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Şefika Şule Erçetin  
Şuay Nilhan Açıklan  
Emir Vajzović *Editors*

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# Chaos, Complexity and Leadership 2020

Application of Nonlinear Dynamics  
from Interdisciplinary Perspective

 Springer

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Editors

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Application of Nonlinear Dynamics from  
Interdisciplinary Perspective

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*Ş. Ş. E. To researchers who broadens horizons of chaos and complexity studies with their multidisciplinary contributions*

*Ş. N. A. To our generation which would build post Covid-19 world*

*E. V. To the one who tests the hypothesis “the sky is the limit” and the metaphysics of the open sea.*

# Preface

History of human is a long journey that all of us have experienced within different geography, culture, and language. However, year 2020 has been a remarkable year for humanity that teaches us we are all one and have one common destiny. The COVID-19 pandemic marked this year, and likely years to come, directly and indirectly. Beyond numbers, lives of people have been altered. Schools and universities are closed in physical world and mostly continue in online space. Most of the office environment moved to our houses. Some business sectors have almost shut down, while online shopping and technology saw its peak. World also witnessed surprising reactions which mass protests across the world against COVID-19 measures. Politics and diplomacy are also affected by the pandemic. Leaders have been tested in terms of crisis management, leadership, flexibility, and rationality.

Meanwhile, forced digitization has made another layer of the unknown in the digital ecosystem, obliging us to put additional effort in understanding diverse systems, networks, and relationships in post digital world.

As expected, our annual conference cannot be an exception during COVID-19 pandemic time, and the 7th International Chaos Complexity and Leadership Symposium was held online between 29 and 31st of October 2020. The 7th Chaos, Complexity and Leadership 2020 hosted distinguished key speakers from various disciplines. Although they are pioneer persons in their field, they have one common-undeniable effect of COVID-19. In addition, this two-day-long conference has been a home for multidisciplinary discussion of complexity studies and application of chaos and complexity in different fields.

This book includes unique chapters within different disciplines. Reader will find new insights on neurology, foreign policy, terrorism, energy, education, and other interesting fields vis-a-vis COVID-19 and its implications in the future. In this respect, once more we would like to thank our keynote speakers, including Deputy from İstanbul, TGNA President of Turkish Group to the IPU Dr. Ravza Kavakci Kan, Minister of Security of Bosnia and Herzegovina H. E Prof. Dr. Selmo Cikotić, Deputy Minister of Foreign Affairs of Turkey H. E Yavuz Selim Kıran, Balıkesir Metropolitan Municipality Mayor Yücel Yılmaz, Former Presidential Undersecretary of Turkish Republic of Northern Cyprus Ergün Olgun and President of New England Complex

System Institute Prof. Dr. Yaner Bar-Yam Also, we owe our thanks to invited speakers and participants from all over the world.

With our hopes that this book will be inspiring for you, we would like to underline that our world is at the edge of chaos now: change is undeniable—future is uncertain, but surely digital. In light of this reality, we hope that the chapters in our book will open new questions and horizons for future research, academic excellence, and inspiration for future deliberation of chaos, complexity, and leadership.

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Ankara, Turkey  
Sarajevo, Bosnia and  
Herzegovina

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# Turkish Foreign Policy in Chaotic International System vis á vis Covid-19 Pandemic



Yavuz Selim Kiran

**Abstract** We have long been witnessing dramatic change and transformation in the international order. We live in a fluid and dynamic state of transformation in every sense of the word. This happens against the background of instability, unpredictability and chaos in current international affairs. Long have been established frameworks like globalization, free trade and liberal economic order are shaken. The founders of the traditional international order only care to protect their narrow interests. The rising powers do not have capability and willingness to assume responsibility. As a result, lack of order and clash of interests prevail. Under these circumstances, Turkish foreign policy has showed transformative role in international system. This paper reflects the speech I delivered on Turkish Foreign Policy with a view to chaotic International system during Covid-19 Pandemic.

