is an employee's perception of how happy he or she is with the work. If the person can see the results of work in concrete terms, he would be mostly satisfied (Eren 2001). Individuals have specific expectations within an organization, and to the extent, these expectations are performed they become satisfied with their job and increase the efficiency and performance (Nelson ve Quick 1995). There is evidence to support a relationship between manager-leadership and meaningful work or the quality of job life. If meaningful work is indeed a mechanism that exerts positive influence on psychological well-being (Kara et al. 2007). The employees feel sense of satisfaction. In this study, we will deal with two aspects of quality of work life: intrinsic satisfaction extrinsic satisfaction.

Intrinsic Satisfaction

Intrinsic motivation is the motivation that comes from inside of the individual emotional energy and the pleasure one gets from the task his or herself. Also intrinsic satisfaction can be defined as a social psychological energy that drives people completing or working on a task. The main source of intrinsic satisfaction is still to meet internal needs (Burns 1978). The person doesn't work on their task properly if he feels emotional energy. Bass (1985) proposed as a kind of leadership can help to reveal the emotional energy of the employee. This leadership is transformational leadership. Transformational leader has the one who motivates followers to do more than they originally expected to do by using intrinsic instruments (Krishnan 2001), and to motivate followers to achieve beyond what was originally thought possible (Sivanathan and Fekken 2002). Motivated employees in a working environment of trust, flexibility, and empowerment by the manager-leader create intrinsic motivation.

Extrinsic Satisfaction

Extrinsic motivation refers to motivation that comes from outside an individual. The motivating factors are external, or outside, rewards such as money or grades. These rewards provide satisfaction and pleasure that the task itself may not provide. Employees lacking commitment and motivation in an working environment characterized by rigidity and lack of trust will depress the leadership of the CEO and others (Zhu et al. 2005). Recent research has demonstrated a positive link between transformational leadership and employee perceptions of meaning in terms of job satisfaction. Another way to conceptualize meaningful work is finding a purpose in work that is greater than the extrinsic outcomes of the work (Kara et al. 2007). In other words, satisfaction is the interest derived from work and the happiness of providing an achievement in the work (Serinkan and Bardakcı 2007).

H1 Intellectual Properties of Manager-Leaders are positively and significantly correlated with both dimensions of Quality of Work Life (Extrinsic and Intrinsic Motivation).

52.1.2 *Organizational Change*

Change is described different ways. For example change is defined as the transition from a particular situation, conditions and environment to a different situation, conditions and environment (Top 2008). The new task of manager-leadership in organizations involves creating new resources and combining existing resources in new ways in order to develop and commercialize new products and move into new markets (García-Morales et al. 2006). Organizational change is a structuring

innovating, empowering, learning and improving of the company and the human resource (Top 2006). It is favored by the presence of strategic capabilities (learning and innovation) in organizations that allow the creation of sustainable earnings and competitive advantage (García-Morales et al. 2006). In our study, organizational change will be discussed in two categories: organizational innovation and organizational learning.

Organizational Innovation

Organizational innovation refers to new ways work can be organized, and accomplished within an organization to encourage and promote competitive advantage. In a general sense, the term ‘organizational innovation’ refers to the creation or adoption of an idea or behaviour new to the organization (Lam 2004). It encompasses how organizations, and individuals specifically, manage work processes in such areas as customer relationships, employee performance and retention, and knowledge management. Leadership builds and nurtures organizational learning (OL), which enables the formulation of organizational innovation (OI) strategies that lead to greater performance (García-Morales et al. 2006).

OI is a key dimension of a manager-leader orientation. Innovation is the means by which the entrepreneur creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth (García-Morales et al. 2006). Organizational innovation contains activity such as the rate of introduction of new products or services, into the organization has grown and introduction of new methods of production or delivery of services into the organization has grown rapidly. There is a strong interrelationship between leadership and organizational innovation (OI), where we understand OI to be the process of proposing, adopting, developing, implementing a new idea (related to a product, process, policy, practice, behavior, program, service) generated internally or taken from outside (García-Morales et al. 2006).

Organizational Learning

Theories of organizational learning attempt to understand the processes which lead to (or prevent) changes in organizational knowledge, as well as the effects of learning and knowledge on behaviors and organizational outcomes (Schultz 2001). Organizational members have acquired some critical capacities and skills over the years. An early view of OL was “...encoding inferences from history into routines that guide behavior” (Levitt and March 1988). So, OL has to do with embedding what has been learned into the fabric of the organization. The organization’s performance has been influenced by new learning that it has acquired over the years from the employees. The manager’s perception of personal mastery is fundamental, since he will use his own personal development to guide others on their

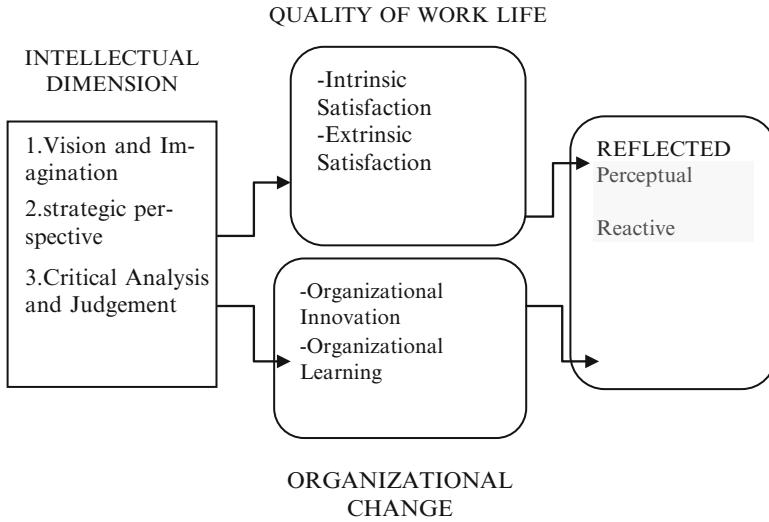


Fig. 52.1 The model of study

professional road and will support them in their organizational growth, acting as a mentor/master (García-Morales et al. 2006). Contemporary organizations require a strong learning orientation to gain competitive advantage. It enables the leader to commit himself openly to learning and innovation, stimulating them and doing everything in his power to overcome the internal skepticism and external difficulties that prevent learning and innovation from being implemented in the organization (García-Morales et al. 2006).

H2 Intellectual Properties of Leaders are positively and significantly correlated with both dimensions Organizational Change (Organizational Learning) (Fig. 52.1).

52.1.3 Method

This study is an area searching and we reached master and doctoral students who work for organization and most of them are managers or potential manager candidate. We designed our study in three dimensions. In first dimension we investigate which intellectual traits of managers-leaders are dominant QWL and OC in general meaning. In second dimension we studied to learn how to effect on the quality of work living and organizational change. Thirdly we aim to reveal the impacts of managerial intellectual traits reflect on the organizational change (cultural perceptions).

Sample and Data Collection

The study was conducted with 271 employees from different sectors including service, public, trade, industry and agriculture sectors. Simple random sampling method was used to collect data. Questionnaires distributed and collected within 2 months. Respondents' confidentiality was ensured to be kept strictly by the researcher. Participants were encouraged to complete the questionnaire sincerely and voluntarily and enough time was allocated to complete the survey. Owing to the fact that there is a closer link with our research, that they reflected the different prior trends well and that the scale's validity was verified in detail.

Measures

In this study, multifactor leadership questionnaire (MLQ) revised and also the new leadership dimensions questionnaire (LDQ) was used. LDQ was developed by Dulewicz and Higgs (2003) who provide a "map" of some of the key leadership models and their potential relationship to the elements of emotional intelligence as defined by Higgs and Dulewicz (2002). The key themes were propounded by eminent authorities on the subject of leadership. Dulewicz and Higgs (2003) also conducted a similar mapping exercise on the key themes propounded by same eminent authorities onto the IQ, EQ and MQ dimensions required for effective leadership. IQ or intellectual dimension consists of three parts. These dimension are Critical Analysis and Judgment, Vision and Imagination, Strategic perspective Leadership style was measured by the 15-item Leadership Style Questionnaire developed by Northouse (2001). The items were measured on a 5-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Quality of work life (QWL) was measured by Abridged Job In General (AJIG) scale was revised. We used revised Minnesota Satisfaction Questionnaire (MSQ) By Weiss et al. (1967). 5-point Likert-type response measure (1 strongly disagree to 5 strongly agree) was used in the current study instead of the original scale format. Quality of work life was measured by 20 items.

Organizational change is favored by the presence of strategic capabilities (learning and innovation) in organizations that allow organizational learning (OL), which enables the formulation of organizational innovation (OI) strategies (Lee and Tsai 2005) that lead to greater performance (Senge et al. 1994). We based our scale on Miller and Friesen's (1983) work and defined OI for respondents. We used the first two items from the scale developed by Kale et al. (2000) and added two items based on Edmondson (1999). We developed a confirmatory factor analysis to validate our scales and showed that the scale of items had a high validity.

Data Analysis

Results of the study were analyzed using the Statistical Package for the Social Sciences (SPSS 17.0). To understand the internal consistency of the measures,

reliability analysis was performed and coefficient alphas were taken consideration. For the construct validity of the measures, factor analyses were performed with principal components model and oblimin rotation. To test the hypotheses bivariate correlation tests were conducted in order to test the relationships between variables. Expected results, that are found by data from analysis, reveals what amount of dominant personal traits are reflected to managerial leadership styles.

52.1.4 Findings

Factor and Reliability Analysis of Measures

Confirmatory factor analysis was conducted for Organizational Change Questionnaire. Prior to the factor analysis, scales eligibility for this analysis was checked. The suitability of the sample size for factor analysis was tested by Kaiser-Meyer-Olkin (KMO) values and results indicated that the sample size was adequate (KMO: 0.869 > .50 Chi square 1480.659, df: 36) Bartlett tests which indicates whether relationships between variables are sufficient at a significant level were checked and found to be significant. ($p = 0.00 < .05$).

Confirmatory factor analysis was conducted with the principal components method in order to determine the factor construct and reliability of organizational change questionnaire. Since independent factors were desired, orthogonal rotation technique varimax had been applied and after removal of the items with factor loadings below (.50) or reducing internal reliability, or having inconsistent meaning all items of the questionnaire were loaded in a single factor which was named "Organizational Change". Cronbach Alpha reliability was found 0.898 which indicates that factor was highly reliable.

Confirmatory factor analysis was also conducted for Leader's Intellectual Properties Questionnaire. Prior to the factor analysis, scales eligibility for this analysis was checked. The suitability of the sample size for factor analysis was tested by Kaiser-Meyer-Olkin (KMO) values and results indicated that the sample size was adequate (KMO: .953 > .50 Chi square 2275.734 df: 91) Bartlett tests which indicates whether relationships between variables are sufficient at a significant level were checked and found to be significant. ($p = 0.00 < .05$). Confirmatory factor analysis was conducted with the principal components method in order to determine the factor construct and reliability of Intellectual Properties Questionnaire. Since independent factors were desired, orthogonal rotation technique varimax had been applied and after removal of the items with factor loadings below (.50) or reducing internal reliability, or having inconsistent meaning all 14 items of the questionnaire were loaded in a single factor which was named "for Leader's Intellectual Properties". Cronbach Alpha reliability was found .936 which indicates that factor was highly reliable (Tables 52.1 and 52.2).

Same methods were followed for Quality of Work Life Questionnaire and Kaiser-Meyer-Olkin (KMO) values and results indicated that the sample size was adequate

Table 52.1 Results of factor and reliability analysis for leader's intellectual properties questionnaire

Factor 1: Leader's intellectual properties	$\alpha = .936$
Kaiser-Meyer-Olkin sample adequacy: .953 Chi-square: 2275.734	
df: 91 Significance: .000	

Table 52.2 Results of factor and reliability analysis for organizational change questionnaire

Factor 1: Organizational change	$\alpha = .898$
Kaiser-Meyer-Olkin sample adequacy: .869 Chi-square: 1480.659	
df: 36 Significance: .000	

Table 52.3 Results of factor and reliability analysis for quality of work life questionnaire

Factor 1: Extrinsic satisfaction	$\alpha = .838$ %VAR: 31.311
Factor 2: Intrinsic satisfaction	$\alpha = .832$ %VAR: 26.250
Kaiser-Meyer-Olkin sample adequacy: .890 Chi-square: 1430.383	
df: 66 Significance: .000	

(KMO: 0.890 > .50 Chi square 1430.383 df: 66) Bartlett tests which indicates whether relationships between variables are sufficient at a significant level were checked and found to be significant ($p = 0.00 < .05$). Items of the questionnaire were loaded in two factors which were named "Intrinsic Satisfaction" and "Extrinsic Satisfaction". Cronbach Alpha reliabilities were found highly reliable and shown in Table 52.3.

Demographics Findings

In this study 45.4 % of the participants were from service sector, 36.2 % from public sector, 7 % from trade, 6.3 % from industry and 5.2 from agriculture sector. The participants included 53.1 % males and 46.9 % females aging between 20 and 61. 21.0 % of the respondents were between ages 20–25, 30.6 % were between 26 and 30, 19.6 % were between 31 and 35, 13.3 % were between 36 and 40 and rest (15.5 %) were at age 41 and older. Tenure of the participants was 6–10 years for 64.2 %, 1–5 years for 33.6 %, 11–15 years for 1.5 % and more than 16 years for 0.8 %. 67.2 % of the participants had a master degree and 25.5 % of them were university graduates. 5.2% had a doctoral degree and 1.5 % had high school degree. 0.7 of them graduated from vocational schools (Table 52.4).

Relationship Between Variables

A bivariate correlation analysis is conducted in order to test the relationship between dependent and independent variables. The results of the correlation analysis show that there are statistically significant, positive (linear) and strong

Table 52.4 Demographics

		Frequency	Percent	Valid percent	Cumulative percent
Sector	Service sector	123	45.4	45.4	45.4
	Industry	17	6.3	6.3	51.7
	Agriculture sector	14	5.2	5.2	56.8
	Public sector	98	36.2	36.2	93.0
	Trade	19	7.0	7.0	100.0
Age	20–25	57	21.0	21.0	21.0
	26–30	83	30.6	30.6	51.7
	31–35	53	19.6	19.6	71.2
	36–40	36	13.3	13.3	84.5
	41+	42	15.5	15.5	100
Gender	Male	144	53.1	53.1	53.1
	Female	127	46.9	46.9	100.0
Tenure (year)	1–5	91	33.6	33.6	33.6
	6–10	174	64.2	64.2	97.8
	11–15	4	1.5	1.5	99.3
	16+	2	0.8	0.8	100.0
Education	Master degree	182	67.2	67.2	67.2
	University graduates	69	25.5	25.5	92.7
	Doctoral degree	14	5.2	5.2	97.9
	High school degree	4	1.5	1.5	99.4
	Vocational schools	2	.7	.7	100

correlations between variables. Intellectual dimension (Traits of Leader) contains; Vision and Imagination, Strategic Perspective and Critical Analysis and Judgement. Leader intellectual dimension is significantly and positively correlated with Intrinsic Satisfaction (.462) The power of the relationship is $r=.462$. To calculate how much these two variables explain each other we calculate r^2 and determine that Intellectual traits of leader explain the 21 % of the total variance in intrinsic satisfaction. Intellectual Dimension of Leader is correlated with other dimension of the quality of work life too. It is significantly and positively correlated with Extrinsic Satisfaction (.578) and explain the 33 % of the total variance in it. Intellectual dimension of Leader also correlates with Organizational Change significantly and positively (.609) explaining the 37 % of the total variance in Organizational Change. To sum up; the results of the correlation analysis in this study show that there are statistically significant, positive (linear) and strong correlations between intellectual traits of manager-leader (Vision and Imagination, Strategic Perspective, Critical Analysis and Judgment) and the both dimensions of quality of work life; intrinsic satisfaction, extrinsic satisfaction and also organizational change (organizational innovation and organizational learning).

There are statistically significant, positive (linear) and strong correlations between the Intrinsic Satisfaction and extrinsic satisfaction (.589) or (within quality of work life). In addition there are statistically significant, positive (linear) and strong correlations between the Intrinsic Satisfaction and organizational change

Table 52.5 Results of the correlation analysis between the variables of the study

	Intellectual dimensions (vision and imagination strategic perspective critical analysis and judgement)	Intrinsic satisfaction	Extrinsic satisfaction	Organizational change
Intellectual dimensions (vision and imagination strategic perspective critical analysis and judgement)	1			
Intrinsic satisfaction	.462**	1		
Extrinsic satisfaction	.578**	.589**	1	
Organizational change	.609**	.533**	.583**	1

** $p < .01$

(innovation and learning) (.533) (See Table 52.5). On the other hand there are statistically significant, positive (linear) and strong correlations between the extrinsic satisfaction and organizational change (.583).

52.2 We Can Explain These Findings

There are statistically significant, positive and strong correlations between intellectual dimensions of manager-lesdar and with both organizational change and quality of work life. When we rank these variables within itself, the best relationship is seen intellectual dimensions of manager-leader and with organizational change (OC). Also there is significant, positive and strong correlations between the extrinsic satisfaction and the organizational change. The second best relationship is shown within the intellectual dimensions of manager-leader and with quality of work life (extrinsic satisfaction) and also it is followed by intrinsic satisfaction relations. We can evaluate our hypotize: Intellectual Properties of Manager-Leaders are positively and significantly correlated with dimensions of Quality of Work Life is proven this study.

This study is shown another finding about quality of work life that significant, positive and strong correlations within the intrinsic satisfaction and extrinsic satisfaction. We evaluate this event with regard to participants view. Extrinsic satisfaction is more important than intrinsic satisfaction. Again there is significant, positive and strong correlations between the intrinsic satisfaction and organizational change (innovation and learning). We can evaluate our hypotize: Intellectual properties of leaders are positively and significantly correlated with both dimensions organizational change (Organizational Learning and Innovation) is proven this study.

At this study can be said that only intrinsic satisfaction and extrinsic satisfaction be seen as a QWL's sub-factors by participants' perception. On the otherhand intellectual dimensions of manager-leader traits and organizational change can be seen as a whole single factor. We can interpret this findings is cultural reflection that comes from the participants value judgment of manager-leader intellectual properties and organizational change factor. We can do our assessments in the light of these findings.

There are significant, positive, strong correlations between intellectual dimensions and quality of work life (QWL) especially in intrinsic satisfaction dimension. Also there are significant, positive and strong correlations between intellectual dimensions and extrinsic satisfaction. At the same time there are significant, positive and strong correlations between intellectual dimensions and organizational change. From the point of participants, there are priority between the intrinsic satisfaction and extrinsic satisfaction in terms of the relationship manager-leader intellectual features. Extrinsic satisfaction come from the first than intrinsic motivation. In other words extrinsic motivation is more than relational intellectual features than intrinsic satisfaction.

52.3 Conclusion

This paper examines manager-leader intellectual traits such as vision and imagination, strategic perspective and critical analysis and judgment of strategic capabilities. These factors affect QWL (IS/ES) and OC (OI/OL). We develop two testable hypotheses concerning the influence of employee perceptions of vision-proactivity-and environment on OI/OL and IS/IM. We also examine how these factors influence each other. Intellectual dimension is discussed as a whole. Relational analysis indicated that respondents of the study perceive the intellectual properties of leader as a whole which is sum of preassumed three subdimensions. In this instance we considered the intellectual dimension as a single dimension by the perception of participant. When these significant, positive (linear) and strong correlations is ranked between the sub scale of intellectual dimensions (Vision and Imagination, strategic perspective and Critical Analysis and Judgment) and organizational change (organizational innovation and organizational learning) shows the best relations. This means manager-leaders intellectual feature and organizational innovation and learning closely related to the creating knowledge and firm advantage.

There is a strong interrelationship between manager-leader and OC. The second level of significant, positive (linear) and strong correlations are ranked between the Intellectual Dimensions (Vision and Imagination, strategic perspective and Critical Analysis and Judgment) and the quality of working life (extrinsic satisfaction) that shows the good relations. This means manager-leaders intellectual feature and extrinsic motivation closely related to the creating better economic, physical and social work environment.

The third level of significant, positive (linear) and strong correlations are ranked between the Intellectual Dimensions (Vision and Imagination, strategic perspective and Critical Analysis and Judgment) and the quality of working life (intrinsic satisfaction) shows the good relations. This means manager-leaders intellectual feature and extrinsic motivation closely related to the creating satisfaction among the managers and employee in intrinsic satisfaction.