**Keywords** Turkish foreign policy · Covid-19 · Chaos · Complexity · Turkey

## Introduction

International system has undergone evolutionary transformation for a long time. Discussions related to globalization and later glocalization dominated questions of actor and structure. Under-developed nations and oppressed communities are suffering and falling victim to disorder and chaos. However, the old international structure does not and did not provide an answer to this human suffering. Nor, did it shelter and protect the humanity against cruelty and oppression. Tragedies experienced in the Balkans during the 1990s is a striking example of this. How can we forgive the massacre of the Bosnian Muslims? Likewise, can we forget the Bosnian Muslims forced to flee for their lives? The worst crimes against humanity after the Second World War were committed in Bosnia. Srebrenica turned into a shameful spot in our collective memory under the watch of the **international community**.

---

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Unfortunately these brutalities were not limited to the Balkans: We witnessed deeply troubling scenes in the Caucasus as well. As a result, the territories of Azerbaijan had remained under the Armenian occupation since the nineteen nineties. Four separate U.N. Security Council resolutions affirming Azerbaijan's territorial integrity are widely disregarded. Once again, the leading nations of the existing global order failed to counter aggression and occupation. After almost three decades, only now we witness justice delivered. With no other options left, Azerbaijan took back its territory on its own.

In this international system, Turkey, as an important actor of the international system, have been implementing entrepreneurial and human centred foreign policy across seven continents and in its relations with all countries in the world. More importantly, Turkey has been voice of oppressed people in all regions with the vision of our President Recep Tayyip Erdoğan.

## **Covid-19 Pandemic and Beyond**

Even before the pandemic, we were observing chaos, and complexity and lack of leadership across the globe. The pandemic, on the other hand, gave pace to many negative global trends. First of all, the pandemic revealed the shortcomings of the existing international system. UN Security Council spent more than three months to adopt a resolution on coronavirus. International cooperation is unfortunately losing ground. While unilateralism and populism gain upper hand. Therefore, now is the time to take steps for the reform of international institutions. As clearly stated by President Recep Tayyip Erdoğan, "the world is bigger than five" and the U.N. must be reformed accordingly.

Secondly, the pandemic has deepened the existing divisions and conflicts around the world. A brief look at Libya, Syria, Yemen, Palestine, Somalia, South Sudan and Myanmar clearly reveals this. There are multiple challenges in these regions that include governance failures, economic hardships, growing inequalities. Vulnerable groups like the internally displaced people, the refugees, and the migrants are suffering more. Obviously we need solidarity, resilience, good governance to prevent further misery.

A third point is that there has been an increase and intensification in geopolitical competition. The geopolitical rivalry between the US and China is both widening and deepening. The growing clash between these two powers leads to further instability and unpredictability.

## Turkish Foreign Policy in a Chaotic World

Countering these challenges, we implement an “Enterprising and Humanitarian Foreign Policy” under the leadership of our President Recep Tayyip Erdoğan and Foreign Minister Mevlüt Çavuşoğlu. How does this foreign policy approach differ from others? In simple language,

- We engage in world affairs actively and constructively.
- We place the human factor at the heart of our policies.
- We serve only for the well-being of people.

Beyond words, we accomplished solid outcomes. We take on leadership to develop regional cooperation mechanisms. We have fourteen trilateral or quadrilateral mechanisms among regional actors in the Balkans, Asia, the Middle East, and Eastern Europe. In the Balkans, we initiated two trilateral mechanisms with Bosnia and Herzegovina, Serbia and Croatia.

From our perspective the Balkans is a priority region because;

- Turkey is part of South East Europe. Geography, history, cultural and demography are key factors in this.
- There are millions Turkish citizens with Balkan origins. Large Turkish communities live in the region.
- We contribute to stability of the Balkans through NATO and regional organisations.
- This year, we took over the Term Chair for the South East European Countries Process for the third time.
- Our Term Chair priorities address challenges common to the region. These priorities include security, trade, culture-tourism, and connectivity and migration management.
- We also focus on cooperation to counter the coronavirus pandemic.

Turning to other regions, I would like to outline the following:

Our enterprising and humanitarian foreign policy underlines international law. This is why,

- We stand with those whose legitimate rights are violated.
- We stand with Azerbaijan in its struggle to restore its integrity.
- We support the integrity of Georgia, Ukraine and Moldova.
- We assist the U.N. recognized legitimate Libyan Government.
- And, in the East Mediterranean, we strive to protect our rights and the rights of the Turkish Cypriots.

As President of Turkey emphasized, “We neither violate the rights of others nor shall we allow anyone to violate what is ours”.

Our foreign policy provides answers to the pandemic conditions. We called for a collective global action for this global challenge. Our key message to the world is to promote international solidarity, cooperation and effective multilateralism.

To this end, we co-sponsored the UN General Assembly Resolution that called for a fair, transparent, and equitable access to essential medical supplies and future vaccines. We joined the EU's Coronavirus Global Response Conference. In short, we extended a helping hand to other nations.

We provided medical supplies to 155 countries and 8 international organizations. This is part of our Enterprising and Humanitarian Foreign Policy. Before the virus outbreak, we were already the top refugee-hosting country and most generous humanitarian donor. The coronavirus outbreak has just earned us another badge of honour. We became the second largest medical aid supplier. This is because we believe true friendship is tested during hardship.

During this crisis, we also took measures to care for our citizens and others. Since March, we brought back over one hundred thousand Turkish nationals from one hundred and forty-four countries. This is the largest evacuation operation in our history. Our evacuation flights carried over five-thousand and five hundred foreign nationals from sixty-seven countries. Having the fifth largest diplomatic and the fourth largest flight network in the world **enabled** to make this difference. Turkish Embassies and Consulates rushed to assist our citizens and others around the clock.

In accomplishing all these, digital outreach, effective governance and political leadership and play a defining role. With foresight, we were prepared for the digital challenge looming over the horizon. Last year, our Foreign Minister announced the "Digital Diplomacy" initiative.

Currently, we utilize the transformative power of technology in all aspects of our diplomatic work, including consular services, public diplomacy and policy analysis. We will continue to tap on the potential of big data and artificial intelligence in foreign policy.

Yet these steps are not sufficient alone. Effective governance and political leadership to address the challenges is more important than ever. With this understanding, Turkey's visionary leadership and institutional capacity demonstrated an impressive performance in facing this challenge. We employed a solid crisis management system. Well-supplied medical equipment procurement and production chains increased the quality of health service. Strong social support services to the vulnerable parts of the society are critical to our success. We left no-one unattended, or alone on his own. We also support medical research. We have 13 vaccine studies in the pre-clinical stage. Four of those will enter the clinical- human trial stage.

## Conclusion

Before concluding, I want to underline an emerging threat we all face in Europe. This is the threat of racism, xenophobia, Islamophobia and intolerance. Charlie Hebdo published so-called cartoons full of disgusting images aiming against our Prophet and our President. We condemn this savage effort by the strongest terms. This publication has nothing to do with freedom of expression. They are spreading cultural racism and hatred. Turkey, under the leadership of our President, is supporting millions of



people in need around the world. We host over 4 million refugees in our country. Those who have not lifted a finger to help women, children and disabled are now targeting our President with indecency. We will not remain silent in the face of these reckless attacks on our culture and religion no matter where it comes from. In the meantime, we call on all sensible European friends to fight back against this kind of primitive cultural racism and uncivilized discourse. With these in mind, we will continue our endeavours to make our foreign policy relevant to the realities of the post-pandemic world.