Also there are statistically significant, positive (linear) and strong correlations between extrinsic satisfaction and intrinsic satisfaction that showing better relation. We evaluate these findings extrinsic motivation is more important than intrinsic motivation from the perception of respondents. Extrinsic motivation given by the manager-leader of the organization support employee satisfaction and encourage the organizational change. Again there are statistically significant, positive (linear) and strong correlations between extrinsic satisfaction and organizational change (innovation and learning) shows a good relation. We evaluate this finding between the extrinsic motivations and innovation and learning has positive. Organizational innovation and organizational learning is an important factor for firm performance. At the same time extrinsic motivation affect the organizational innovation and organizational learning. We can say evaluate this relation that is more important than intrinsic motivation from the perception of respondents.

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Chapter 53

Relationship Between the Attitudes of Undergraduate Students Towards Complex Numbers and Misconceptions

Vildan Keçeli and Necla Turanlı

53.1 Introduction

According to Dursun and Dede (2004), factors that may affect the individual's mathematics success positively or negatively are as follows; age, level of development, interests and needs, intelligence level, health, environment, the teacher, school-starting age, quality of the teaching environment, habit of studying, teaching methods, attitude and misconceptions towards the maths course. Ubuz (1999) states that **misconception** is students comprehending the concept differently than the concept's scientifically accepted definition; **error**, on the other hand, is the mistake in the answers. Baki and Bell (1997) accept misconceptions as information that prevent teaching and learning concepts, which has been verified by science and are against the scientific truth obtained through personal experiences. Özbellek (2003) puts forward that misconceptions pose as a great obstacle to meaningful learning and that if permanent misconceptions are not overcome in time, then there will be major difficulties in reaching the goals of teaching mathematics. Baki (1996) states that one of the most important reasons of low success levels in mathematics courses is misconception. Due to these and similar reasons, determining the misconceptions and developing class materials that will reduce or eliminate them are of great importance.

According to Eryılmaz and Sürmeli (2002), three circumstances should be provided respectively in order to accept the student's thought as a misconception: The first one is the student's thought lacking correspondence with real science, the second is the student defending (in other words, claiming) this wrong thought, and the third is the student being sure of the answer and explanations.

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Ma and Kishor (1997) suggest that attitude, belief, and feelings are the most important elements in teaching mathematics. In response to this, knowledge and thinking are the important definers in the process of the human brain. All affective elements can be found through cognitive agents. For this reason, mathematics educators have identified the relation between attitude and success towards mathematics traditionally as the most significant area of interest (Ma and Kishor 1997).

Akgün (2002) states that endearing mathematics, increasing interest, and bringing success begins from the very first moment of the introduction to mathematics. Thus, developing a positive attitude towards mathematics can be enabled. In this way, it is important to know the students' attitudes towards mathematics, whose importance is increasing every other day, to facilitate success and solve the problems in this field.

“**Attitude**” is gained through learning. It directs the individual's behaviour. In addition, it is a feature that leads to biasness in the decision process. In a way, it is a state of readiness of individuals responding in this or that way or being ready for action due to certain simulators. In general, attitude is the biased reaction of the individual towards a certain object. Ülgen (1997), Özgüven (2004), and Karasar (2005) provide Alport's definition of attitude as a continuous mental and neural readiness and Ralflinton's definition of attitude as an implicit reaction.

53.2 Problem Statement

The following sub problems have been created in order to determine the misconceptions and errors in complex numbers together with the relation among the attitudes towards complex numbers of Faculty of Education, Department of Secondary School Science and Mathematics Education, Division of Mathematics Education (DSSSME-DME) students and Faculty of Science, Department of Mathematics (FS-DM) students that have taken the Complex Analysis Course.

53.3 Sub Problems

1. Do students that have taken the Complex Analysis course in DSSSME-DME and FS-DM have misconceptions related to complex numbers and do they have common errors? If so, what are they?
2. How is the attitude of the students that have taken the Complex Analysis course in DSSSME-DME and FS-DM towards complex numbers? Does the attitude of the students towards the complex numbers differ according to their departments?
3. Is there a significant relation between the misconception and errors of complex numbers and the attitude towards the complex numbers of the students that have taken the Complex Analysis course in DSSSME-DME and FS-DM? If so, how is this relation?

4. What are the difficulties the students that have taken the Complex Analysis course in DSSSME-DME and FS-DM have encountered when learning complex numbers?

53.4 Method

Research Model: This study is a general scan model and is of descriptive and relational quality.

Population and Sample: The population of the research is of Hacettepe, Balikesir, and Gazi Universities' DSSSME-DME students and Hacettepe, Balikesir, Ankara, and Zonguldak Karaelmas Universities' FS-DM students that have taken the Complex Analysis course in the education year of 2007–2008. The sample consists of 350 students who have accepted to take part in the research.

53.5 Data Collection Tools

53.5.1 *Complex Numbers Diagnostic Test*

In order to collect the necessary data for this research, related publications have been examined first. The data has been collected through sources related to scientific studies previously carried out in teaching mathematics and difficulties encountered in teaching mathematics. Turanlı and Keçeli (2006) have determined the misconceptions in complex numbers and common errors between second grade students in secondary schools. In line with expert opinions, in order to establish the answers to the questions “Do university students have similar misconceptions and errors in complex numbers?” and “What kind of difficulties do university students encounter when learning complex numbers?” a question from the Complex Numbers Diagnostic Test developed by Turanlı, Karakaş Türker and Keçeli in 2007 was taken out and three questions that are of quality to bring up the errors and misconceptions of the basic concepts of complex numbers were added. In addition, a blank page has been handed out to students so they could express the difficulties they have encountered when learning complex numbers. The validity and reliability of this method has been studied once again. The prepared “Complex Numbers Diagnostic Test” has been carried out on a trial group of 55 people and the Cronbach Alpha coefficient has been determined as 0.84. For the validity, on the other hand, experts' opinions were taken into consideration. The scale has been examined by 12 field experts, 2 language experts, and 5 scale evaluation experts and they have reached to the conclusion that the scale items are focused on determining errors and misconceptions.

Complex numbers attitude scale: Another data collection tool in this study is the “Complex Numbers Attitude Scale”, which is an adaptation from the 5-point likert type “Mathematics Attitude Scale” developed by Aşkar (1986). This “Complex Numbers Attitude Scale” consists of 20 items, 11 of which are positive and 9 are negative. This scale is also scored through a one to five point scale. Students have stated their responses by selecting one of the appropriate response points (**Very Appropriate, Appropriate, Uncertain, Inappropriate, Very Inappropriate**) for each item. For this reason, items that consist of positive attitude sentences were scored as **5-4-3-2-1** and items that consist of negative attitude sentences were scored as **1-2-3-4-5**. According to this, the highest score to be achieved in this attitude scale is 100 and the lowest is 20. In this sense, an attitude score has been obtained for each student. Prepared scales have been applied to a group of 44 people and a validity and reliability test of the scale was also carried out. The Cronbach Alpha Coefficient of this scale’s reliability has been identified as 0.93 and by carrying out a factor analysis for the validity; it has been observed that the items of the scale gather in a single dimension.

Collecting the Data: The course’s instructors at the aforementioned universities have collected the data in a single course period. Before the application, the course instructors told the students that they will be part of a research on attitude towards complex numbers and misconceptions on complex numbers and they were also explained in detail on how to answer the questions. The importance of the research and their contribution to future studies related to teaching mathematics has also been emphasized. In addition, they were informed that they would be notified about the findings of the study. In this sense, their motivation levels have been increased. During the application, in order to decrease the impact of interaction among the students, an elaborately quiet classroom was provided.

Students were asked to write pseudonyms instead of their names, as it would enable the chance to arrange face-to-face interviews on the next level. According to White and Gunstone (1992), the purpose of interviews is to determine the level of understanding concepts and misconceptions by bringing forward the related information existing in their minds. By the end of the interviews, plenty of data gathered from the individual can be analyzed and the individual’s level of comprehension can be brought forward. It is possible to reveal the individual’s spectrum of knowledge related to concepts, the degree of correctness, the level of being able to relate other information present in the mind, and revealing the sub elements that form the information (Karataş et al. 2003). Interviews were carried out with students who were thought to have misconceptions regarding this study.

Data Analysis: The prepared scales were applied to a group of 350 people, 301 of which were evaluated. In the data analysis, SPSS program was used. In line with the findings from the diagnostic test, interviews were carried out with students to determine the errors and misconceptions in detail.

Table 53.1 The attitude score and numbers of misconceptions and errors in categories

Attitude		Misconception and error	
20–46	Low	0–3	Low
47–73	Average	4–6	Average
74–100	High	7–10	High

The attitude score and numbers of misconceptions and errors have been divided into categories as shown in Table 53.1:

The chi-square test has been used to find the relation between attitude and misconception and error. In order to determine whether the sample's attitude score's mean is different than the population's neutral value, a single sample *t*-test has been applied. In the comparison between the groups (DSSSME-DME and FS-DM), the *t*-test was used for the independent groups. The significance of the statistics is at the level of 0.05 and has been tested two-way. The percentage and frequency has been made use of when examining the students' answers to the questions.

53.6 Findings and Interpretation

This section consists of the findings based on the data analysis of the study.

53.6.1 Findings and Interpretation Related to the First Sub Problem

In order to find the answer to the first sub problem, "Do students that have taken the Complex Analysis course in DSSSME-DME and FS-DM have misconceptions related to complex numbers and do they have common errors? If so, what are they?" the answers of the students of the Complex Numbers Prognosis Test have been examined.

The Cronbach Alpha reliability coefficient of the Complex Numbers Prognosis Test that consists of 17 items has been determined as 0.84.

The answers the students have given to the items of the complex numbers prognosis test have been divided to categories as follows: "empty", "correct", "answers far from the solution", and "misconception and error".

Misconceptions and common errors in complex numbers (Keçeli and Turanlı 2013) have been examined in detail. The relation with attitude is to be emphasized and the errors and misconceptions confronted in the research are shown in Table 53.2.

Table 53.2 Table of misconceptions and errors

aa	The misconception of changing the second term's notation when finding the conjugate of a complex number
ab	The misconception of changing both the real and imaginary part's notation when finding the conjugate of a complex number
ac	The misconception of using only the conjugate of the denominator's expression to change a rational expression into a real number in complex numbers
ad	Mal-rule in multiplying the conjugate
ae	Error in finding a single root
af	The misconception of the rule $\sqrt{a} \cdot \sqrt{b} = \sqrt{a \cdot b}$ that is valid in the real numbers set also being valid in the complex numbers set
ag	The inside of the root cannot be a negative
ai	The misconception of thinking i as an unknown
aj	Errors in determining the real and imaginary parts of a complex number that includes more than two terms
ak	Misconceptions in notation of the real and imaginary parts of a complex number that includes more than two concepts
al	Using the "a complex number's module making an angle on either x or y axis" definition instead of the "a complex number's module making a positive angle on the x-axis" definition belonging to a complex number's argument
an	Defining the argument as the tangent of the angle
ao	Defining the argument as the angle between the two complex numbers
ap	The misconception of considering an order relation in complex numbers as valid just as it is valid in real numbers set
ar	Errors related to the sub set and inclusion relations among number sets
as	$0 \notin N$ learning difference
at	The error of showing the degree and radian together when finding the square roots of a complex number due to the miscomprehension of the statement π radian = 180° as $\pi = 180^\circ$
ay	The misconception of generalising the "if one of the roots of a second degree equation that has a real coefficient is $a + bi$ then the other is $a - bi$ " rule to a second degree equation that does not have a real coefficient
bb	The error of using the quotient instead of the difference when carrying out an operation according to mod 4 when finding the powers of i
bc	Errors when finding the real and imaginary parts of an equation that consists of a complex number and its conjugate (not being able to solve a polynomial equality)
bd	Due to the lack of information on circle and analytic geometry, errors in determining the centre and radius, geometrical position and field
be	The error of considering the distance between two complex numbers as an absolute number in the real numbers set
bf	The misconception of all powers of number 1 being 1
bg	The misconception of regarding the $\ln 1$ number to be zero when solving
bi	The error of not having a negative number's logarithm
bj	The error of determining an angle in the polar coordinate system
bk	The error of finding three roots as 1 by solving as in real numbers

Table 53.3 Single sample *t*-test results regarding the scores of the students' attitude towards complex numbers

Neutral mean = 60						
Number of students	Arithmetic mean	Standard deviation	Standard error	Degree of freedom	t	Level of significance
301	66.22	13.738	0.792	300	7.854	0.000

53.6.2 Findings and Interpretation Related to the Second Sub Problem

Within this section, the answer to the second sub problem, "How is the attitude of the students that have taken the Complex Analysis course in DSSSME-DME and FS-DM towards complex numbers? Does the attitude of the students towards the complex number differ according to their departments?" has been investigated. With this purpose, to test the sample size, the Kaiser-Meyer-Olkin (KMO) coefficient has been calculated. In addition, to determine whether the range is normal, the Bartlett test has been carried out.

The KMO value of the Complex Numbers Attitude Scale has been calculated as 0.935 and the significance value of the Bartlett test as 0.00. According to this, the sample size has been considered as sufficient and the sample to range as normal.

The Cronbach Alpha reliability coefficient of the Complex Numbers Attitude Scale that consists of 20 items has been determined as 0.93. As a result of the factor analysis carried out for the scale's validity, it has been designated that the items gather in a single dimension.

When the highest and lowest values that can be achieved in the attitude scale are taken into consideration, the neutral value for the population's attitude mean is $\frac{100+20}{2} = 60$. In order to determine whether the sample's attitude score mean is different than the population's neutral value, a single sample *t*-test has been carried out. Data related to the single sample *t*-test are provided in Table 53.3.

As seen in Table 53.3, the arithmetic mean of the students' attitude scores is 66.22. This calculated value is higher than the neutral mean and it is statistically significant at the level of 0.05. In this case, it is possible to state that the students' attitudes are close to positive.

In order to find the answer to the question "Does the attitude of the students towards the complex number differ according to their departments?" a *t*-test has been carried out in independent groups between the scores of attitude and departments. The results of the independent groups' *t*-test results according to the departments of the students' attitudes towards complex numbers are shown in Table 53.4.

Table 53.4 The independent groups’ *t*-test results according to the departments of the students’ attitudes towards complex numbers

Department	Number of students	Arithmetic mean	Standard deviation	Standard error	Degree of freedom	t	Level of significance
SSSME	99	69.27	12.947	1.301	207.634	2.795	0.006
FS	202	64.72	13.897	0.978			

Table 53.5 Results to the chi-square test of the misconception and errors of complex numbers and the attitude towards the complex numbers

		Misconception and error				
			Low	Average	High	Total
Attitude	Low	Number	10	18	3	31
		%	32.3	58.1	9.7	100.0
	Average	Number	64	97	12	173
		%	37.0	56.1	6.9	100.0
	High	Number	39	49	9	97
		%	40.2	50.5	9.3	100.0
Total	Number	113	164	24	301	
	%	36.9	55.1	8.0	100.0	

As can be seen in Table 53.4, the mean of the 99 DSSSME-DME students’ attitude towards complex numbers’ score has been calculated as 69.27 ± 12.947 ; the mean of the 202 students’ attitude towards complex numbers’ score has been calculated as 64.72 ± 13.897 . A significant difference has been determined as the department variable with regard to the students’ attitude towards complex numbers. When the attitude score means are taken into consideration ($69.27 > 64.72$), it has been observed that this difference is in favour of the students of the faculty of education: in other words, the students of the faculty of education have a more positive attitude towards complex numbers rather than the students of the faculty of science do.

53.6.3 Findings and Interpretation Related to the Third Sub Problem

In order to find the answer to the third sub problem “Is there a meaningful relation between the misconception and errors of complex numbers and the attitude towards the complex numbers of the students that have taken the Complex Analysis course in DSSSME-DME and FS-DM? If so, how is this relation?” a Chi-square test has been carried out and the results have been provided in Table 53.5.

$$\chi^2 = 1,414 \quad Sd = 4$$

Table 53.6 The answers of the students that encounter difficulties when learning complex numbers

The difficulties of the students encounter when learning complex numbers	Frequency	Percentage (%)
Difficulties related to the teaching of the course and finding related sources	39	20.1
Subject specific concepts being abstract, their theorems being long and requiring memorisation	64	33
Generalising the rules of the real number set to the complex numbers set	26	13.4
Not liking the course and therefore not studying	13	6.7
Not having encountered any difficulty	52	26.8
Total	194	100

As can be seen in Table 53.5, there is not a significant relation between the misconceptions and errors towards complex numbers. 58.1 % of the students that have a negative attitude towards complex numbers have an average level of misconceptions and errors in complex numbers. Similarly, the 50.5 % that have a positive attitude towards complex numbers also have an average level of misconceptions and errors in complex numbers.

53.6.4 Findings and Interpretation Related to the Fourth Sub Problem

In order to find the answer to the fourth sub problem, “What are the difficulties the students that have taken the Complex Analysis course in DSSSME-DME and FS-DM have encountered when learning complex numbers?” the question “What are the difficulties you encounter when learning complex numbers?” included in the scale has been examined (Table 53.6).

To the question “What are the difficulties you come across with in complex numbers?” 107 students out of 301 have not provided an answer. From the 194 students that have provided an answer, 20.1 % have mentioned they have difficulties related to the teaching of the course and finding related sources; 33 % have mentioned the subject specific concepts being abstract, their theorems being long and requiring memorisation. 13.4 % have stated they generalise the rules of the real numbers set to the complex numbers set, they have difficulty when comparing two sets, and they have lack of information on other mathematics subjects. 6.7 %, on the other hand, have emphasised they dislike the course and for this reason they do not study. 26.8 % of the students has stated that they do not have any kind of difficulty.

53.7 Conclusion and Discussion

The following conclusions have been reached in this study that has been carried out in order to determine the relation between the misconceptions and errors in complex numbers of students that have taken the Complex Analysis course in DSSSME-DME and FF-MB:

Students lack information on the meaning and complex number concept of the number “ i ” and the students have not fully comprehended these concepts. For this reason, the students make a serious mistake “the inside of the square root cannot be negative”.

In addition, they lack information whether complex numbers can be mixed or not. Students make misconceptions and errors when finding the roots of a complex number.

Students tend to generalise a rule they have learned. For example, the $\sqrt{a} \cdot \sqrt{b} = \sqrt{a \cdot b}$ rule that is valid in real numbers is mistakenly thought to be valid in complex numbers set as well. This conclusion is parallel to the findings of Şenay (2002), Turanlı et al. (2006), and Özdemir (2006).

At the same time, regarding the statement “Negative numbers’ logarithm is undefined”, they make misconceptions and errors when calculating the logarithms of complex numbers. In addition, they make misconceptions when calculating the n . degree roots and exponents of a $z = 1$ complex number. Students lack information related to the argument concept.

In addition, students accept the π number to 180° and use it in equations as such. This conclusion is parallel to the conclusion of Demetgül’s study (2001).

The students lack information about circles, analytic geometry, and trigonometry as well and they avoid answering questions that relate to defining a concept or questions that look complicated.

The attitudes of the sample’s students towards complex numbers have been designated as positive. DSSSME-DME students’ attitudes towards complex numbers have been observed as more positive when compared to FF-MB students’ attitudes.

58.1 % of those that have a negative attitude towards complex numbers has shown average level of misconceptions and errors in complex numbers. Similarly, 50.5 % of those that have a positive attitude towards complex numbers have shown average level of misconceptions and errors in complex numbers as well. According to this conclusion, it is difficult to interpret as those that have a positive attitude towards complex numbers make less errors and misconceptions or as those that have a negative attitude make a lot of errors and misconceptions.

In this study, similar conclusions have been reached to the conclusions of Turanlı and Keçeli (2006) and Özdemir’s (2006) studies that have focused on the misconceptions of second grade students in secondary schools towards complex numbers. However, the university students’ misconceptions or errors are much lesser than secondary school students. The reason for this is thought to be DSSSME-

DME and FF-MB being preferred by students interested in mathematics, these students having the capacity to achieve the university entrance exam, and the students have dismissed their misconceptions through the course Complex Analysis they have taken.