# Leadership in Complex Situations



Selmo Cikotić

**Abstract** Leadership is important in all aspects of the organizational life and functions, in all circumstances and anywhere. Whenever an organization is faced with challenges and risks, its leadership is expected to assume the burden of the risk assessment and to find best suited ways and mechanisms to pass the time of crises and complexity. Responsible organizations, therefore, invest into its capability to cope with times of challenges and chaos, by developing and nursing its own good and effective leadership. Emotional intelligence, ethics, triple helix concepts, specifics of leadership in Bosnia and Herzegovina have been discussed in terms of leadership within chaos and complexity in this chapter.

**Keywords** Leadership · Complexity · Chaos · Emotional intelligence · Ethics · Triple helix

## Introduction

Leadership is as old as human society is. It is needed everywhere, any time and in any kind of situation or circumstances. All kinds of human structures—groups, teams, companies and any kind of organizations or societies need leadership. The more complex the situation or circumstances, the more important role the leadership has got. The better the leadership, the more successful is the organization it leads. Psychology, business psychology, sociology, social psychology, modern business theories and many organizations and science theories have been dealing with leadership practical (empirical) and theoretic aspects. Within the United States there exist more than thousand universities teaching some kind of leadership aspects. Pacific region, characterized with fast and steady development pays a lot attention to the theory and application of leadership.

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## Understanding Leadership

Having completed the Harvard University Leadership Academy more than a decade ago, I engaged myself into a comprehensive approach to the leadership theory and practice. My intention to define leadership ended with a few hundreds of different definitions existing within different leadership theories and books.

I decided to create my own definition of leadership with an intention to include the best content of many different definitions I had collected and considered previously.

**Leadership**, therefore, could be defined as a *capability of the one who leads to inspire, motivate and persuade those who follow, based on common vision and within the given situation, to undertake the risk of change, to make the change and institutionalize it.*

Capacity of **vision** creation basically differentiate leaders from followers. Vision is capacity to see what others cannot see. Vision is *desirable and achievable picture of the future*. **Change** is an important element of leadership—if there is no change in certain process or interaction, we than don't speak about leadership, but about some formal position or relationship. For the leadership understanding, in any situation or realm, it is crucially important to analyze together three important elements—**the leader, the followers and the situation**. Leadership quality is defined by the strength and amount of followership. If there is no followership, the leadership does not exist. The situation, to a large extent, determines the conduct and effects of the work of the leader and the followers.

Dimensions of leadership are: concept, qualities and leadership process [1: 43]. **CONCEPT** encompasses ideas, hopes and impact on followers. **QUALITIES** include, but are not limited only to, integrity, selflessness, trust, wide vision, understanding, responsibility acceptance, decision-making, and competence. **LEADERSHIP PROCESS** reflects the capability of application and implementation of the concept and all leadership qualities. The concept and the qualities could be understood as the leadership prerequisites. Implementation process is the most sensitive and complex part of leadership. This is the case with many other processes, projects, strategies, politics. The leadership succeeds or fails in the implementation stage—during the process itself.

## Leadership Within Chaos and Complexity

Chaotic and complex situations need active, agile and often preemptive leadership. An increase of chaos and complexity of the situations demands leadership which is vital, flexible and thoughtful.

A good leadership in crises, largely overlaps with another organizational capability, often referred to as crisis management. This combination of capabilities include, also, risk management, and represent an intention to effectively lead the organization through a difficult and trying time of chaos and complexity, prepare

itself, the followers, the organization and a number of other elements, well before the crisis arises.

There exist many crisis management theories, which specifically deal with management of the crisis situations and recoveries after them. In order not to confuse my argumentation with similarities and differences of leadership and management, I'll just make two lines of distinctions between the two. Leadership is focused on people, while management keeps focus on organization and structure. A change is an essence of leadership whereas management tends to maintain existing process in function.

It's very important, to underline that there are more similarities than differences between leadership and management. They are both focused on the process, they both communicate with the people within the team or organization, perform different missions and tasks, and take the organization through complex risky and challenging situations.

Communication between the leader (or the manager) and the followers is important in all situation, in crisis and complex environment in particular. Communication integrates the qualities of speaking and listening of all its participants. It is hard to learn to speak well, but, it's even harder to learn to listen to, properly and well, especially if the one who listens want to understand the causes and end intentions of the one who speaks. This relations is best defined by our peoples proverb which suggests *the God gave us two ears to listen and one mouth to talk, and that proportion is to be respected.*

Responsible leaders consider and estimate possible contingencies they could be challenged with. They conduct certain contingency planning and considerations and prepare themselves, their followers and organizations for the best answers and reactions to those circumstances. They tend to prevent crisis from eruption. If they don't manage to exercise preemptive approach, then they lead the organization in a way which, to a highest possible extent, reduces the consequences of the crisis and return the organization to a standard way of operation.

The ability of an organization to accept sudden appearance of crisis, and to adjust itself to the crises demands, depends of the mental and emotional preparedness of the leadership of the organization and of its members.

## ***Emotional Intelligence and Leadership***

Apart from many other qualities and human characteristics that are very useful during tensions and chaotic situation, **emotional intelligence** could be considered to be exceptionally valuable. Emotional intelligence may be understood as an ability of an individual to control his own and emotions of others, negative emotions in particular.

Without it, a person can have the best training in the world, an incisive, analytical mind, and an endless supply of smart ideas, but he still won't make a great leader [2: 1].

This capability of emotionally intelligent people is most visible in times of uncertainty, crisis and chaos. It helps individuals to select emotions and actions which

contribute to positive approach and resolution of troublesome situation, while putting aside negative emotions and thoughts which restrict their productive thinking and acting.

Self-awareness is very important component of the emotional intelligence and team building mechanism. Self-aware people know—and are comfortable talking about—their limitations and strengths, and they often demonstrate a thirst for constructive criticism [2: 10].

Emotionally intelligent leaders make very productive atmosphere within their teams or organizations. Members of the team have got a strong sense of belonging to the team. They understand that they depend on each other, they are constantly ready to help and assist each other, and they all act coherently with other team players, believing that success of the team depends of contribution of every individual member. On the other hand, they comprehend that achievements and progress of every individual team member directly depends on the progress of the team.

Such an atmosphere of a team create stronger links between the team members, increase their mutual understanding and trust and help them communicate and work together much faster and stronger. Emotionally intelligent leader understands that his power and capacity to perform are directly dependent upon the quality and the strength of his team. He invests into the team unity, mutual understanding and functionality during the development of the team, which is exceptionally valuable in times of chaos and crisis. Such kind of leader is called **resonant leader**. A leader who doesn't create resonant and harmonious relations within the team is called dissonant leader.

### ***Ethic and Professional Component of Leadership***

Leadership, generally, depends on the character and human qualities of the leader, on one, and his professional knowledge, on the other side. The quality of leadership is mostly the marriage of the human dimension and value of the character of the leader and his (her) professional competencies and values."As Sergiovanni [3] implies in his distinction between moral and managerial imperatives, technical expertise without a moral compass is inadequate for the task, as is a moral compass without technical expertise" (in Starratt [4]: 4).

### ***Triple Helix and Leadership***

Leadership during chaotic and complex situations may be expected to be effective and successful if it prepares itself for such circumstances well before they occur. In the world of constantly increasing uncertainty and growing overall social speed of change some regular relations and functions bring the quality of all participating organizations to a higher level, on one side, and also elevate the quality of all these

organizations individually, on the other side. Such functioning link of every prosperous modern state and society, linking together *state, economy and university* is known as **triple helix**.

Triple helix means constant exchange of knowledge, experience and ideas of all participants, whereas the participants, apart from their own ones, take part of responsibilities of other participants. *Human resources management* is in the center of this exchange. Triple helix is an excellent environment for the development of **knowledge-based economy** and also for the increasingly important trend of *socially responsible corporations*.