53.8 Suggestions

Exams that focus on determining the lack of learning and misconceptions of the students should be carried out. These exams should be of questions that focus on explaining the reason and process instead of tests that depend on results. According to Askew and William (1998), when misconceptions are discovered when teaching and are emphasized to the students beforehand, learning is much more efficient. This is because telling them their misconceptions when teaching is the path to increasing success.

Attitude scales should be used, according to the obtained results, students with positive and negative attitudes should be identified and precautions should be taken at the very beginning.

Teachers and students do not like or care for all of the subjects of a course equally all together. For this reason, studies to develop scales focusing on attitudes towards mathematical subjects instead of just towards mathematics should be increased. These developed scales should be applied on teachers and students to investigate the relations between teacher attitudes and student attitudes.

This study that was carried out on complex numbers can be replicated on a different subject or on a much broader scale. In addition, taking the determined misconceptions and errors into consideration will be effective in preventing the misconceptions and errors in new teaching programs.

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Chapter 54

Turkish Version of the Career Adapt-Abilities Scale (CAAS): The Validity and Reliability Study

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54.1 Introduction

The theory of career construction conceptualizes human development as the efforts to adapt himself to his environment (Savickas 2005). The adaptation to social life for human being includes all the basics and other roles and shapes our future (Savickas et al. 2009). It is important that people adapt the possible changes in their career life in parallel with the fast developments in recent years. Individuals may have difficulties in transition of their career life and adapt to the new situations (Savickas et al. 2009; Nota et al. 2012). According to Savickas et al. (2009) individuals have to face career transitions and adapt himself to different job roles at different times during their career life. Career transitions require individuals to review their purposes, attitudes, personal features and this makes their career adaptation ability so important (Klehe et al. 2011). In order to draw attention to career adaptation process, Savickas uses the terminology “career adapt ability” (Savickas et al. 2009).

“Career adapt ability” is accepted as the construction including abilities and behaviors required for adaptation of the changes in career life (Youseffi et al. 2011). Dufy (2010) defines “career adapt ability” as the critical skills required for the process of choosing their jobs. Savickas and Porfeli (2012) takes “career adapt ability” as the physiological structure involving personal resources used for handling the challenging job experiences, carrying out the tasks successfully which needs to be succeeded now and later, and adapting career transitions.

Career adapt abilities are the self-regulation skills that individuals use in hard job conditions, job roles which occur developmentally and career transitions

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(Savickas and Porfeli 2012). Those self-regulation skills can be acquired by education and experience (Ford 1994; Sullivan Sheffrin 2003; Savickas and Porfeli 2012). Self-regulation skills are multi-dimensional not one dimensional. The theory of career construction takes these skills as a combined system.

Those career adapt abilities are concern, control, curiosity and confidence. The combination of these four components demonstrate the career adapt abilities of the people (Savickas and Porfeli 2012). Concern is related to being ready for the possible steps in the future. Control is the self-disciplination and having voice in shaping himself. Curiosity makes person think himself in a new and different job roles. Confidence can be explained as the self-sufficiency while exploring and searching (Savickas and Porfeli 2012).

When a career transition, a job-related obligation or a challenging job occurs; (a) Person feels concern about his career future, (b) Person needs control about his future, (c) Person curiosity about the possible scenario or situations, (d) Person feels confidence about being follower of his situation. The rise of career adapt abilities is the main purpose of career education and counseling (Savickas and Porfeli 2012).

The researches in 13 different countries demonstrate that career adapt ability scales measure what it purposes to measure and it can be accepted as a reliable study (Savickas and Porfeli 2012). In the studies which search career adapt abilities and different variable relations; it is found that there is no considerable connection between career adapt ability and general ability (Van Vianen et al. 2012); there is positive intermediate relationship between career adapt ability and taking work responsibility (Rossier et al. 2012); there is a high positive relationship between career adapt ability and vocational identity (Savickas and Porfeli 2012); there is a high positive relationship between career adapt ability and loyalty to job and being open to new experiences (Teixeira et al. 2012); there is a high positive relationship between career adapt ability and motivation, negative intermediate relationship between career adapt ability and concern (Pouyaud et al. 2012); unemployed people have higher subdimensions of concern, curiosity and control (Duarte et al. 2012; Djaló 2012); negative relationship between career adapt ability and perceived barriers, positive relationship between career adapt ability and wideness of interest and live satisfaction (Soresi et al. 2012).

Career adaptability was assessed using Savickas and Porfeli's (2012) Career Adapt Abilities Scale (CAAS). The 24-item five-point Likert scale (1 = not strong-5 = strongest) is composed of four subscales (concern, control, curiosity and confidence) which make up the over-arching construct of career adaptability that are confirmed by factor analysis carried on data collected from 13 countries. The results of confirmatory factor analysis indicated that the four-dimensional Career Adapt Ability model (confidence, control, curiosity, and concern) model was well fit ($\chi^2 = 4,987.1$, $df = 248$ $p = 0.00$, $RMSEA = .050$, $CFI = .93$). The internal consistency reliability coefficients were .83, .74, .79, .85 for concern, control, curiosity, and confidence scales respectively and .94 for the total scale. The aim of this research is to translate the Career adaptability Scale to Turkish and to examine its psychometric properties.

The Career Adapt Abilities Scale, as an instrument devised for assessing the psychological dimension of career adapt, which has sufficient psychometric properties, is presented to the attention of researchers and practitioners in Turkey for utilization in evaluation and research activities in various areas like management, vocational guidance and leadership.

54.2 Method

54.2.1 Participants

Participants were 320 (146 female and 174 male) teachers who were employed in different schools in Istanbul and Kocaeli, Turkey. The departments of these teachers were psychological counseling and guidance (n = 25), science education (n = 23), pre-school education (n = 67), computer and instruction technology education (n = 24), primary education (n = 125) and Turkish language education (n = 56) and the mean age of the participants was 30.3.

54.2.2 Procedure

Primarily translation of the CAA into Turkish was based on the recommendations of Savickas and Porfeli (2012). As the first step two specialists who were a native Turkish speaker fluent in English translated English version into Turkish. Discrepancies in initial translations were addressed with the assistance of a third independent translator. The Turkish version of the CAA was then translated back into English by two English-speaking language specialists who were blinded to the original scale and the objective of the study. The differences between translated versions were evaluated and a satisfactory compliance with the original scale was achieved by consensus of the translators. The completed Turkish version was evaluated for cultural appropriateness by three academicians from department of English Language and Literature, controversial items were determined and necessary modifications were done. The updated version was reevaluated by the original group of expert reviewers, to finalize the Turkish version used in this study.

After that a study of language equivalence was executed and then the validity and reliability analyses of the scale were examined. In this study confirmatory factor analysis (CFA) was executed to confirm the original scale's structure in Turkish culture. Also concurrent validity, internal consistency reliability, the item-total correlations and the differences between mean scores of upper 27 % and lower 27 % groups were examined. Data were analyzed using LISREL 8.54 and SPSS 17.0 package programs.

54.3 Results

54.3.1 Construct Validity

The results of confirmatory factor analysis indicated that the model was well fit ($\chi^2 = 504.48$, $df = 240$, $RMSEA = .059$, $NNFI = .92$, $CFI = .93$, $IFI = .93$, and $SRMR = .049$). Factor loadings and path diagram of Turkish version of CAAS are presented in Fig. 54.1.

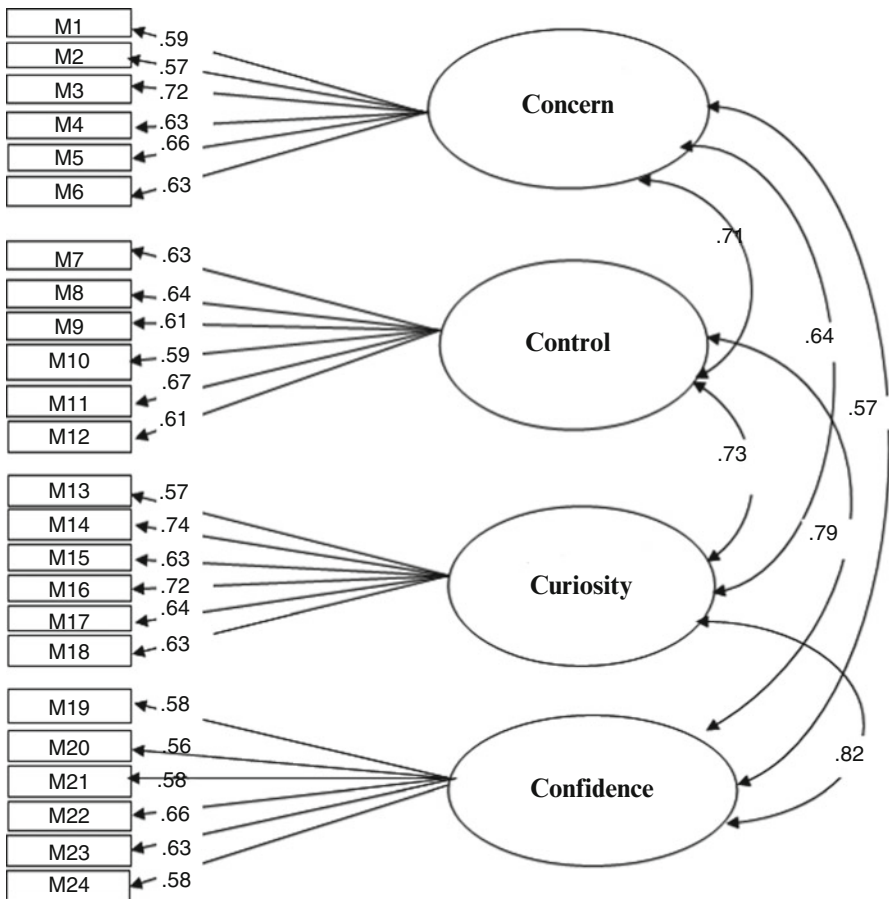


Fig. 54.1 Factor loadings and path diagram for the CAAS

Table 54.1 The CAAS item-total correlation, *t*-test results differences between each item's means of upper 27 % and lower 27 % group

Items	Corrected item-total correlation	Upper 27 % lower 27 % group t	Items	Corrected item-total correlation	Upper 27 % lower 27 % group t
1.	.57	5.78***	13.	.56	2.87*
2.	.59	4.10**	14.	.60	2.73*
3.	.64	3.65**	15.	.55	2.13*
4.	.64	2.21	16.	.42	4.40**
5.	.62	2.54	17.	.60	7.98***
6.	.61	2.12	18.	.66	3.65**
7.	.60	3.20	19.	.57	4.95**
8.	.59	4.18**	20.	.57	2.31*
9.	.58	3.19**	21.	.54	3.88**
10.	.51	-4.70***	22.	.67	3.41**
11.	.63	3.77**	23.	.60	4.74***
12.	.60	2.11*	24.	.65	3.07**

*** ($p < .001$); ** ($p < .01$); * ($p < .05$)

54.3.2 Reliability

For reliability of the Turkish version of the CAAS internal consistency coefficient was calculated. The Cronbach's Alpha internal consistency of the scale was as .82 for concern sub-scale, .84 for control sub-scale, .86 for curiosity sub-scale, .85 for confidence sub-scale, .93 for whole scale. The corrected item-total correlations of CAAS ranged from .42 to .67. The *t*-test results differences between each item's means of upper 27 % and lower 27 % points were significant ($p < .05$). The item analysis result and descriptive statistics are presented in Table 54.1.

54.4 Discussion

The purpose of this study was to adapt the CAAS into Turkish and examine its psychometric properties. Confirmatory factor analysis demonstrated that the factor structure was harmonized with the factor structure of the original scale. Thus, it can be said that the structural model of the CAAS which consists of four factors was well fit to the Turkish culture (Bentler and Bonett 1980; Hu and Bentler 1999; Schermelleh-Engel and Moosbrugger 2003). The internal consistency reliability coefficients of the scale were high (Büyüköztürk 2010; Kline 2000). Considering that item total correlations having a value of .30 and higher and significant test results differences between each item's means of upper 27 % and lower 27 % are

generally considered to be adequate in terms of distinguishing between the traits to be measured for construing item total correlation, it is possible to state that item total correlations and *t*-test result regarding the scales are adequate (Büyüköztürk 2010). Overall findings demonstrated that this scale had high validity and reliability scores and that it may be used as a valid and reliable instrument in order to measure the career adapt abilities outcome among low-income job-seeking clients. Nevertheless, further studies that will use CAAS are important for its measurement effectiveness.

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Chapter 55

Reflections of Syrian Chaos to Turkey: A Geopolitical Analysis

Nurettin Özgen

55.1 Introduction

Geopolitics is one of the most controversial terms on the topic of political geography or political science in general (Kopeček 2010, p. 99). Geopolitics is, by general terms, analysis of data and information pertaining to a certain geographical region by states or administrative bodies and structuring of spatial planning studies through political applications based upon these analyzes. Evaluation and implementation of the factors as diverse as geographical location, energy resources, water courses, minerals, water resources, tourism, industry, agriculture, and ethnologic-culture of a geographical area with the help of political approaches form the major considerations of geopolitical themes. Briefly stated, geopolitics is, as an integration of the policies comprehensively developed by states with a view towards analyzing geographical space and towards having control over that space and place.

Geopolitical knowledge is “situated knowledge”. Geopolitics uses components of human geography to examine the use and implications of power. Contesting the nature of places and their relationship to the rest of the world is a power struggle between different interests and groups. Geopolitics, as the struggle over the control of spaces and places, focuses upon power, or the ability to achieve particular goals in the face of opposition or alternatives (Flint 2006, pp. 17–28).

Limitations of energy resources to meet growing demand, against increasing population and rapidly developing industrial plants all over the world, is one of the most important problems of societies. Superpowers of the twenty-first century feel obliged to have control over energy resources in order to maintain and solidify their power in the world. Western (USA, EU) and Asian/Northern (China, Russia) states, which are in an inexorable competition for having or maintaining control

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over energy basins, are trying to strengthen their powers by implementing their knowledge and analysis of geographical space by means of political measures. Furthermore, they are competing to rule the markets of the world for their products, as well. There are several geopolitical spaces that happen to gain enough importance to attract superpowers wishing to rule the world. There is no doubt that one, and perhaps the most important, of these areas is the Middle East. This region, which hosts major energy resources of the world, is also an important trade region and market. Thus, it is of great geopolitical importance and witnessing ruthless fight among powers. In other words, the energy, natural resources, and policies regarding them are golden keys to the power on the world. Powers are in a ruthless competition and struggle in order to get control of this golden key. As a matter of fact, as stated by Westing, natural resources have played a conspicuous role in the history of armed conflicts. From competition over wild game to merchant capital and imperialist wars over precious minerals, natural resources have motivated or financed the violent activities of many different types of belligerents (Westing 1986). Armed conflicts and natural resources can be directly related in two main ways: armed conflicts motivated by the control of resources, and resources integrated into the financing of armed conflicts (Billon 2001, p. 580).

Relations between Turkey and Syria, which are the remainders of Ottoman Empire, have always gone perfunctorily since foundation of both states up until now. However, support of Turkey for the insurgents rebelling against the BAAS regime in Syria has resulted in souring the relationship between the two countries. Syrian geography, which was ruled by the Ottoman Empire for very long (1517–1920), was mandated by France following the Mondros Armistice Agreement. The political regime in Syria has since been restructured. In parallel with these developments, borderline between Turkey and Syria (911 km) was determined in 1923 by Treaty of Lausanne. These political developments and treaties contributed to different political designs and scenarios aiming to restructure the two nations, which had been living under the same roof for centuries thanks to the feeling that both nations do belong in a huge Islamic community. As result of these developments, especially of the revolutionary transition from religious community to nationalism, together with the interactions pertaining to political borders and historical structures, tensions came about between the two countries and periods of crises increased in number. While issues such as trans-boundary watercourses (Dicle/Tigris and Fırat/Euphrates Rivers), the issue of Hatay, illegal organizations, spying and smuggling activities have always come to the fore as problems between the two countries, the solution to these problems has proved to be even more difficult, inasmuch as both countries have sided with opposing sides in the world of powers.

While Turkey has chosen to seal an alliance with western world (USA, UK, France, Germany) and expected continuous support of western countries (under the roof of NATO) Syria has been protected and supported and used as strategic outpost by Russia, which has attempted to maintain its power in the Middle East and Eastern Mediterranean against the alliance of the western countries. This strategic partnership has increased the importance of Syria, which has already been the key country of Middle East. Although almost all countries in the Middle East

have pragmatic and mutual relations with the West, though at administrative level, countries such as Iran, Lebanon, and especially Syria have been closer to the North (Russia) rather than to the West, on grounds of some compelling conditions, which is what makes Syria even more important in the Middle East.

During the Cold War, Turkey was perceived by Syria either as a “Trojan horse” through which Western imperialism infiltrated into the Middle East or as a “gendarme” through which Western influence was exercised over the region (Muslih 1996). On account of Turkey’s memberships in NATO, it was seen by Syria as a shield against the Western bloc. Therefore, from the viewpoint of Syria, Turkey was serving not only its own interests but also those of the West at the expense of Arab interests (Süer 2008).

As a matter of fact, five countries that are permanent members of The United Nations (UN) drift apart in taking decisions to stop civil war in Syria, which seems to account for the significance of Syria in terms of its geographical location as well as its intricate political and geographical considerations. While the western world are in favour of some sanctions to be imposed upon the existing Syrian government to stop massacre of thousands of civilians and loss of billions of dollars, Russia and China, both of which have sided with Syria since the civilian war, found the insurgents at fault. This, in fact, does nothing but contribute to the killing of further people in favour of spatial interests. Superpowers (especially USA and Russia), which aim redesigning Syria by means of political scenarios in accordance with their economic structures and interests, have pushed Syria into a “deep space-sharing war”.

55.2 Internal Dynamics of Syria and Partners of Power

Surface area of Syria is approximately 185,180 km². The population of Syria, a vital gate opening to the Mediterranean Region, as well as Asia and Africa, is estimated to number 23 million as of 2012 (Güzel 2012). Although it may not be rich in underground resources, its geographical position and inter-continental (Asia-Europe-Africa) location are of great importance. Syria is an important strategic seaport of south-western Asia towards the Mediterranean Sea. In addition to being a significant strategic seaport that serves as a passage to the Mediterranean Sea for northern-west, Syria is also important strategic corridor that enables the western world to get involved in the Middle East and Asia through the Mediterranean Sea. When the internationally-strategic importance of Middle East and Eastern Mediterranean is taken into account, one can better appreciate the significance of Syria for this region, which harbours a considerable amount of potential petrol and natural gas as far as the future prospects of the world energy is concerned. To this end, international powers have gone to great lengths in order to have Syria by their side as an allied country before they can realise their ambition to have dominance over the space, a goal that has basis in not just strategy but also in political geography.

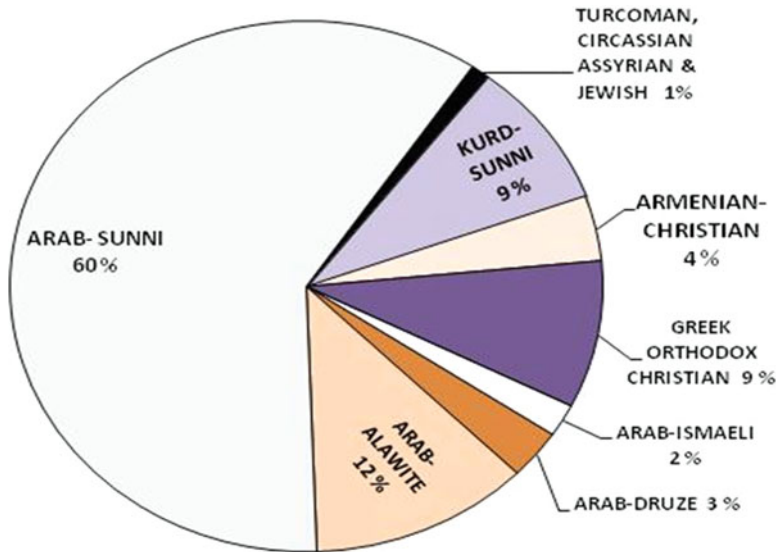


Fig. 55.1 Syrian ethno-religious groups (Statistics derive from Nikolaos van Dam, *The Struggle for Power in Syria: Politics and Society under Asad and the Ba'th Party* (New York: I.B. Tauris & Co Ltd, 2011), corroborated by the US State Department), cited: Kendal 2012

Since the end of Soviet financial and military support for Syria in the late 1980s, many observers have questioned the ability of the Syrian economy to thrive on its own and keep pace with its rapidly-rising population. Syria's economy is still dominated by an inefficient public sector, which employs 1.4 million civil servants out of a workforce of 5.3 million (CRS Report for Congress 2007). Corruption is all over the place. The national budget devotes an estimated 40–50 % of government revenue to military and intelligence spending, leaving little for infrastructure investment and education. With a bloated bureaucracy that is slow in responding to commercial opportunities, Syria receives little foreign investment and depends heavily on remittances from Syrians working abroad (Sharp 2008).

Syria is a country which hosts different religious and ethnical communities. This way, it is a multi-cultural, cosmopolite geographical area. Major ethnical-cultural groups in the country are Arab-sunni (60 %), Turcoman, Circassian, Assyrian and Jewish (1 %), Kurd-sunni (9 %), Armenian-Christian (4 %), Greek Orthodox Christian (9 %), Arab-Ismaeli (2 %), Arab-Druse (3 %), and Arab-Alawite (12 %) communities (Fig. 55.1).

Ethnical and cultural diversity in Syria has resulted in debates and even conflicts in respect of administration of the country. Consequently, problems, especially in terms of freedom, justice, and sharing are very common. The power is in the hands of a Nusayri family, while most of the Kurdish population is suffering from disidentification. Sunni groups, in particular Muslim Brothers, are under serious pressure. These are major indicators of serious discrimination of Syrian government

against religious and ethnical groups in the country. Besides, diversity of ethnical and religious groups in the country gives opportunity to the superpowers. As a result, regional or global supporters of many ethnical and religious groups in the country are in touch with Syria at different levels.

The biggest actor in the region that backs up the BAAS regime in Syria is Iran. Western countries, especially USA, make great effort to isolate Iran from international area, freeze its bank accounts in European countries, and prevent commercial relations and activities of others with this country by declaring that Iran produces or attempts to produce nuclear weapons and protects and supports illegal organizations, and that it poses a menace to security of the world. Western powers, with these efforts, aim to weaken Iran in economic terms and change the regime in the country. Against these political and economic sanctions, Iran, which has looked for political and economic partners in order to increase its political and economic power in the region, has entered into a fierce economic cooperation with Russia and Syria. This has made the Middle East a bipolar competition area. This polarization in the Middle East is, in fact, based on political-economical policies. As stated by Goodarzi (2012), alliance between Syria and Iran is based on the fact that both countries have common enemies and agenda. Both have shared their political apparatus and military resources in order to strengthen their powers, create a network of paramilitary forces, and get rid of the insurgents. They put pressure to make US peace-corps leave Lebanon in 1984 and thus were able to prevent Israel from making Lebanon a satellite country following the 18-year invasion that ended in 2000. These two allied countries have attempted to maintain their strength in the region by sponsoring Hezbollah, Hamas, Islam Jihad movement, and a series of radical groups in Palestine.

Syria's historic rivalry with neighboring Iraq created opportunities for improved Syrian relations with Iran, another natural rival of Iraq. The Syrian-Iranian alliance has always been considered a "marriage of convenience," as both countries have placed a higher value on regional strategic interests rather than shared cultural and religious affinities. In recent years, as Syria has grown more estranged from the West, Syrian-Iranian relations have improved, and some analysts have called on U.S. policymakers to "flip" Syria and woo it away from Iran. Others assert that the foundation of the Syrian-Iranian relationship – a shared concern over Iraq, support for Hezbollah in Lebanon, and countering Israel-is deeply rooted in the geopolitics of the region and cannot be easily overturned (Samii 2008, p. 11). Thus, Syria's determination to hold onto "cards" needed in the struggle with Israel, manifest in its role in Lebanon and its support of Hizbollah, soured political relations not only with the US, but also for a time with Europe and Saudi Arabia, key economic partners (Hinnebusch 2009, pp. 11–12). Besides, whenever Damascus has faced wholesale international pressure in the past, Iran has traditionally responded with high-stakes foreign policy choices that often complicated matters further rather than helped to secure and stabilize Syria's regional position (Lawson 2007).

It is clear that this religious-based (Alawite cult) and regional power-based alliance between Iran and Syria is against Sunni-based structure in Middle East. As a matter of fact, both Syria and Iran have claimed that Sunni Islam rulers in

Middle Eastern countries (Saudi Arabia, Qatar, and Bahrain) are under the influence of the West, especially USA, and argued that this situation has resulted in the underdevelopment of Middle East. They have propagated that western culture comes with dangerous games and pressures in order to destroy values, morality, and culture of Middle Eastern people.

Russia hopes to balance against the US and the West in a region where Moscow faces declining influence. Russia has few prospects of recovering financial losses in post-Gadhafi Libya and apart from arms deals with Damascus worth some \$4 billion, Moscow may have also invested billions in Syrian infrastructure, energy and tourism related ventures. Military intervention and the potential rise of political forces hostile to Moscow further downgrade Russia's role in a changing region (Nerguizian 2011, p. 21). On the other hand, Russia faces its own risks of political instability from upheaval in Syria and the region. The mainly Sunni breakaway region of Dagestan in the North Caucasus may be of particular concern as a theater for Sunni insurgency against Moscow (Hearst 2011).

There is no doubt that one of deep observers of Syrian civil war is Israel. Israel, which has always been on the brink of war with the countries in region, especially with Shiah Islam block, is now a silent observer of the Syrian civil, as it does not view either of the warring side as its partner. Israel is likely to go into a war with Iran, Syria, or and Lebanon Hezboollah any time. Furthermore, the fact that the insurgents of Syria are given support by Sunni Islamic countries, such as Saudi Arabia, Qatar, and Turkey is what does not coincide with the interests and politics of Israel in the Middle East. The most important development in the region in favour of Israel would be a war to be fought between the Islamic cults occurring in the Middle East, especially one between Sunni and Alawite cults, which would serve pretty well for the aims of Israel.

55.3 Internal Dynamics of Turkey and Its Partners in Syrian Politics

Geopolitical position and political steps in international area in the last decade are evaluated as a disconcerting development by some of countries in the region. Denominational, ethnical, political, and economic conflicts in the Middle East have gained a different dimension after hundreds of years. Riots starting from Tunisia in 2010 and called as Arab spring/awakening have spread over some other countries in the Middle East. Collapse of powers in these countries one by one have paved the way for a new political action for Middle Eastern people, who have been aspiring justice and freedom for ages. As a matter of fact, demands of Middle Eastern people for justice and their rights, especially in Egypt and Tunisia, have led to collapse of the long-lasting powers in some countries. Nonetheless, this reverse in power was happened unexpectedly quickly in Tunisia while, in other places, this has been very slow. One of these conflicts is the riots, which started in March 2011 and

have developed into a civil war in Syria ever since. Extension of resistance in this country, which has been going on in a rather unfashionable way, is closely related to the geographical position and religious-ethnic structure of this country. The most important reason for the chaos that has spread across the country over such a long time is associated with a conflict between political and economic interests of the countries intervening in the situation. Turkey, as a party that has found itself one way or another involved in the chaotic situation affecting its neighbour for several reasons, has come to fore with the help of the support that it has given to the insurgents by trying also to gain the support of the western powers for the involved issue.

Syria claims rights in sharing Firat (Euphrates) Water and power on Hatay province. According to Lausanne Agreement, independence of Hatay and its vicinity was accepted through a decision made by the United Nations in Geneva in 1937, which was out of the boundaries of Turkey. However, in 1939, this province decided to stay with Turkey as result of referendum. However, this decision has not been accepted by Syria and this country has claimed rights to rule this region. Another claim of Syria is that Turkey has not been fair as regards the water provided by the Euphrates River. Syria has never given up on these claims of hers for years as part of its conflict with Turkey, due to which both countries have put the blame on the other side for the support that ethnical and religious groups get. Turkey has argued that Kurdish problem in Turkey has been supported by Syria, and that Syria has attempted to separate Turkey. As opposed to this claim, Syria has accused Turkey of attempting to change the regime in Syria and support the insurgents together with the western alliance.

Kurdish problem in both countries has gone with no solution for a very long time, which has affected their domestic and international affairs. Turkey has declared both in its domestic policy and common negotiations with its neighbours that it will attempt to find a solution to the Kurdish problem and establish a peaceful environment in the region while creating a perception of peace-making country of region through slogan of zero-problem with neighbours. Negotiations with the countries in the region have given positive results in a short time. For example, Turkey and Syria have become two close friends and neighbours, these countries have organized a joint cabinet meeting, and have removed visa application. As result of these positive developments, trade volume between two countries has increased up to 2.5 billion dollars from hundreds millions of dollars in a very short time (Ministry of Economy 2012). During these developments between two countries, riots starting from Northern Africa and spreading over Middle East have led Turkey to the parting of the ways in terms of Middle East politics (Tan et al. 2012). Turkey had to make a choice between Syrian regime (Alawite regime), with which economic and political relations were in a positive way, and civil commotion (Sunni movement plays lead role in Syria), which demanded for change, justice, and freedom. And this choice depended on “walking-path” constructed by international powers rather than desires of Turkey. As a matter of fact, Turkey chose supporting opponents (Sunni movement) together with its western allied countries (EU) and played role as leading countries in the reconstruction of Syria.

Building a separate European Rapid Defense Force, as is planned by the Europeans, would strengthen Europe's influence within the eastern Mediterranean coastland states. Europe has both the capital and the technical know-how to develop the sophisticated armaments industry that an independent force requires. Should it gain the military capacity to match its economic power, Maritime Europe would be especially well positioned to play a partnership role with the United States within the eastern rim of the present Middle East (Cohen 2003, p. 23).

Turkey is currently observing the structure and plans of action adopted by the insurgents in Syria with great care, as well as taking part in all the relevant meetings and negotiations. The chief goal of Turkey, which has been trying to gather the insurgents under a single roof called Syrian National Council while also making effort to maintain integrity of the territory, is to help overthrow the BAAS regime, thus establishing good relationships with the fighting groups that are opposed to the regime in favour of a reliable partner in the boggy Middle East. With this in mind, Turkey has so far put its support for the peoples of Syria on view of the whole world by hosting leaders of the warring dissidents every now and then, conducting meetings in Istanbul, and providing shelter and food for over 120,000 refugees within the territory of Turkey on humanitarian grounds. In addition to these close relations and interests regarding the situation in Syria, Turkey's cooperation with other Sunni Islam countries did not escape the attention of western countries, especially that of USA. When it became apparent that radical organizations have positioned in Syria and fought in favour of the insurgents, the USA stated that the organizational structure of existing opposition in Syria should be reviewed altogether, claiming that the opponents in Syria are in control of illegal Islamic organizations (Robert Fisk 2012; Bérès 2012). In this context, the organizational structures of the opponent groups were redesigned in the meeting that was called under the leadership of USA, Qatar, and Turkey in Doha (Qatar) in November 2012.

Earlier in 2012, the Al Qaeda leader, Ayman al-Zawahiri called on its fighters to fight against the Bashar regime. The official Syrian News Agency (SANA) has shown Tunisian militants, who were captured by Syrian security forces (Syrian Arab News Agency/SANA, 2012; cited Joya 2012). There is increasingly more evidence of al-Qaeda militants making their way towards Syria (Cockburn, 2012, cited; Joya 2012, p. 33). On the other hand, Turkey is deeply concerned about the growing influence of Kurds in Iraq, fearing that it could spark off a internal war in southeastern Turkey. The United States, on the other hand, has been working closely with the Kurdish groups in northern Iraq (Tausch 2003, p. 4).

Attempts to keep the opponent groups in Syria together are thought to be the common goal of the allied countries such as the USA, the EU, Qatar, and Saudi Arabia as well as of Turkey. However, it should be borne in mind that allied countries, especially the USA, have the "Option B". Should the BAAS regime fail to prove victorious in this civil war, separation will be inevitable in Syria, and the ensuing plans will be devised accordingly. What planning here means could be best appreciated in consideration of the fate of the former Yugoslavia. Thus, the present market areas in control of Western and Asian/Northern powers alike in the Middle East will continue to exist.

55.4 Conclusion

The civil war that has been going on for 2 years in Syria, which is simultaneously a hybrid and a hetero-cultural country in the Middle East, has made the country a hard-to-solve geopolitical manoeuvre area, partly because regional and international powers have become a part of this phenomenon. The BAAS regime of Syria has been in power for over 40 years, while also having taken side with Russia from the time the cold war began. Syria, which has succeeded in striking up close relationships with Russia in defiance of the sanctions imposed by the Western world, is now an important geopolitical zone of the Middle East, together with and in unity of faith with Iran and Lebanon (Hezboollah), which has close ties with Shia and Arab-Alawite unity. The Shia and Arab-Alawite zone, which has so far united against political and economical imperialism of the West, has limited, and sometimes prevented, intervention by the West in this region by means of the support it is provided by Russia. It so appears that as long as China, the giant of Asia, continues to lend Syria its support, the chances for peace in Syria will continue to be slim.

The USA is persistent about its politics regarding the Middle East, which is why it does, and probably will not ever, be willing to leave this “strategic market and energy basin” in the hands of the other superpowers, such as Russia and China. Playing the true card in such an unstable region as the Middle East is of great importance. Economical structures established on the basis of regional alliances, rather than on military interventions, are one of the priorities of the USA, or Democratic Party tradition (Obama, former president Clinton, and their teams). The biggest partners of the USA in the region are the countries with Sunni Regime (Qatar, Saudi Arabia, Bahrain, and Yemen), Turkey, and especially Israel. The USA, as result of commercial and military agreements with these countries, has maintained its mutual interests at the level of governments. When the USA has maintained these relations by importing energy and exporting weapons, autocratic and totalitarian regimes in these countries have been its good partners. The gap of justice and freedom in these countries has resulted in the actions of revenge against both the ruling classes of these countries and superpowers supporting these rulers. The USA supports Arab awakening/spring in order to remove reasons of such actions and movements, which continue as various violence and terrorist actions. As a matter of fact, time to renew mutual interest relations with former powers; in other words, time to renew partners in the region had come and this change was named as Arab Awakening.

Leading countries of EU (UK, France, and Germany) are also part of Syrian Civil War with the reasons similar with those of the USA. Considered that political map of Middle East has been drawn by UK and France (Encyclopedia Britannica 2012) and Syria was once mandated by France, importance of these countries in reconstruction of the Middle East can readily be understood. With this treaty, borders of the many Arab countries were determined completely on political and economical basis. Arabs have come to realise how the Middle East might be shaped

via the Sykes-Picot Treaty much later than they should have by now (Helmreich 1974, p. 8; Sander 2009, p. 382).

What summarizes the policy adopted by France in Syria is that fact that France claims that it is necessary that the Free Syrian Army, which they think is the legitimate representative of the insurgency in Syria, should be given military training support and its operational capacity should be increased (<http://www.bbc.co.uk>, 2012). The UK has also adopted similar approaches. All of these have made the situation even more difficult for the BAAS regime and the civil war in Syria has spread over a long process. Declaration that European countries, together with USA, recognize the opposition reorganized in Doha as legitimate representative of Syria, has cleared the road map of the West. Aleksandr Lukasevich, speaker of the Ministry of Foreign Affairs of Russia, defined external military support for Syrian opposition as “breach of international law” in his speech to Russian News Agency Interfax, immediately after Laurent Fabius, former Minister of Foreign Affairs of France, stated that the opposition in Syria should be supplied with weapons and that he will discuss this matter with the other European countries. However, it is surprising that Russia has declared that its weapon sales to Russia has been realized as one billion dollars as of 2011 as continuance of agreements remaining from Soviet period, in expressions of Lavrov, Minister of Foreign Affairs of Russia (Vatan 2012). This statement is an indication of how unlawful the war has been going on ever since it broke out.

Energy and trade volumes of two superpowers in this region are not the sole reason for which the war has not been able to be ceased for 2 years. The geopolitical position of Syria in the region is another important reason. Because ending the civil war in Syria will necessarily mean that one of the superpowers has lost the game to the other, the possibility of an end to this war in the near future does not look very likely.

Of course, those suffering from this chaotic situation in Syria most are the Syrian people. Unless one of the two sides backs down, the cost of the war will reach even higher levels. According to the existing conjuncture, possible results and regional impacts of Syrian Civil War can be listed as follows:

- Even though some countries have either directly or indirectly intervened in the Syrian Civil War in an attempt to achieve territorial integrity of the country, the war does not look destined to end anytime soon, as the power balance between parties seems equal and the intermediating role of the UN will not suffice.
- It is possible that Syria will divide into three parts. The first part will possibly be Nusayri region, which covers western part of Syria and where Shia population will be dense. The second part will cover inner and southern regions of Syria, where Sunni groups are dominant. The third and last part will be the Kurdish region in northern Syria.

It is clear that the possible results of this civil war will have effects on Turkey too. However, how effective the impacts will be is closely dependent upon Turkey’s political applications. Turkey cannot only ensure its economical growth but also become a powerful actor that can help balance evenness of the power in the Middle East by establishing close relations with the existing Kurdish region as part of

possible future of Syria. Besides, cooperation of Turkey with other regional (Saudi Arabia, etc.) and international powers (USA, EU) in the Middle East will empower peaceful and positive scenarios for the region. Otherwise, Israel will gain power and threat peace and welfare of region.

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Chapter 56

Leaders, Followers and Their Personalities

Burcu Erentuğ and Mehmet Ali Hamedoğlu

56.1 Introduction

Whenever one sets his/her needs and targets which cannot be accomplished by himself/herself, he/she will try to form a group with others who can work in harmony. In order to form goal-oriented groups and to set them in action leaders are required (Akçakaya 2010, p. 12). Leadership which has been encountered throughout the history will be needed in the future as well (Eren 2000, p. 411).

Leadership is a psychological requirement for mankind. Human beings who are accustomed to be led by someone in every phase of their lives such as by their parents at home, by their teachers at school and by their bosses at work, adopt this behavior in personality dimension after some time. And it is really challenging to change this (Akçakaya 2010, p. 57).

Although the term “personality” is generally used to emphasize individual differences, behaviorists and psychologists cannot agree on a definite and a single definition. A lot of characteristics are included in the concept of personality. Scientists who are interested in this topic define the concept by considering some of the characteristics (Güney 2009, p. 185).

Personality is the type of distinguishing, consistent and structured connection between the internal and external environments of the individual. The distinguishing feature of the individual is the one which completely differs him/her from the others. Consistency of the personality means that the behaviors of individual do not change under the same circumstances. The structured side of the personality expresses the fact that personality is a system which consists many interrelated units each of which make up the whole system. The connection refers to the relationship of the individual not only with his/her own inner world but also with other people,

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events and things. The personality of the individual shapes generally as a result of the connection of the individual with his/her internal and external environment (Cüceloğlu 1991, pp. 404–405).

The complex structure of the humans including feelings, thoughts, religion and so on can be considered as the result of various personality theories. Freud stated that there are almost infinite personality types which can be categorized under three groups; erotic, obsessive and narcissist types. Fromm added marketing personality as the fourth one. Actually most of us carry the elements of each of them. The main point is one of these dynamic inclinations (dinamik eğilim) predominates and causes to react differently. Erotic personalities are usually inefficient leaders as they need to be approved excessively. Obsessive personalities are better at management; they can be good company managers due to their critical and cautious behaviors. However, narcissist personalities are the closest type to the effective and well-known leader image since they can introduce an interesting and even a fascinating vision to the organization and make them follow the leader. For organizations which need members who dare to drag them to new directions narcissists are the best option. Narcissist leader can make his/her followers identify with their goals, persuade them to think like him/her and that is he/she can become a very important example for the followers (Hamedoğlu 2009).

Leaders are aware of the fact that they are following a very long and complicated path. They are potentially confronting a group of people who are either unhappy or pretend to be happy. They are supported only by a few people or sometimes they are alone. They have to be insistent and determined to struggle with the others. They are afraid of the flexibility that can occur in the belief and character. Therefore the first element to be strengthened will be their own egos. As a result, in time the seeds of the narcissism will grow and become a plane tree. Sun, soil and water which are necessary for a seed to grow represent the initiative, marginality and resistance of the leader who has a strong personality and ego. Of course, the above mentioned plane tree will go through some changes in the course of time (Soner n.d).

56.1.1 Narcissist Personality and Leadership

Narcissist personality displays a fake modesty despite their arrogance and feeling of superiority: Actually what he/she really cares is being “number one” in a group and being perceived like this by others and live that way. With proper conditions this person has a tendency to go into politics and be a successful leader (Volkan 2009, pp. 289–290).

Searching success and praise in the inner world of some of the remarkable, good-looking, strong and leading narcissists sometimes help them be a leader in educational, business and social organizations (Volkan 2009, p. 289).

Leaders such as Napoleon, Gandhi and Roosevelt – when military, religious and political aspects dominate the society – Edison and Ford – in the beginning

of the twenty-first century when American Industry gained a new phase – one of the greatest leaders of the World War II Winston Churchill, Pharaohs of the Egypt, Caesar of the Rome, Hitler, Stalin, Trujillo are good examples for narcissist leaders (Maccoby 2002, p. 37).

56.1.2 Obsessive Personality and Leadership

This leader is perfectionist, pay great attention to the details, procedures, regulations and ordering. He/she is stubborn and insistent on the fact that every detail is done according to the rules and expectations. These leaders had difficulties in expressing their personal feelings: they are mostly formalist, cold and constrained. The leader has difficulties in making decisions because they are afraid of making a mistake. They hesitate a lot so they think every detail. They are very fair and precise. For instance, Sherlock Holmes can be a good example for obsessive personality with his love for details, his interest in classifications, his distance and his identical clothes. B. Spock from the Star Trek who is very distant and intelligent can be considered as the caricaturized version of the obsessive personality. He cannot understand the irrational reactions of his friends from the Earth (Andre 2005, p. 104). Obsessive personalities can be successful in management, marketing and finance sectors and besides they can be good teachers (Maccoby 2002).

56.1.3 Erotic Personality and Leadership

Eroticism includes integrity, love, security and wisdom. The strongest feelings, the deepest thoughts and the best senses can be seen in eroticism. Erotic leader can gather all these not only in his own heart and soul but also in his followers' thoughts and in the structure of the organizations.

Erotic leader has a special charm including glance, speech, touch, sensation and influence which can be noticed from his behaviors to his clothing. A body without any ambition, logic, feeling, love, desire, passion, wisdom and soul is nothing but plastic. In this respect erotic leadership adopts and applies the art of love.

There is a legal and bureaucratic etki zinciri in leadership. However, erotic leadership there is a sensitive and personal etki zinciri. While in the relations of the classical leader types public relations is important, image management, perception management and even reputation management are in the center of erotic leadership. Leadership prioritizes team spirit and organization spirit but erotic leadership prioritizes love and affection (Nart 2009).

For Americans whose main concern used to be entertainment till September 11 incident an impish leader like Bill Clinton can be favored. This man can even show off when he was quitting presidency and by preparing a little show displaying his retirement he even mocked himself. Self-mocking is an intelligent and erotic

movement which does not let others to make fun of the individual and which displays that the person does not have a fear of losing his/her authority by degrading the importance of the power gradually (Köse t.y.).

The reason why the pose of Bill Clinton shot during the interview with Bülent Ecevit in White House on 28 September 2002 affected us deeply is the fact that eroticism is seen as “owner relationship”. It is important that kowtowing, losing the charm and misuse of the body language are always recognized by the voters (Nart 2009). Putin set his image on the minimum identity (asgari kimlik) which promises trust against the threats of the age (Köse t.y.).

On 11 December 2002 George Bush refused to pose with Recep Tayyip Erdogan who is taller than him and the shaking pose was taken while both were sitting in his office where only one press member was allowed. The banners emphasizing the physical characteristics of the prime minister (such as “we are fond of your walking style”) is a reflection of the personal charm to the publicity. Even being taller than the other presidents can be taken as an advantage by the community. This is a very remarkable improvement for Anatolian People who used to be repressed for a long time (Arikan 2003).

56.1.4 Marketing Personality and Leadership

Tendency to marketing is a natural result of the understanding of contemporary society and individuals and changing economic structures. The humanity of the individual loses its significance, what is important is the amount he/she sells and/or buys and his position in the market. Therefore, the deepness of the relationships of the individual gets lost. Feelings and love and integrity are replaced by dissatisfaction, meaninglessness and insecurity (Fromm 2008).

Marketing tendency blocks the deep connection of the individual with him/her or with others. Loving only one person cannot be substituted with loving humanity. Playing one’s role in the contemporary market pushes the individual to a gradual dissatisfaction and meaningfulness along with desperation and nullity (Geçtan t.y.).

The basic principle of character marketing is **“I am just as the way you want to own me”** (Baltacı 2008).

People with marketing personality can be successful in politics, in creating marketing strategies and brand awareness, in determining product – target mass parameters, in business and social affairs and in conducting public relations works of the corporations and organizations.

Professions requiring short but instant communication such as research and development engineering, product development management and specialty, market and business development management, sales and marketing management, after sales during the services management, hotel management, business management, training and development management and school administration are very suitable for this personality type.

The most distinct leadership example for this personality type can be Nicolas Sarkozy who used to have a friendly relationship with Turkey and take photos with political leaders frequently and give messages about friendship changed his mind during election time and declared clearly that he was against the membership of Turkey to United Union to receive votes (wikipedia.org.03.09.2012; Akşit et al. 2009: 4).

There are sources declaring the fact that a specific personality type especially the narcissist personality has more advantages for being a leader compared to the other personality types (Maccoby 2004). However, leaders from almost every personality type have been encountered at different times in several societies.

Thus the personal characteristics of the leader affecting the choices of the followers (voters) are generally wondered. For instance, does the sex of the leader influence the preferences of the followers? Or do the educational levels of the leaders affect the choices of the followers? Do narcissist personalities prefer narcissist leader candidates or others? And so forth.

In this paper thoughts of the university students from Department of Public Administration, Department of Turkish Language and Literature, Department of Physical Training and Sports, Department of Pre-School Education and State Conservatory of Sakarya University in 2012–2013 academic year. The relationship between the personality types of the leader and the followers and the connection between these personality types and some variables such as sex, profession and the personality of the leader have been examined in this study.

56.1.5 Problem Sentence

Is there a connection between the personality types in terms of the leader and the followers? (Sakarya University example)

56.1.6 Sub Problems

1. What are the personality types of the leader and the followers?
2. Is there a connection between the sex and the leader choice?

56.2 Method

56.2.1 Research Model

Relational screening model was used for the research.

56.2.2 *Universe and Sample*

While the universe of the research consists of the students of Sakarya University in 2011–2012 academic year, sample includes 203 university students from Department of Public Administration, Department of Turkish Language and Literature, Department of Physical Training and Sports, Department of Pre-School Education and State Conservatory. As students determine their majors as a result of their personal characteristics, departments of public administration and physical training and sports were chosen for the competitive characteristics of the students, literature and conservatory departments were chosen for the artistic features of the students and department of pre-school education was picked for the sentimental sides of the students.

56.2.3 *Collecting Data*

In order to establish the personality types of the students, personality scale of Maccoby which has 80 items were used (Maccoby 2007) to find out their leader choices the direct question of “for you who is the leader of your class?” was addressed and they were asked to make three choices at most.

56.2.4 *Analyzing the Data*

SPSS 15.0 package program and UCINET network analyzer were adopted to statistically analyze the data gathered for the study. The data were tabulated, interpreted and discussed.

56.3 Findings

56.3.1 *Personality Types and Leader Choices Based on the Departments*

As it is seen in Fig. 56.1 the leader choice of the Department of Turkish Language and Literature is for the Narcissist Personality (52.38 %) each personality type voted for the Narcissist Personality. Besides, it is observed that erotic personalities generally vote for each other as they are close friends in everyday life and as a part of their personality in order not to offend their friends they vote for each other. This implies that sentimentality, compassion and friendship sides of the erotic personalities are quite strong.

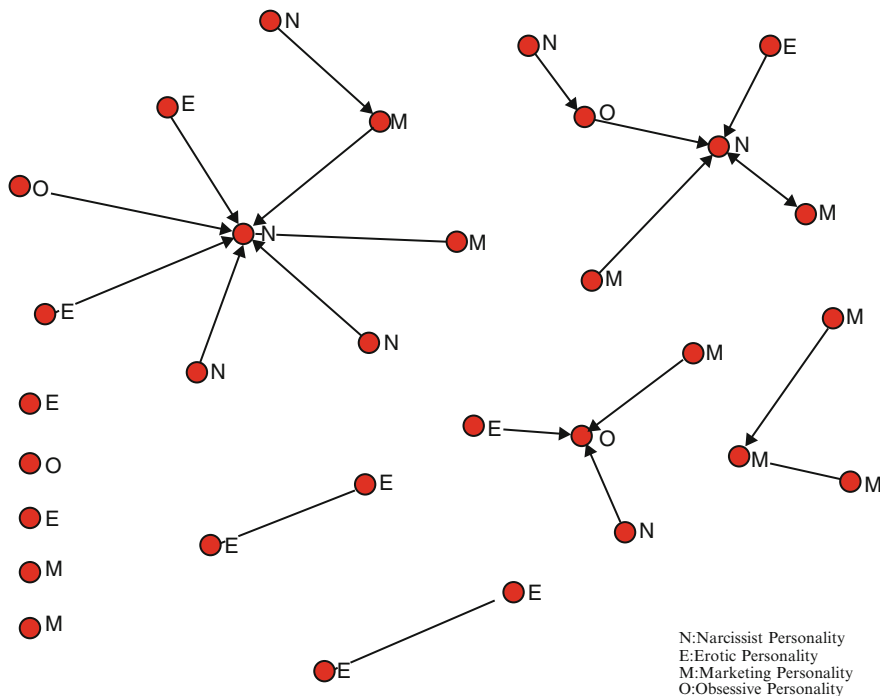


Fig. 56.1 Department of Turkish Language and Literature

Figure 56.2 depicts that in the department of public administration narcissist and erotic personalities are distinguished from the others. With 29.41 % vote percentage Narcissist Personality is the top type which was followed by Erotic Personality type with 26.47 % percentage.

Since the students are mostly away from their families and hometowns their love, affection and nurturing attitudes might affect their choices on erotic personality.

Besides, Obsessive Personality is the most preferred and Narcissist Personality is the least preferred options in the department of public administration. In the same department compared to the other personalities Obsessive Personalities are less successful in social and friend relations but Narcissist Personalities are more successful.

As it can be understood from Fig. 56.3, in State Conservatory Narcissist Personality (50.00 %) is the most preferred leader type and Erotic Personality (41.67 %) is the second most preferred leader type. In this illustration it is clearly seen that Erotic Personalities voted for the Erotic Personalities but didn't vote for Narcissist Personalities at all although Narcissist Personalities received vote from all personality types.

Moreover, self-confidence of the Narcissist Personalities gives clues about their priorities about their appearance and communication. Their experience on stage also affects their popularity on leadership.

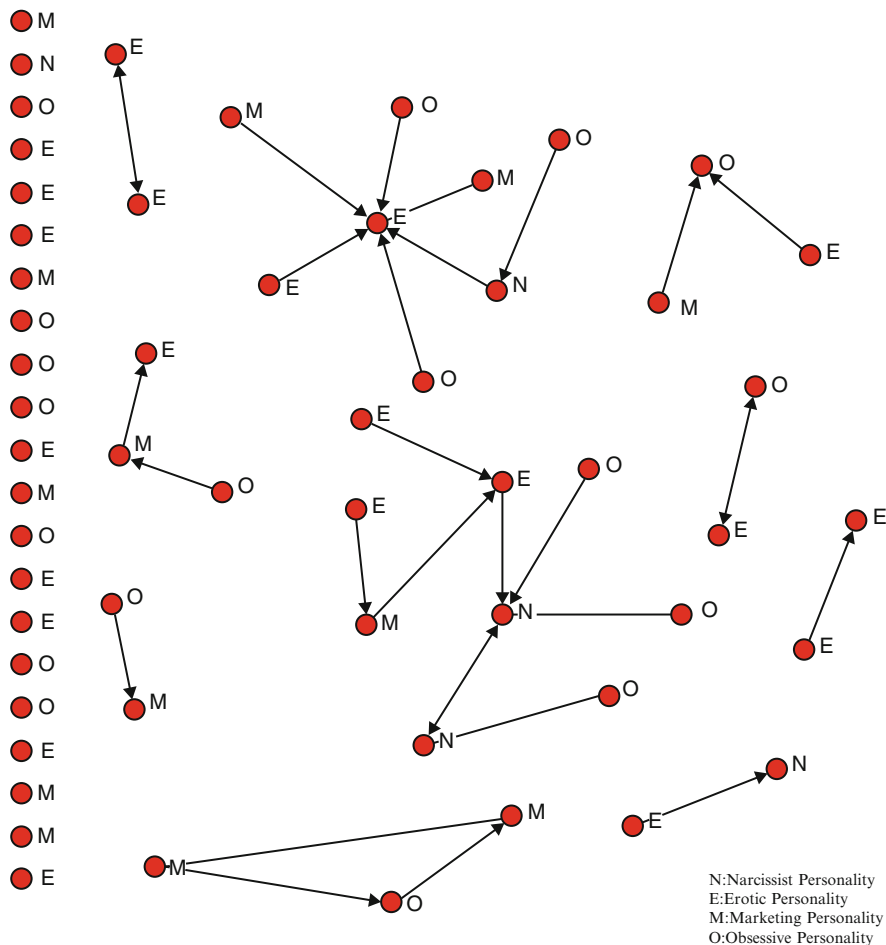


Fig. 56.2 Department of Public Administration

As it is understood from Fig. 56.4 Narcissist Personality is the most preferred leader type in the department of physical training and sports. In this department each personality type voted for the same type. In this department, there are personalities who did not receive any votes. Among the non-voted participants, Erotic personalities were the most. On the other hand, the Narcissistic Personalities were voted in highest frequency.

Figure 56.5 illustrates that in department of pre-school education there is a leader from each personality type. While Marketing Personality types voted for Marketing Personality types, Narcissist and Erotic Personality types were preferred by every

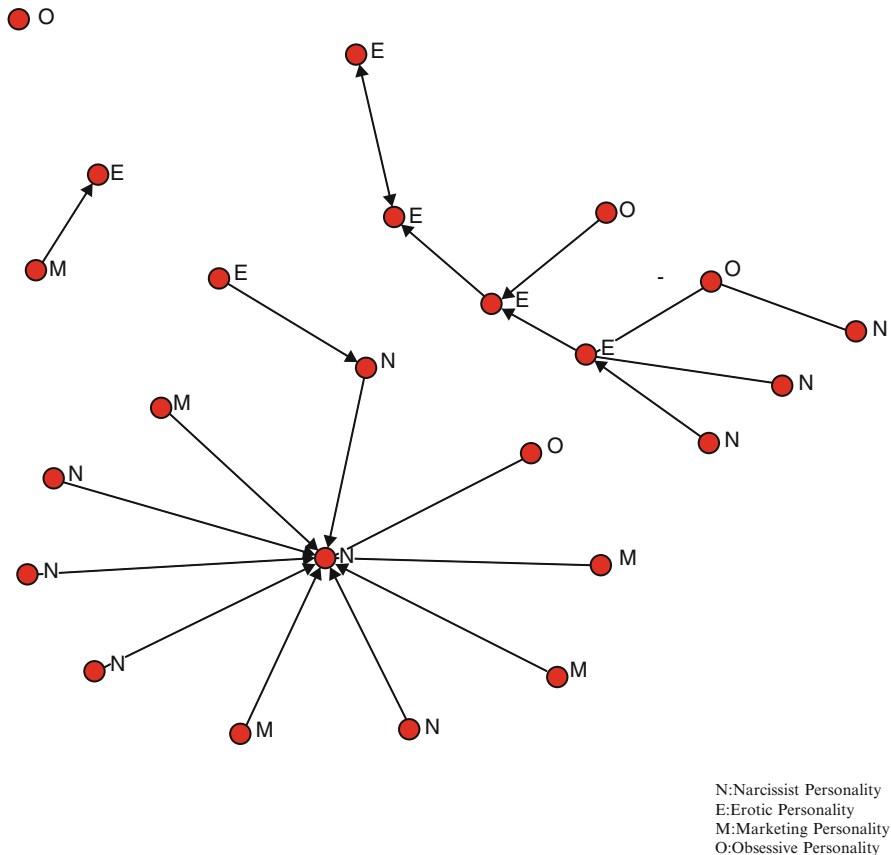


Fig. 56.3 State Conservatory

personality type. It can be concluded that Obsessive Personalities were preferred due to their attention on child care and rearing and being clean, neat, precise and perfectionist; Erotic Personalities were chosen as a result of being full of love and compassion; and Narcissist Personalities received votes for their self-confidence. Erotic Personalities are the only group who received votes from every group.

Variance analysis results of the Table 56.1 shows that distribution of the votes displays a significant difference according to the personality types ($F = 2.699$, $p < .05$) in order to establish which personality type displays difference LSD test was done and the results are given below.

The results of the LSD test (Table 56.2) states that Narcissist Personalities received more votes than the others.

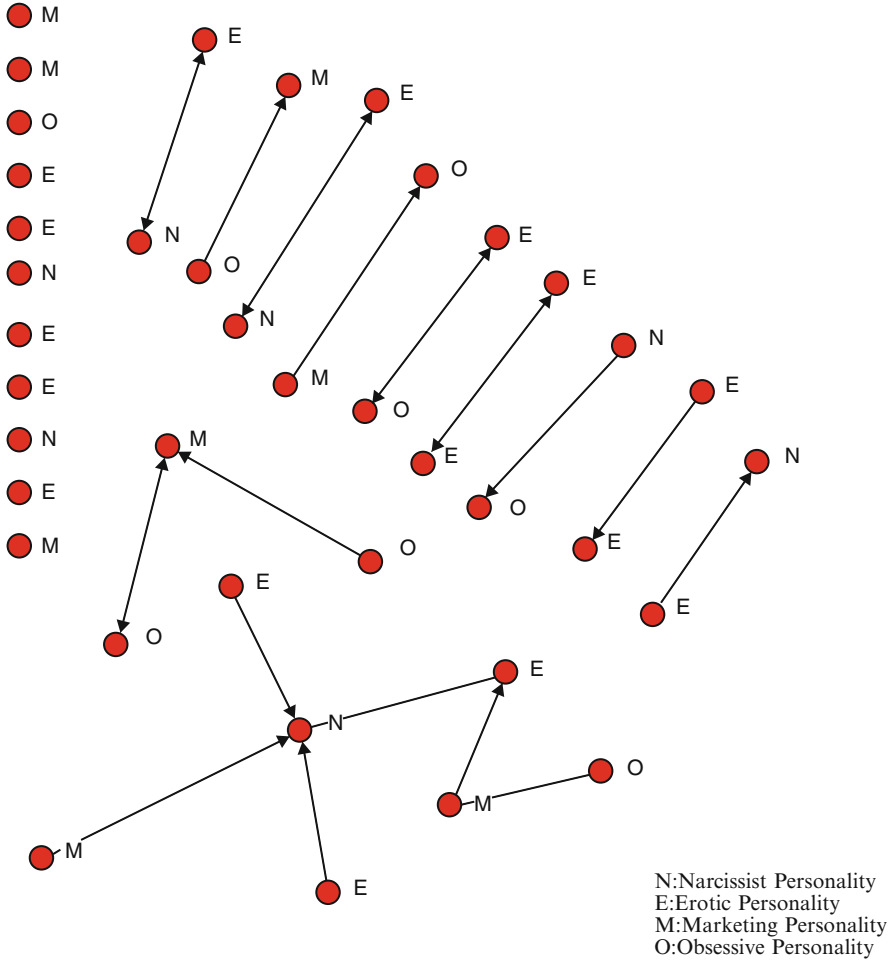


Fig. 56.4 Department of Physical Training and Sports

56.4 Results and Discussion

This study has revealed that university students prefer Narcissist Personality at most and then Erotic Personalities as leaders. This finding is in accordance with the thesis of (Maccoby 2003) stating that narcissist personalities are generally accepted as leaders. Moreover, Volkan (2009) also has similar findings. Thus, it can be mentioned that university students prefer leaders who can express themselves very clearly and who are self-confident and nurturing. They also tend to choose least

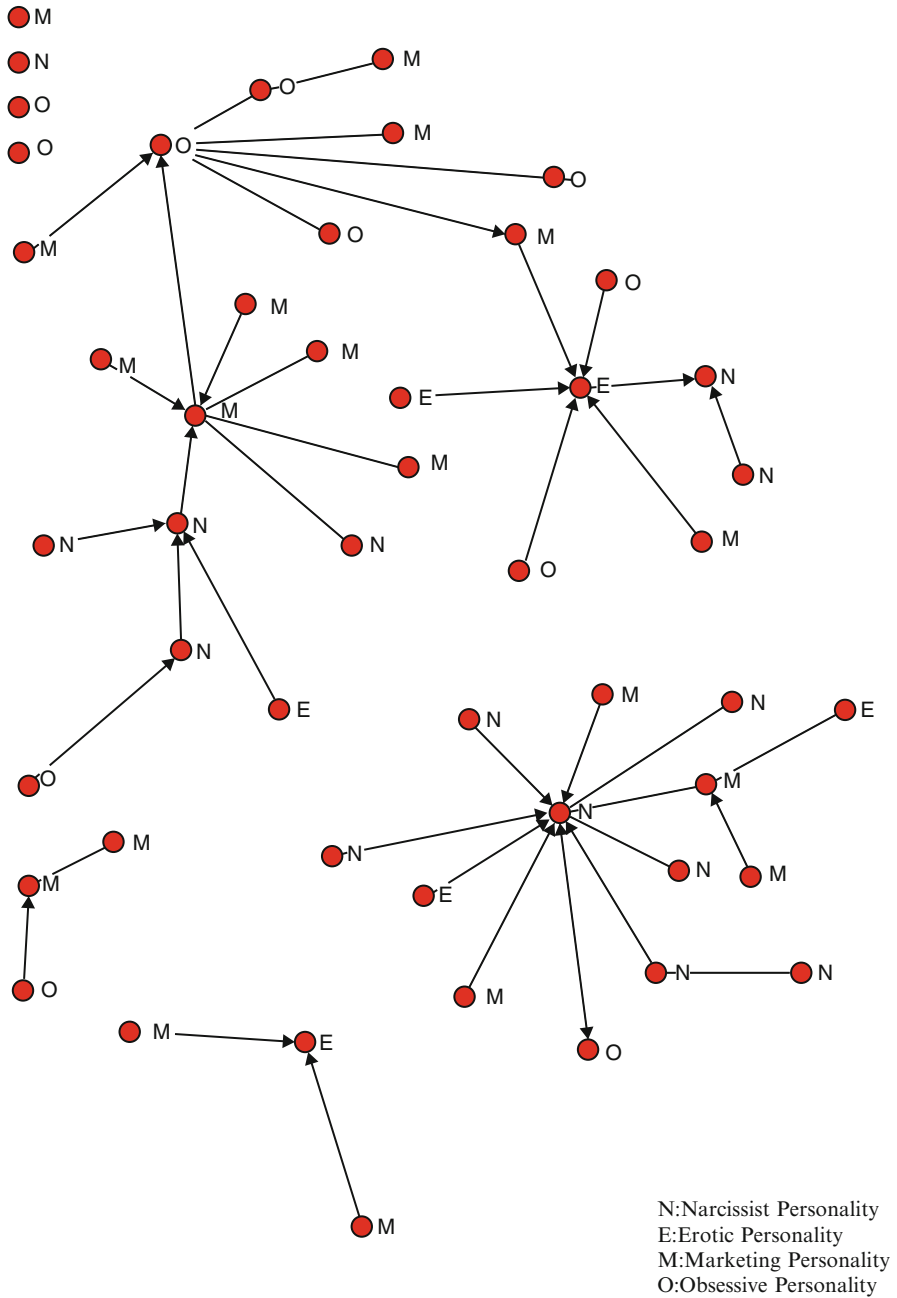


Fig. 56.5 Department of Pre-School Education

Table 56.1 Personality types and differences among the votes

Received votes	Sum of squares	df	Mean of squares	F	p
Among Groups	18.74	3	6.249	2.699	.04*
In-Group	456.15	197	2.316		
Total	474.90	200			

* $p < .05$

Table 56.2 LSD test

Dominant personality		Mean difference	s.h.	P
Narcissist	Marketing	.75	.31	.01*
Narcissist	Erotic	.68	.30	.02*
Narcissist	Obsessive	.80	.32	.01*
Erotic	Marketing	.07	.28	.79
Obsessive	Marketing	-.05	.30	.86
Obsessive	Erotic	-.12	.30	.68

* $p < .05$

obsessive types as their leaders. No connection between the personality type and preferred leader was observed. Each personality type preferred each personality type. Obsessive Personality type is the least preferred leader type for the university students.

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Chapter 57

Determination of Leadership Behaviors of Mayors Who Have Been Elected with Local Election According to the Opinions of Employees

Fuat Uzun

57.1 Introduction

In competition conditions that are increasing due to globalization, application of leadership and suitable leadership styles is an important factor in the performance of organizations. Behavioral features of leadership are important not only for upper managers but also for middle or lower levels in private and public businesses. In this regard, as well as financial and physical conditions, leadership skills of the managers are also important for the success of organizations (Dubrin 2005). Especially for our day, when there are rapid changes and uncertainties, one of the factors affecting the competitive capacity of organizations against changing and developing economical and social conditions is the skill, style and power of leadership of the people who are both the manager and leader of organization.

In the studies carried out, leadership styles of the leader and specific behavioral patterns attributed to these styles have been researched and it has been proved that leaders motivate their employee within these behavior patterns. In characteristics approach, there are studies (researches) about the effects of seven characteristics of the leaders - instinct, desire of managing, honesty, self-confidence, intelligence, occupational knowledge, being energetic and social – and personal features on the performance of the organization (Yörük and Dündar 2011).

When we focus on leader-follower relationship rather than personal features, behaviors and habits of leaders, we can explain leaders and leadership. Warren Blank expressed ‘9 laws of leadership’ like that (Blank 1995);

1. A leader has voluntary followers and allies.
2. Leadership is an area of mutual interaction.

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Table 57.1 Distinctive features of leaders and managers

Managers are/managers	Leaders are/leaders
Executive	Innovative
Repeater	Original
Sustain	Developer
Focus on the systems and structure	Focus on people
Rely on supervision	Honest and rely on honesty
Have short-term ideas	Have a long-term perspective
Ask questions with 'how and when'	'Why' is important for them
Always look at the floor	Always look at a horizontal plane
Act as a soldier	Act as themselves
Their ideas are true	Have true notions
Accept the current situation	Defy current situation

3. Leadership comes about as an event.
4. Leaders use 'impression' beyond official authority.
5. Leaders act different from procedures that are defined organizationally.
6. Leadership includes risk and incompetence.
7. Not everyone follows a leader.
8. Conscious and capacity of processing information creates leadership.
9. Leadership is a process of self-counseling. Leaders and their followers evaluate information within the frame of their own subjective references.

We can determine whether mayors are leaders or managers considering features of leaders and managers at first. In the table given below, there are distinctive features of leaders and managers and under the light of these features, we will determine which behavioral or personal features the leaders and managers have (Keçicoğlu 2003) (Table 57.1).

Local Governments or Administrations in our country include Municipalities, Special Provincial Administrations, Metropolitan Municipalities and villages. In this study, the expression 'local government' is used as title and primary subjects of the study are Municipalities that are within the boundaries of Ankara Metropolitan Municipalities (that especially have an efficient management) and leadership features of Metropolitan and Town Mayors in terms of employees have been analyzed.

57.2 Research Method

In this research, survey technique which is one the quantitative research methods has been used. Scanning method has been used as the research model.

Aim of the Research is to determine the performing level of leadership and governorship features of the mayors of the local governments who is acceded with the elections according to the views of the personnel.

Table 57.2 Gender and duty distribution of the personnel who constitute the sample

	Gender		Duty distribution			
	Women	Men	Senior managers	Department head	Managers	Personnel at the manager level
N	18	132	30	4	49	67
%	12	88	20	2.7	32.6	44.7

Table 57.3 Vocational seniority of the personnel who constitute the sample

Seniority	N	%
1–4 year	3	2
5–9 year	11	7.3
10–14 year	19	12.7
15–19 year	35	23.3
20–24 year	57	38
25 year and above	25	16.7
In total	150	100

Population of the Research, 150 personnel who work in the metropolitan municipality, 8 district municipalities, as department head, unit manager and at the manager level (inspector, internal auditor) constitute the research population.

Sample, Names of the municipalities, where the municipality personnel who took part in the research work, have been shown below.

1. Ankara Metropolitan Municipality
2. Altındağ Municipality
3. Çankaya Municipality
4. Etimesgut Municipality
5. Gölbaşı Municipality
6. Keçiören Municipality
7. Mamak Municipality
8. Sincan Municipality
9. Yenimahalle Municipality (Tables 57.2 and 57.3)

Collection and the analysis of the data, The field which is related to the subject has been scanned while the data collection organ is developed, survey forms have been analyzed and question clause pool has been formed. Survey form which has been prepared in relation with the research subject consists of 2 parts and includes 43 questions. In the first part of the survey form, question related with the demographic features have taken part and in the second part, questions which have been asked to determine the styles of social leadership, ethic leadership and political leadership have taken part.

Our survey has been applied by using simple coincidence sample and choosing 150 samples.

In the analysis of the data, SPSS 20 package program has been used. Differences between the groups have been detected with 3 different anova analyses. First of these analyses has been practiced with the aim of evaluating the features of male

and female mayors' leadership features, the second one has been practiced with the aim of evaluating the leadership features of mayors of different seniority groups and the third one has been practiced with the aim of comparing the evaluations of the persons at different duty types. In the analyses in which there are groups more than 2, comparisons have been made by considering the averages with Post-hoc Bonferroni method.

In the senses of unit managers or the personnel who work at the manager level or mayors, any meaningful difference has been found according to the seniority variances of the personnel who are at the manager level and who took part in the survey.

57.3 Findings

When we look at the gender distribution of the people who took part in the research, it can be seen that men are numerically much more than women. Findings show that number of the men is 132 and their percentage in the distribution is 88 %, number of the women is 12 and their percentage in the distribution is 12 %.

Any difference couldn't be found in the evaluation of leadership features of women and men mayors ($F(1,149) = 0.41, p = .84$).

A meaningful difference in the evaluation of leadership features of mayors in the seniority groups couldn't be found ($F(5,149) = 210.95, p < .01$).

When the groups have been compared among themselves with the bonferroni analysis, the persons who have 1–4 year seniority aren't different meaningfully from the ones who have 5–9 and 10–14 year seniority. But they evaluated the leadership features of mayors higher according to the ones who have 15–19, 20–25 and above 25.

In the evaluation of leadership features of the mayors, the persons who had 5–9 year seniority didn't show statistical difference with the ones who had 1–4 and 10–14 year seniority. But they evaluated the leadership features of mayors meaningfully higher according to the ones who have 15–19, 20–25 and above 25 year seniority.

While the ones who have 10–14 year seniority does not differentiate meaningfully from the ones who have 1–4 and 5–9 year seniority, they meaningfully gave more point to the leadership feature of their leader in comparison with the ones who have 15–19, 20–25 and 25-above year seniority.

People who have 15–19 year seniority gave meaningfully less point to the leadership feature of their leader in comparison with the ones who have 1–4, 5–9 and 10–14 year seniority. However they gave more point in comparison with the ones who have 20–25 and 25-above year seniority.

The ones who have 20–25 year seniority gave meaningfully less point to the leadership feature of their leader in comparison with the ones who have less seniority and they gave more point in comparison with the ones who have more seniority.

Finally, the ones who have 25-above year seniority gave meaningfully less point to the leadership feature of their leader in comparison with all level who have less seniority.

To sum up, there is no concrete difference between the ones who have 1–4, 5–9 and 10–14 year seniority but as long as the seniority increases, the points which are given to the leadership feature of the leader decrease.

$$1 - 4 = 5 - 9 = 10 - 14 > 15 - 19 > 20 - 25 > 25 \text{ year and above}$$

When looked at the difference between leadership point score of the mayor according to their mission type we can see meaningful difference between them ($F(3,149) = 76.81, p < .001$). When looked at the difference among groups through Bonferroni analysis, there is not a meaningful difference between senior managers and department heads about giving point to the leadership feature of mayors. Nevertheless, senior managers and department heads meaningfully gave more points to the mayors about leadership in comparison with branch managers and employee at the level of management. Branch managers, mentioned before, meaningfully gave less point in comparison with senior managers and department heads but meaningfully gave more points in comparison with employees at the level of management. Finally, employees at the level of management gave less point to the leadership feature of mayors in comparison with any other level.

Senior Manager = Department Head > Branch Manager > Employee at the level of Management

The reliability of the survey was calculated and because cronbach' alpha was found .99 it was considered as highly reliable.

57.4 Conclusion and Suggestions

1. As a result of the research, the mayors of the municipality of Aldındağ, Çankaya, Etimesgut, Gölbaşı, Keçiören, Mamak, Sincan, Yenimahalle and especially metropolitan municipality of Ankara was found to have leadership feature. It was founded that at all leadership standards, mayors have the knowledge of all standards, they show tendency to these standards and they show performance proper to these standards.
2. Lidershhip takes shape according to the experiences and personal traits. Democracy approach applied in Political Parties affects all leadership style of managers who are in that party. Because of this, main approach of political parties at administrative level should focus on democratic governance and democratic leadership. During the process of determining the mayoralty candidate, if political parties gave privilege to the ones who have better education apart from

political experience and in case of selection of this candidates we can say that most probably there will be democratic leadership and democratic governance.

3. Leadership in policy is an important issue. Mayors' adapting of a leadership style who is one of the main elements of decentralization will pave the way for the development of policy.
4. Mayors should adopt the approach of being a leader in service not being a political leader in their service territory. Local governments which are service-oriented and open to the participation of countryman academically fit more to the sustainability of the government's main factors.

It has appeared that mayors who adopts social, ethical, political leadership style in this study act like local governors in service delivery.

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Chapter 58

Dystopian Future View as a Narrative of Inherent Entropy of Organizations

Ulaş Çakar and Ozan Nadir Alakavuklar

58.1 Introduction

Studies in management and organization generally have a performative and functional orientation (Burrell and Morgan 1979; Walsh and Weber 2002) but there have been some alternative perspectives and approaches in order to reflect the reality of organizing and managing processes. Analyzing radical organizations such as mafia (Parker 2008), pirate organizations (Çakar and Alakavuklar 2012; Land 2007; Parker 2009) and analyzing the representations of managing and organizing processes in popular culture products (Hassard and Holliday 1998; Rhodes and Parker 2008; Rhodes and Westwood 2008) are good examples of these alternative approaches that give us new insights to organizational reality. In this study, we examine dystopian future of Warhammer fictional universe to examine the chaotic reality of organizations. Because, supposedly reality based utopian fiction of orderly organization is causing a dream-like state that misses the continuous flux of the reality. We need to balance this optimistic illusion with the help of dystopian views. Hence, our study is a matter of Utopia (More 2012) meeting the realities of the Leviathan (Hobbes 2009) it faces.

58.2 An Organizational View on Utopia and Dystopia

Utopia can be defined as an imaginary place where ideal society exists (More 2012). Today's management ideals can be presented as a utopia itself (Reedy 2002) or the well-oiled, orderly structure of free market is exhibited as a utopian end itself (Grey

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and Garsten 2002). Whilst utopias are based on good and ideal society, it is very arguable who's good and ideal it is. Therefore, there are also dystopias discussing how the reflected heaven of one may be a hell for other. It can be argued that dystopias are cynical utopias presented like cautionary tales (Parker et al. 2007, p. 81). Science fiction is a field that is rich for providing these dystopian warnings. Originally, science fiction had begun as a modernist and orderly narrative. As time passes, important writers of science fiction went beyond a mere understanding of shiny future and castles in the sky, so, they wanted to evaluate the chaotic aspects of human existence, its organizations and the universe (Asimov 2009; Clarke 2000; Herbert 2005). Therefore, many of the science fiction worlds of twentieth century were based on dystopias such as Orwell's *1984*, Huxley's *Brave New World*, Bradbury's *Fahrenheit 451* or Zamyatin's *We*.

In a special issue on Science Fiction and Organization, it is also claimed that science fiction and organization studies are not strictly separate fields since science fiction creations symbolize what organizations and people are capable of doing (Parker et al. 1999). As a part of this relationship Asimov's Foundation's implications for organizational theory is evaluated (Phillips and Zyglidopoulos 1999), Stanislaw Lem's philosophical narrative and its depictions on human existence and organizational reality is discussed (Case 1999) and also Philip K. Dick's treatise on the matter of robots and androids are examined as a part of managerial issue (Srinivas 1999). Following the special issue, a book is also published demonstrating the interest on the relationship between science fiction and organization (Smith et al. 2001). In our study, to further the studies on the subject and to benefit from the contemporary science fiction genre's evaluations of the chaotic essence, we aim to study the grim reality of Imperium of Man in the Warhammer 40,000 Universe (Abnett 2011; Bayley 2000; Mitchell 2010; Priestley 1998). We claim that study of this chaotic narrative will provide a deeper understanding of inherent entropy of organizations.

58.3 Warhammer 40,000 Universe and Chaotic Narrative

Warhammer 40,000 universe is a dark science fiction setting that takes place in the far future of 40,000 AD. Even though it began as a background story for wargaming hobby, in time it has grown beyond a mere cliché science fiction setting. Its intellectual roots were many; Asimov's Foundation, Frank Herbert's *Dune*, H.P. Lovecraft's Chuthulu Mythos and even historical wars such as Second World War are among many influences in this universe.

The most basic thing about Warhammer universe is; it is about chaos and order struggle. It doesn't have a dualist good and evil definition. There are aspects of order and chaos but defining them in the traditional approach is not possible. The fictional universe of Warhammer is a diverse setting but as the Imperium of Man is the main focus of the universe we will examine it. Imperium of Man is a galaxy

spanning empire that rules over a million worlds. It was founded about 10,000 years ago by the Emperor of the Mankind with the ideals of progress, science and hope for humanity. But as empire reached its limits, a great civil war broke out and empire has fallen into a conflict between supporters of Chaos and supporters of Emperor that exemplifies the forces of order (Abnett 2011). In the following conflict, rebels have been defeated with a great cost and as Emperor has been injured so much that he had to be kept in a special time freezing field, and thousands of souls are sacrificed to keep him alive (Merret 2006; Priestley 1998). In the years after 40,000, we see a decaying empire in which science became a matter of faith (For instance, Tech-priests are the ones that maintain the high-tech machines by praying to their machine spirits), progress has been replaced by decay and hope has diminished to a point of disappearing (Abnett 2000; Mitchell 2010).

The organization of Imperium of Man in such a grim future provides rich dystopian insights to entropic power of inherent chaos in organizational setting. Organization's bright ideals, charismatic and inspiring leader and innovative acts has transformed into decay and entropy. More importantly, the seeds of this transformation come from the core of this empire's formation (Merret 2004). Discontent leading to civil war was part of humanity's essence; hence, our desires and short lived lives are at the heart of the primal chaos of our existence. And in this changing environment, the innovative thoughts and ideals of the past begins to transform into a matter of blind faith, which people begin to cling to desperately (Abnett 2002). From an ethical standpoint, we can't directly say forces resisting the change are evil, or forces of change are evil. Even though chaotic essence acts as a force of entropy, its destruction of status quo is about to bring change and creation. Without this change, ideal of order is an undisturbed existence that doesn't change anymore, even if it seems admirable at the first look, it can be seen that it can be another kind of hell in its own right.

As time passes in an organization the orderly bastion begins to decay towards the inherent entropy. Members of the organization realize that organization is in decay and it can't maintain its past status and power anymore. What organization does is, similar to the transformation of Imperium of Man, becoming a xenophobic being. In the modern organizational context, strangers and aliens are the ones outside the organizational cocoon. The basic tenet is coming from the expression that says *"Forget the power of technology and science, for so much has been forgotten, never to be re-learned. Forget the promise of progress and understanding, for in the grim future there is only war"* (Mitchell 2010, p. 5). Change is wrong, anyone outside of the organization is dangerous, and there is only the reality of overzealous struggle of keeping the balance. And more importantly less experienced and young ones that dare to think out of the box can be lost to this chaotic change. This war is organization's inner and external struggle to survive. As the organization's decay becomes more life threatening, desperation increases and the struggle becomes more intense and organization begins to see nothing but an existential struggle around it. It can be claimed that this kind of problems happen at failing organizations but it shall not be forgotten that even the worst performing organization was once

formed as a shining dream of a founder/founders who was/were the creator of the organizational universe. Claiming the downfall of the organizations' are only because of the mistakes is naïve. Mistakes are not the only reasons for a downfall; they are factors accelerating inherent entropy.

58.4 Conclusion

This chaotic depiction of future provides a metaphorical narrative that can help us to see deeper into the reality of today and tomorrow. Further studies can be done by conducting a deeper research on mechanisms of Imperium of Man or other organizations of the Warhammer 40,000 lore. We need to learn more about this radical narrative as our present organizational narratives are concentrating more on the naïve assumption that it's possible to get rid of the chaotic reality (Çakar and Alakavuklar 2013) and bring order to organizational life. We need to embrace the fact that this inherent entropy of organizations is a part of their existence, not just a mere annoyance that can simply be dealt with; therefore, chaos is an ultimate power that is gnawing the existence of the organizational order.

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Chapter 59

The Turkish Version of the Career Futures Inventory-Revised: The Validity and Reliability Study

Mehmet Ali Hamedođlu, Ahmet Akin, Serhat Arslan, ınar Kaya, Taner Demir, Recep Uysal, and Hakan Sariam

59.1 Introduction

A career is getting together and sequence of roles played by an individual during the course of a lifetime (Super 1980) and the process by which individuals make less their life choices as a way to create and find the self (Gottfredson 2002). Nowadays it is an important phenomenon for individuals to make best decision and career choice between educational, vocational, and job options (Vianen et al. 2009). In general, it is not easy to make the best choice and to use rational strategies when making career decisions for most people (Anderson 2003). Depending on making wrong career choices individuals sometimes unhappy with their decisions once they are made. So, many career theories emphasize the importance of conscious decision making for healthy career development (Vianen et al. 2009).

Career develops over a lifetime and all individuals must meet the social norms, and a central construct in career preparation and an important variable in career development is career adaptability which is derived from Super’s original term “career maturity” (Super and Kinsel 1981) Career adaptability forms an idea about how individuals adjust the changes or new things in work life (Super and Kidd 1979), an important structure for healthy career decision making (Rottinghaus et al. 2012), should be thought as a remarkable construct in career theory and includes three major components; conscious planning attitudes, exploration of self and environment, and informed decision making (Vianen et al. 2009). Because of changing world of work that require rapid adaptation of knowledge and skills career

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adaptability is getting a necessity and traditional linear careers are becoming less effectual (DeFillippi and Arthur 1994) and it is a key competence in career success (O'Connell et al. 2008).

Savickas (1997) first defined career adaptability as “the readiness to cope with the predictable tasks of preparing for and participating in the work role and with the unpredictable adjustments prompted by changes in work and work conditions” (p. 254) and later (Savickas 2005), “a psychosocial construct that denotes an individual’s readiness and resources for coping with current and imminent vocational development tasks, occupational transitions, and personal traumas” (p. 51). According to Rottinghaus et al. (2005) career adaptability is a tendency which effects the way an individual views his or her capacity to plan and adjust to changing career plans and work responsibilities, especially when he or she met with an unexpected event.

Savickas (2002, 2005) proposed four main aspects of adaptability: concern, control, curiosity, and confidence. According to him to have a successful career adaptation, firstly, people must have concern about the future of their occupational path to have a meaningful career planning. Secondly they must have more control and autonomy of their occupational path by decision-making interventions and assertiveness training. Thirdly, they must be curious about the future to have an open view of career possibilities and must think where they see themselves in their work lives in future and finally, they must increase their confidence, self-belief to reach their aims. These four major aspects involve the entire career development of an individual (Magruder 2012).

Previous studies have shown that there is a strong relationship between career adaptability that accepted as a useful construct for examining what it is that career counselors do, and what they will need to do in the future (Swanson and Parcover 1998) and leadership (Rottinghaus et al. 2005). Leaders must encourage their employees “to become more career-resilient and engage in career development activities to deal with changes in required knowledge, skills, and abilities, and to facilitate their mobility” and participation in decision making process and autonomy, along with supervisory career support (information, advice, and encouragement), enhance employee’s career adaptability (Ito and Brotheridge 2005, p. 5). Similarly, changing, dynamic environments are crucial in today’s organizations, so they need for adaptive workers (Edwards and Morrison 1994) and supervision/leadership is one of the major component of adaptive job performance (Campbell 1999; Campbell et al. 1993).

Rottinghaus et al. (2012) developed the Career Future Inventory-Revised (CFI-R) to assess aspects of career adaptability, including positive career planning attitudes, general outcome expectations, and components of Parsons’ tripartite model and Bandura’s personal agency. CFI-R is composed of 28-items and career agency (Factor 1), negative career outlook (Factor 2), occupational awareness (Factor 3), support (Factor 4) and work–life balance (Factor 5) were found to be the two main factors in the exploratory factor analysis (EFA); all factors had high internal consistency (Alphas for Factors were, .88, .77, .80, .77 and .75 respectively). Respondents indicated on a 5-point Likert scale (1 = strongly disagree to

5 = strongly agree) how often they felt as described in each item. The overall pattern highlights numerous examples supporting the validity of the CFI-R scales. Career Agency demonstrated a pattern reflecting more adaptive coping methods, including .28 and .30 correlations with problem-focused and avoidant coping, respectively. Negative Career Outlook was significantly correlated with Life Orientation Test-Revised .37 and demonstrated moderate correlations with the CDP subscales, decidedness .41, comfort .49, and reasons .56 career agency related positively to decidedness .38, comfort .46, and reasons .47. Occupational Awareness showed moderate relationships with comfort .34 and reasons .39 (Rottinghaus et al. 2012). The aim of this research is to adapt the CFI-R to Turkish and to examine its psychometric properties.

59.2 Method

59.2.1 Participants

Participants were 587 university students (350 female and 237 male) who were from different programs of Education Faculty of Sakarya.

59.2.2 Procedure

Primarily the CFI-R was translated into Turkish by five academicians. After that the Turkish form was back-translated into English and examined the consistency between the Turkish and English forms. Turkish form has reviewed by six academicians from educational sciences department. Finally they discussed the Turkish form and along with some corrections this scale was prepared for validity and reliability analyses. In this study confirmatory factor analysis was executed to confirm the original scale's structure in Turkish culture. Data were analyzed by LISREL 8.54 and SPSS 13.0.

59.3 Results

59.3.1 Construct Validity

The results of confirmatory factor analysis indicated that the model was well fit ($\chi^2 = 800.01$, $df = 335$, $RMSEA = .049$, $NFI = .88$, $NNFI = .92$, $CFI = .92$, $RFI = .86$, $GFI = .91$, $AGFI = .89$, and $SRMR = .040$). Factor loadings are presented in Fig. 59.1.

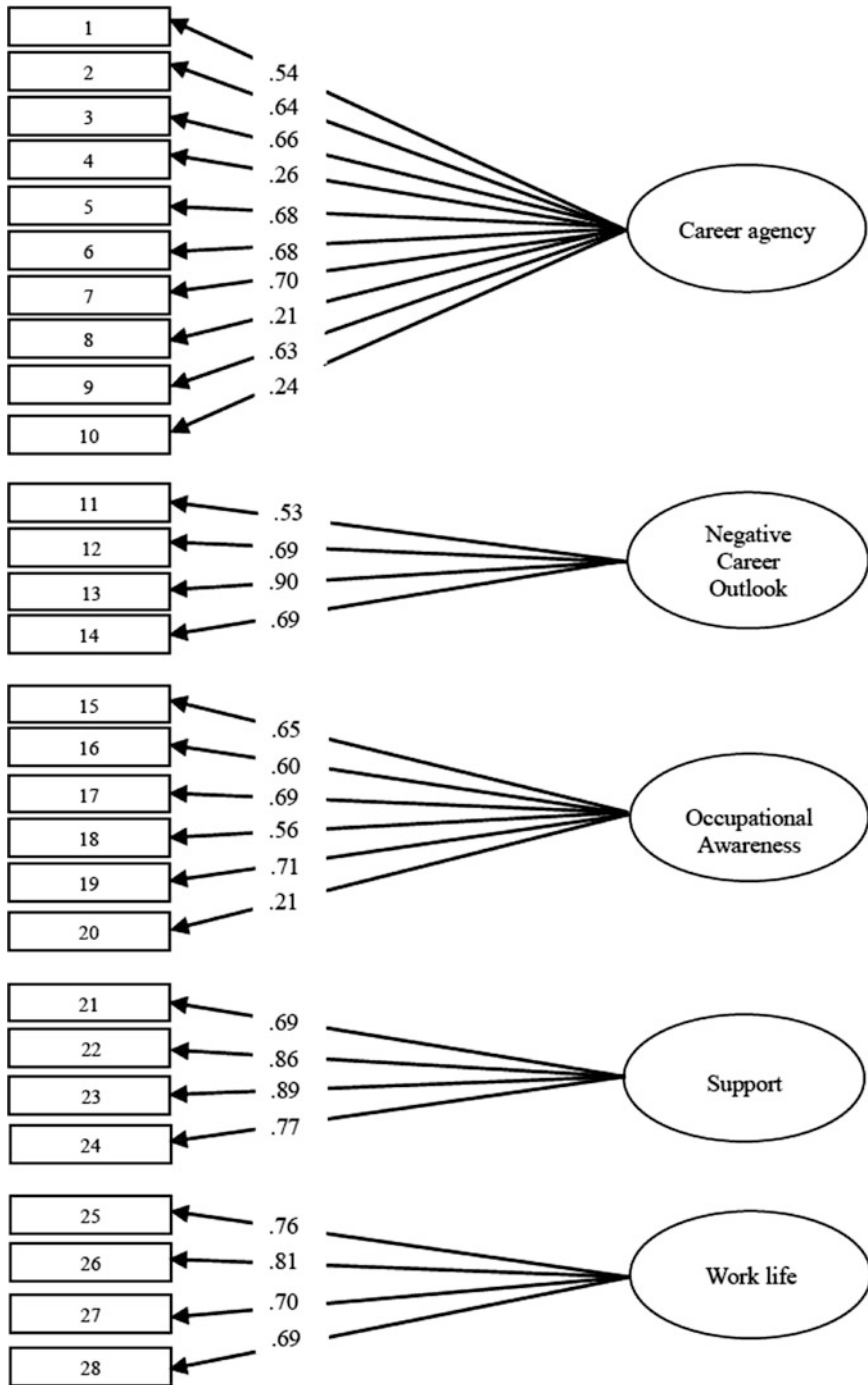


Fig. 59.1 Factor loading and path diagram for the CFI-R

59.3.2 Reliability

The internal consistency coefficients of five subscales; career agency was .58, occupational awareness was .81, support was .70, work–life balance was .88, and negative career outlook was .83. The corrected item-total correlations of CFI-R ranged from .55 to .86.

59.4 Discussion

The purpose of this study was to translate the CFI-R into Turkish and examine its psychometric properties. Confirmatory factor analysis demonstrated that the factor structure was harmonized with the factor structure of the original scale. Thus, it can be said that the structural model of the CFI-R which consists of five factors was well fit to the Turkish culture (Bentler and Bonett 1980; Hu and Bentler 1999; Schermelleh-Engel and Moosbrugger 2003). The internal consistency reliability coefficients of the scale were high (Büyüköztürk 2010; Kline 2000). Overall findings demonstrated that this scale had high validity and reliability scores and that it may be used as a valid and reliable instrument in order to measure the dimensions of career future. Nevertheless, further studies that will use CFI-R are important for its measurement force.

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Chapter 60

The Importance of Building Leadership Skills with the Contemporary Youth

Kadisha Shalgynbayeva

60.1 Introduction

Questioning of leadership dates back to the ancient Greeks. The nature of the leadership was first questioned by Socrates. According to Socrates leadership depends on the circumstances and usually relies on having sufficient knowledge of the leader (Adair 2005). Leadership has been continued to be questioned for ages. And ever since Socrates there have been made many research about leadership. Especially in twentieth century leadership has been a dominant subject on administration (Erçetin 2000).

What makes leadership take the attention so much? Or lets change the question what is the climax for it? It is maybe because of change the way we consider the organization. Everything is changing. Systems are getting more flexible. The perception of organization is changing as well. In the past organizations were thought to be a part of something mechanical. They were administrated with certain strategies. They had control systems and their success were mainly depended on these systems (Sadler 2003).

Today there are a lot of corporations with complex management systems. Thus, the demand for leaders is growing. Because administrators notice that it is important to influence the members in organization to achieve the organization's goals (Northouse 2010).

What is leadership? Actually there are many definitions about leadership. Namely there are more than 350 definitions. The definition of leadership changes person to person. Because everyone has a different context and individual perception (Ricketts and Ricketts 2011).

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60.2 Leadership and Leadership Skills

According to well-known Russian scientist B.D. Parygin the definition to leadership is this: “Leader is person who suddenly appears as a head of a group in an unofficial situation. He/she is the figure that helps people to delegate quickly in achieving a common goal” (Parygin 1971).

The capitalistic dynamics is changing fast, and that is why today we cannot apply past century’s formulas of success. Thus, if we implement methods of the past they will not respond to the modern requirements of efficiency. Nowadays companies are facing big challenges – to stand up to the upcoming changes and to save their ability to compete. If there are big changes coming, then the necessity for leaders emerge naturally. That is why the business has realized in the last 10 years that there is a demand to form a new corporate culture which is supposed to develop leadership skills. What is need for the organization’s prosperity is to involve as much people as possible into the formation of this culture (First September newspaper 2003).

Despite the fact that developing leadership skills is a natural process along the way to success, a lot of people find it hard to obtain such skills because of the life’s obstacles. However, there a lot of examples in the world on how some companies and corporations make leaders and professional managers out of their employees. In this case companies should clearly see whom they need most: leaders or managers, because leaders and managers are absolutely different types of people. To understand the difference between them we can look at the situation with military: when there is peace, managers provide the normal functioning of the army, and there is just one main leader seen, that is the General of military arms, however, if there is a war situation, the military forces need several local leaders who will be able to operate quickly and efficiently at every level. People have not found a method to simulate an extreme situation by administrative means yet. For that purpose, the “soldiers” must be encouraged enough. Managing and being a leader is quite different as it is seen by the functions described (Andreyeva 1988).

Companies that have achieved certain level of success have never waited for leaders to fall down from the heaven. They search people with leader’s qualities and give them career opportunities that will open up their potential to the fullest. About 10 people are chosen after the selective and training procedures.

To accept people with leadership potential on work is just the first step in up bringing leaders. To grow professionally it is essential to have a work experience in different fields. The important period in future leader’s career is when he/she is given a hard and responsible task at the beginning of his/her career. The young specialist is given an opportunity to test his/her abilities at the new work place, to feel the exiting feeling of victory or the bitter taste of failure. The experience like this is a precedent to development of leadership skills in the future. This test clearly shows the hardships of the leader’s role while pointing to the numerous change opportunities at the same time (Zankovskiy 2001).

The next level in raising leaders is to broaden their professional vision. Usually this happens during the personnel rotation- the change to a position which needs absolutely different skills. In the western corporations future leaders usually

undergo several of such rotation processes in their professional career. During these years a person can go from office to office around the globe.

Finding and employing leaders is directly related to the company's personnel policy. There are two different conceptions related to this. The first is called "Japanese model". This model is based on the life-long employment. Within this model the employer evaluates the future leader by several criteria. The main attention is paid to individual and personal qualities of the candidate. The goal of the employer is to select a person with high intellectual abilities combined with reliability and high humane qualities. Then professional qualities are trained during the work time in a company.

The second conception is called "American model". According to it the main attention is paid to the candidate's professional and business qualities: his/her knowledge, professionalism, skills and experience are the main criteria in the selection process. Personal qualities are put to the second place. The company tries to find a "ready" candidate for a certain position (Andrienko 2000).

Our companies implement both models. They even have the choice to select leaders for every level in their enterprise. Usually "American model" is used for choosing leaders and managers on the lower levels of an enterprise, while "Japanese model" is applied for choosing personnel on the higher levels of an organization.

For choosing the leaders among numerous candidates it is important to define specific criteria for the selection process. Also, some questions on how to develop and enhance the leadership qualities appear in this case. Leaders are usually born leaders; however every person can develop certain leadership qualities. What are they?

Today we can hear a lot about leaders' characteristics. In 1940 an American psychologist K. Bard defined 79 main characteristics which are common for leaders. Later scientific works have added to this list. However, there are some constant characteristics that are met in every work on leadership. The function of each characteristic is related to a place, time, situation, and personal qualities. Let's name some of the basic leaders' characteristics broadly used today: ability to see potential opportunities, being able to create a general picture of the future, being able to convert opportunities into results, being able to develop people around, being able to open the potential of employees, ability to face changes and challenges, being able to take risks, self-belief and confidence, high competence, always learning, reading, implementing his/her knowledge on practice, positive thinking and speaking, the initiative to manage, the sense of partnership, acting according to social and team interests, being able to admit his/her faults and mistakes, keeps the energy for acting and taking measures even in the case of failure. Also, such characteristics like height, weight, gender, extroversion, attractiveness don't matter at all. Of course, all of the leadership qualities are not necessary in one person at once. The main thing is to be able to form and develop those several qualities that are quite necessary in the modern society (Bendas 2004).

Up bringing leaders and their self-development work is an ongoing process that never stops. To be a leader a person should have certain level of culture, knowledge and life experience. Of course, leaders always educate and develop themselves.

Every company's management is interested in finding leaders and providing them with challenging and exciting work experience that would give them opportunity to enhance their abilities. As usual, if leaders don't see perspectives in growing and developing at the company, they leave. Also, they will take away knowledge, experience, and even some people from the company. That is why it is very important to give them an opportunity to realize their potential at the work place.

60.3 Conclusion

As a matter of fact, the need for leaders always kept its importance as it is a natural behavior or expectation for human beings. People has felt the need of leaders since the first group was generated naturally. According to the era and the expectations of the people in a society, the characteristics of good leaders have never changed while the managers had to keep up with the current time, and consider the necessities of the related era and place where s/he lived or took responsibility. Following the scientific developments on administration and management, the difference between two concepts, leader and manager, have been more obvious than ever. The formal structure of the institutions or companies required professional managers but natural leaders have been more important in such a competitive world so as to contribute more, lead the groups and increase the profits or outcomes somehow. Moreover, the societies and institutions have always felt the need of growing a real leader who questions, analyses, think and implement beyond a professional manager who only implements the rules and regulations without questioning. This situation caused people to think on this issue and create new models for leadership and set the characteristics of it. Some focused on the personal qualities while others focus more on professional qualities. As a result all these models and discussions have obviously contributed to the discussion and to the process of growing leaders. All these findings undoubtedly show that each institution should determine its own priorities and choose its leaders accordingly in order to survive and show the best performance.

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Chapter 61

Chaotic Politics, Chaotic Relationships

Mina Abbasiyannejad and Rosli Talif

61.1 Introduction

David Malcolm refers to McEwan's shift from Macabre themes to more socio-political issues in *his Understanding Ian McEwan*. He writes that "Certainly both novels [*The Innocent* and *Black Dogs*] are much more engaged with the social, political, and historical than the *The Cement Garden* or *The Comfort of Strangers*" (5). The Great wars of the twentieth century and their impact on society are excellent examples of the connection between world politics and human relationships. Contemporary fiction touches on the interwoven linkage between political decisions of governments and the attitudes of nations towards each other. It unravels the hidden and long-term psychological effects of war on the people of the nations involved, both the victors and the vanquished. The horrible crimes perpetuated by man on his fellow men – the killings, tortures, rape and general carnage that occurred during these wars affected people's relationships in diverse ways. They not only damaged the sacred unit of society, which is family, but also changed the perceptions and values of the people, from the conqueror to the conquered. Literature has always tried to affect culture, and represent societal problems in any possible way. Contemporary writers have been always aware of the nation's problems and attempted to highlight them through their writing. Reviewing McEwan's fiction proves his constant concern with the mirroring of political conflicts in human's relationships.

The volume of McEwan's literary output is significant in a century which experienced the profound and lasting impact of conflict, mostly brought about by the two world wars. The British also suffered from very direct and intense

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terrorizing violence in the twentieth century with, for example, the London Blitz.¹ The perpetration of brutality and violence on a global level, such as the Holocaust, the bombing of Dresden (a city in Germany attacked by the Allies in February 1945), the bombing of Pearl Harbor, Hiroshima and Nagasaki, were widely relayed by the news media.

The Second World War is considered as one of the most devastating conflict in history beings in 1939. “Hitler’s pursued certain aims based on his raciest ideology and his brutal conception of power politics” (*World War II*). Soon after the Second World War ends the Cold War begins. However, after waiting 40 years for the Cold War to end, its legacy invaded almost all parts of the world. The societal destruction and fears induced were reflected in many dimensions of people’s lives. Similarly, a contemporary parallel is the brutal destruction of the World Trade Centre on ‘9/11’ in a terrorist act of unprecedented scale, and the bombing of the London Tube² in 2005, which were acts of violence and the results of conflict that have reverberated throughout the world and affected and will continue to affect the lives of everyone for years to come.

61.2 Discussion

The Innocent (1990) is an excellent example of the reflection of politics on relationships. It is set during the Cold War, and in different places such as Berlin, England and America. This is a time when Americanisation is widespread and Leonard as a young English man is under the pressure of this socio-political power transformation in Berlin. He struggles to cope with the new environment and the new socio-politically dominated circumstances. On the other hand, his instinctual male sex power overcomes his reason and he acts like a domineering brutal enemy to his beloved. There is a direct intermingling of politics with relationships in *The Innocent*. In his *Ian McEwan*, Kiernan Ryan asserts that “*The Innocent* shows how completely the innermost self can be penetrated and disfigured by desires cultivated in the public sphere” (55). David Malcolm in *Understanding Ian McEwan* asserts that

The Innocent has another kind of intertextual reference as well, that is, to its own contemporary literary environment. It can be seen as an almost schematic gathering of certain motifs and concerns of the novelists of McEwan’s own generation. It

¹**London Blitz** is sometimes referred to as the Blitz of London. In 1940, during the Second World War, Hitler decided to take control of Britain by destroying the Royal Air Force before sending his troops there. Due to the failure of the operation, his new tactic was to hit London and other major cities, to kill and spread fear among the civilians. To increase the pressure on civilians, daily attacks were replaced by night attacks. Many people were killed and many more badly injured.

²**London Tube** refers to the suicide attack, on the seventh of July 2005 (7/7), on the public transport system during the rush hour. Three bombs exploded in London Underground trains, and a fourth one an hour later on a double-decker bus. Fifty-six people were killed and around 700 wounded.

does this through its focus on abroad, on what is not British and what is clearly differentiated from it. In the novel this has both a German and an American aspect. Certainly, motifs of the foreign and what it means to Leonard are recurrent throughout the text (118).

What has occurred between Leonard and Maria represent how wars can psychologically manipulates and challenges nations. Leonard uncontrollable fantasy as a conqueror of the war, and Maria as a surrounded ruins their romantic relationships and revitalize the idea of victim for Maria as a German girl. What she has remembered was the brutal and unforgettable mass rapes in Germany committed by Allies in the defeated Germany. When Leonard, the innocent of the story who is quite naive and still a virgin at the age of 25, enters Germany he considers himself the owner of the land, "it was impossible for a young Englishman to be in Germany for the first time and not think of it above all as a defeated nation, or feel pride in the victor" (McEwan 2005).

In a similar vein, *Black Dogs* (1992), set in Berlin, England and France, looks at the societal impact of the Cold War and the legacy of World War II. The emerging themes he develops revolve around radical changes in society in late-twentieth-century Europe, including the horrors of the Nazi legacy and its metaphoric relation of power and domination. There is a presentation of both class and sexuality. *Black Dogs* even pictures political policy for domination in the worst possible way. It pictures how Germany created hostility and terrorism during and even after war. The heinous act of rape by dogs affects Bernard and June's relationships deeply and makes them unable to recover the psychological damage.

Hunter Hayes and Sebastian Groes (2009) explain that in the *Imitation Game* (1981), McEwan shows that "The war, which has often subsequently been represented as a period of women's emancipation, and which at the time seemed to offer so much liberatory potential for women, in this case effectively perpetuates, and even exacerbates, the opposition between sexes" (34). *The Innocent* (1990) and *Black Dogs* (1992) are examples of the direct relationship between the politics of war and sexuality.

In "Bringing the Past to Heel: History, Identity and Violence in Ian McEwan's *Black Dogs*", Muller-Wood A. and Wood J. Carter (2007) say that in *Black Dogs* the characters emphasize the role of history in an individual's life and how "humans are haunted by their own pasts and those of their societies" (4). Jeremy reflects upon the interrelationships between personal and political, present and past, violence and responsibility (4). In "Dialogues with History in Post-War British Fiction" (1997), James Lang considers the relationships between a set of contemporary British novels and the continental style of historiography. Considering the impact of World War II and its cultural and political aftermath on the principle of rationality, Lang argues that these historical novels challenge some historiographical strategies which draw on enlightenment perceptions of history. He sees *Black Dogs* as being obsessed with violence and conflict, suggesting some psychological origins for the violence in McEwan's fiction. He uses the framework of the historical novel to reflect on the nature of widespread violence, both in the world and in his own work.

Ian McEwan (1994) is Kiernan Ryan's exploration of *Black Dogs* to see how McEwan examines the rise of a new generation of vicious racists, exemplified by the scene observed during the collapse of the Berlin Wall. McEwan has been perturbed by developments not only in Germany but across Eastern Europe since 1989, as these events have shaken his political vision and belief in the possibility of social and sexual emancipation. *Black Dogs* compresses the diverse conflicts organizing his work, to date, into a single searching debate. Meanwhile, Nicholas Parker, in "Literary Evasions of The English Nation in the Twentieth Century" (2009), suggests that *Black Dogs* articulates how late twentieth century individuals are drawn to the concept of the nation. In McEwan's novel, nations become meta-narratives which influence meaning, including significance, authority, position and rights. This is well illustrated in *Black Dogs* where a nation tends to build monuments to act as central points in a continuous historical narrative. The two mentioned works highlight McEwan's cynical view of the world in which there is no hope for improvement. Focusing on some memorable moments of history and their turning points in the nation's life, McEwan simultaneously indicates the ruthless and rooted brutality of nations. In Malcolm (2002) words "In *The Innocent* and *Black Dogs*, this fragile yet redemptive quality of love is stressed again. Maria and Leonard cannot stay together, but their love has shaped their lives, and maybe in the end they will meet despite time and distance. June and Bernard cannot live together, but never divorce and remain in love till death and beyond" (175).

61.3 Conclusion

As is made clear in the discussion, the political oppression and domination that occur during the critical time of the Second World War and the Cold War overwhelm society and then individuals suffer from the outcomes. Literature as an influential factor in society has hidden power to affect culture. Fiction as an important part of literature attempts to bring to light the facts in societies which are related to the world of politics. In fact, it shows how political conflicts can penetrate a nation's relationships deeply. The psychological influences of both sides, victor and vanquished, would be a long term effect which makes them suffer throughout their life. McEwan's concerns about socio-political issues and their somehow invisible effect on the individual's life are meticulously presented in the characters' relationships and pictures the real world of domination and oppression. Both *The Innocent* and *Black Dogs* are examples of the intermixed relationship between world politics and people's relationships.

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Chapter 62

Dynamical Motion Capture System Involving via Neural Networks

Eva Volná, Robert Jarušek, Martin Kotyrba, and Daniel Rucký

62.1 System Design

Designing a measurement system has been defined the following initial requirements (Jarušek 2009):

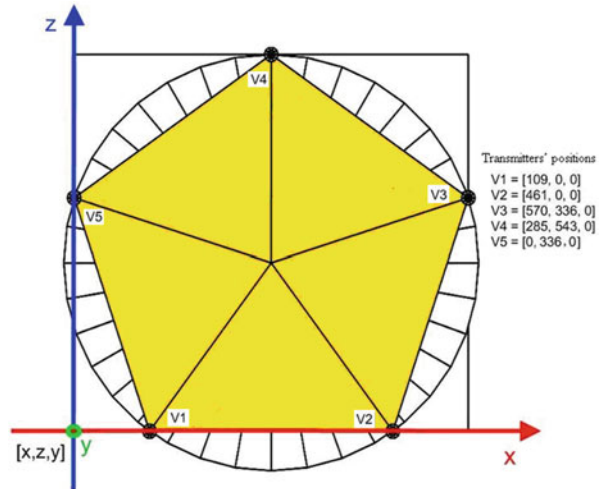
- Active area (domain), where the captured objects move, has to be so large to be able to cover the range of moving objects.
- Active area should not restrict the moving objects. In other words, the active space must not be any equipment needed to operate the system.
- The system accuracy must be constant throughout the active area.
- The system must be able to adapt to environmental changes (e.g. change in temperature).
- The system must be able to detect measurement errors and correct them.
- The output of the system must be data that should be acceptable in other systems (e.g. 3D programs).
- The system should be able to work in real time.
- The whole system, including technology, should be applicable in any environment.

According to the initial requirements, we proposed the system topology containing five transmitters positioned around the space in the corners of a regular pentagon. All transmitters were put into a horizontal plane so that the plane split the space into two half-space, namely the half-space above the floor and half-space under the floor. We introduced a coordinate system into the halfspace above the floor in following way, see Fig. 62.1 (Jarušek 2009):

- We construct a regular pentagon
- Pentagon vertices determine transmitters' positions **V1–V5**

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Fig. 62.1 A coordinate system



- Select **x** passing **V1** and **V2**
- Select **z** axis perpendicular to the axis **x** a passing **V5**
- Select **y** axis passing point of intersection **x** and **z** and perpendicular to floor plane

We had to fulfill the following conditions of sound parameters in order to system worked well (Everest 2000; Huber and Runstein 2005; Sejdić et al. 2009):

- The system used sound waves at a frequency of 4,410 Hz.
- Sound pulse, used as a measurement medium and it is radiated by any transmitter, must leave the domain before any other transmitter starts sending its impulses. This is the most important condition for the proper system functioning.
- Sound pulse must be adequately long to receive it the satisfaction in receiver and process it.
- Sound pulse must be adequately short not to overload space domain by reflections from walls or objects in the room.

Each transmitter covers the whole domain space. We also guarantee transmitters' visibility from any point of the domain. The maximal distance between transmitter and receiver is 686 cm and respects the conditions of the system; height of the scanned area was limited to 300 cm. In this case, the distance between furthestmost points in the domain is of approx. 645 cm. The whole principle of the system is illustrated in the following Fig. 62.2 (Jarušek 2009).

62.2 Measurement in Real Space

We chose room of sufficient size and acoustic properties for the measurement. Used audio technology was selected with the required accuracy and quality measurement (Jarušek 2009):

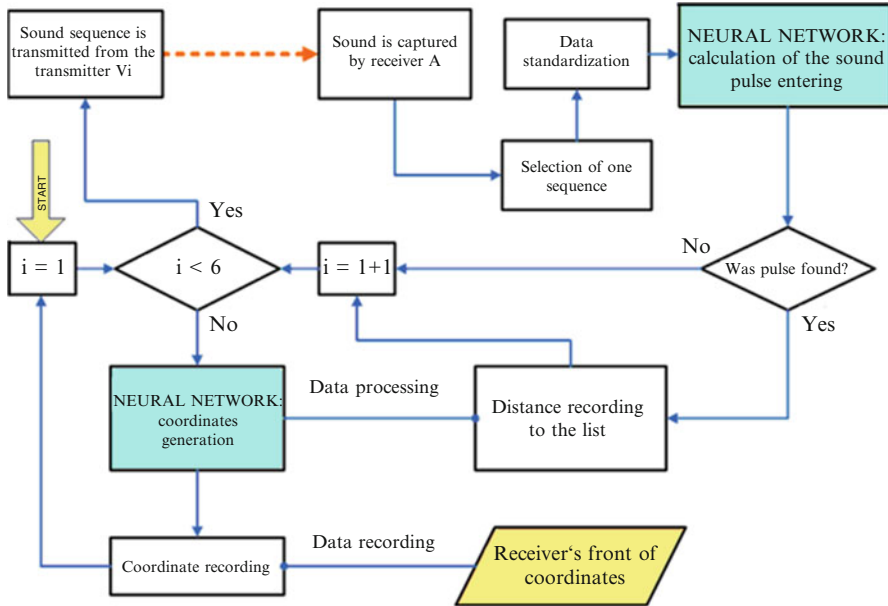


Fig. 62.2 System principle

- **Transmitters** – MS 101 II. (Yamaha) – single-band speakers with an average frequency response, but with sufficient acoustic performance
- **Receiver** – UMT 800 (Microtech Gefell) – professional studio condenser microphone
- **Amplifiers** – Crown CA 2000, Focusrite 8 Red
- **Correction amplifier** – Yamaha 02 v 96
- **Sound card** – HammerFall DSP MultiFace
- **Recording software** – Cubase SX 3, SoundForge 9

There were made 33 measurements in the domain shown in the Fig. 62.1, where we changed the receiver position for each measurement and we obtained 33 audio records. Initially, receiver was placed in the static points in space in order to cover the edge of the domain too. Then the receiver was moving so we recorded its dynamic movement in time. Recorded material was transferred to the stereo base (where the left channel contained impulses of transmitted V1–V5 and right channel contained a record from the receiver) in order to create training and test sets of neural networks.

62.3 Using Artificial Neural Network for a Solution

62.3.1 Calculation of the Sound Pulse Entering

This neural network is able to find the beginning of the sound pulse of transmitter and transform this information into a numerical value expressing the distance between the transmitter and receiver. We used a multilayer neural network with one hidden layer that was adapted by backpropagation algorithm (Fausett 1994). Input data of the training set included fixed range of values of one sample with the length of one (main) sequence, which contained 882 patterns. Number of patterns in the training set was 1,744. Neural network architecture is the following: 88 units in input layer, 120 units in hidden layer, 44 units in output layer.

Input vector of the training set included 88 values from the interval $\langle 0, 1 \rangle$. Values present standard maximal and minimal subsequence values of 20 samples from the main sequence, e.g. pairs of maximum from positive numbers and minimum from negative numbers. The last two samples from the main sequence were omitted. Output vector of the training set included 44 values from the set $\{0, 1\}$. If we divide the main sequence into 44 parts (each part includes 20 samples), then the part, which contains a front edge flag of the pulse equals 1 and all other values remain this value.

Choice of format of input data (input vector) was an important moment, see Fig. 62.3. We preferred maximal and minimal values of subsequences, because their average values did not give desired results. Similarly, the format of output

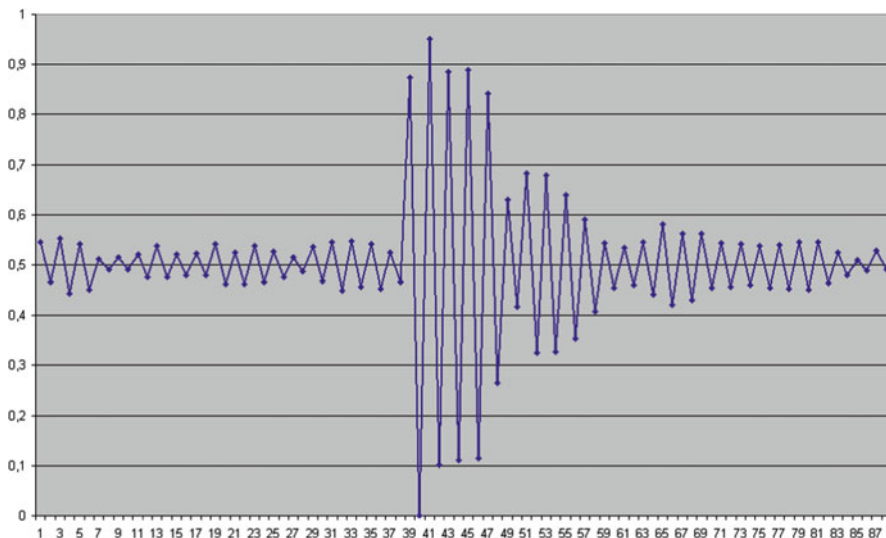


Fig. 62.3 Visualization of the input training vector

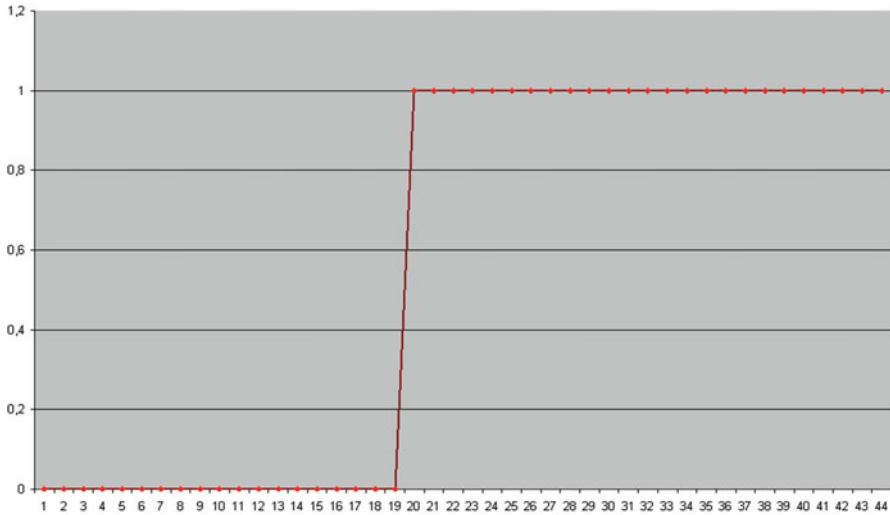


Fig. 62.4 Visualization of the output training vector

data (output vector) was proposed as a no decreasing function with the skip point in front edge flag of the pulse, see Fig. 62.4. The proposed network was able to recognize from input data the pulse signal with an accuracy of 20 samples (e.g. $20 * 0.7 \text{ cm} \doteq 15.4 \text{ cm}$).

62.3.2 Coordinates Generation

We also used a multilayer neural network with one hidden layer that was adapted by backpropagation algorithm. The neural network topology was the following: 5 units in input layer (distance transmitters to the receiver), 12 units in hidden layer, and 3 units in output layer: (receiver coordinates in space).

Measurement results were the following (Fig. 62.5):

- Calculating accuracy of horizontal coordinates (x, z) was, on average, 2.5 cm.
- Calculating accuracy of the vertical coordinate (y) was, on average, 5.5 cm. This reality was due to real disposition of transmitters, where the change about 1 cm in height indicated minimal changing of distance from transmitters. In the case that the vertical coordinate was close to zero, the network error was increased in the calculation.

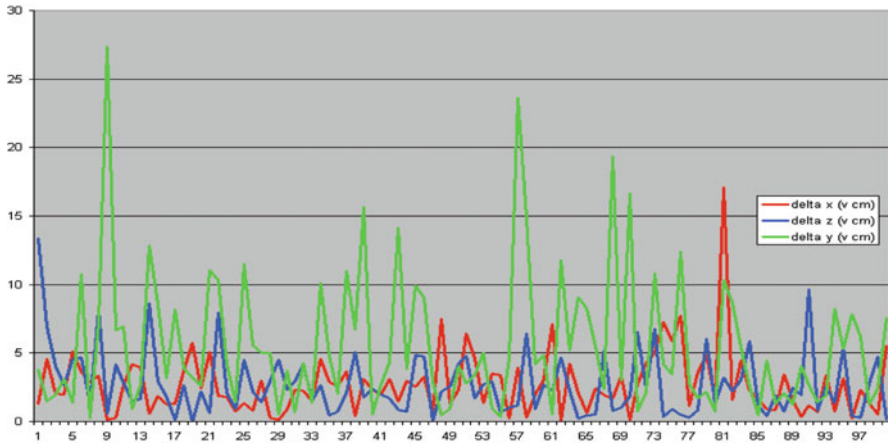


Fig. 62.5 Neural network error in cm (axes x: 100 test sequences)

62.4 Conclusion and Future Works

We found out that Motion Capture System using sound can be applied in real conditions, and physical properties of sound we can really use. Crucial component of the system are neural networks, thanks to their ability of generalization and information filtering, the system was allowed to process mixed and noisy data.

The technological development of this system is in principle possible, and offers rich opportunities for further research. This work deals with determining of one point position (receiver) in space and time. The system does not solve a specific moving object, but system's properties admit this possibility, because the limiting factor is only a number of transmitters, the domain size and average acoustics properties in room. Number of receivers can be in this configuration theoretically unlimited, we have to provide sufficient computing power.

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