There are some other consequences of triple helix, projectable on both society and individuals, relevant for the leadership in chaos and crises—this kind of state and social functional connections and mechanism significantly reduces the alienation effect. Alienation effect is a frequent consequence of the modern tempo and style of life. Alienation additionally increase the burden of crises situations, on individuals and organization. Triple helix reflects the interaction of global trends and local developments—global development includes local dynamism and local changes reflects variations of higher-level systems [5].

## Specifics of Leadership in Bosnia and Herzegovina

Contemplating leadership in Bosnia and Herzegovina in times of chaos, complexity and crisis, we need to have in mind some specifics of the country related to the position, history and present day. It's a state whose millennium long past testifies about the state existence between different worlds—empires, religions, cultures and spheres of influence. The history of Bosnia and Herzegovina is history of survival and protection of its identity, its freedom and its right to live its own specific amalgam of cultural, religious, political and ethnic spirit, throughout history known as Bosnian spirituality. Bosnian spirituality reflects specific way of living and thinking, in politics, literature, art, and in many areas of everyday life of its citizens, regardless if their political, ethnic, or religious background.

Leadership in Bosnia and Herzegovina may not produce long lasting influence and positive impact on the course and quality of life within the country if it ignores this kind of specific spirituality which is, in a specific fashion integrated into the history, geography, society, culture, politics and habits and behavioral patterns of its people.

To be effective and capable of meeting the demands of the actual time and space of its performance, the leadership in Bosnia and Herzegovina needs to respect the state's past, the state's political geography and the state's peculiar political circumstances.

The past of Bosnia is a long struggle for survival and constant need to convince itself and the others of its own capacity and ability to exist as a self-sufficient actor of regional and broader international affairs.

The country's peculiar political circumstances have been created by long historic mixture of diversified ethnic, religious, cultural and political influences within the

state and from the state's immediate surrounding. Very often, in the political practice of Bosnia and Herzegovina, some eminent internal affairs issues, need to be discussed with the capitols of the neighboring states first, and then settled within the state. The impact of the neighboring states is often against interest Bosnia and Herzegovina and even against the interest of those in whose name is allegedly performed.

There are many other specifics of the state and society of Bosnia and Herzegovina, which need to be reckoned with if someone wants to be fully adjusted with the state's reality and complexity.

For all above mentioned reasons and in accordance with the regional and global social and political trends, the leadership in Bosnia and Herzegovina is not just invited, but obliged to practically lead in troublesome and complex circumstances. The lasting characteristics of the leadership in Bosnia and Herzegovina provide the prerequisites of this leadership to be effective and workable in times of chaos and complexity.

The long lasting and recent experience of this leadership suggest some universally applicable principles, applicable in all times and circumstances—dark can't be defatted by dark, hatred can't be defatted by hatred—we need light and love to move the situation to some upper level at which we may expect some positive changes.

## **Conclusion**

Leadership is important in all aspects of the organizational life and functions, in all circumstances and anywhere. Whenever an organization is faced with challenges and risks, its leadership is expected to assume the burden of the risk assessment and to find best suited ways and mechanisms to pass the time of crises and complexity. The basic role of leadership then is to preempt or reduce the negative effects of the crises and to return to favorable or normal (usual) function patterns.

Responsible organizations, therefore, invest into its capability to cope with times of challenges and chaos, by developing and nursing its own good and effective leadership. The development of effective leadership require the preparedness of the whole organization to stick to its leadership, which at the times of crises pays back its best effects and values.

Good leadership resonates the needs, expectations and capacities of its followers and the entire organization. Good leadership, in time of peace and favorable conditions prepare itself, its followers and its organization for the crises and all kind of challenges that might affect the organization.

Good leadership resolves many crises even before they arise or develop. But, whenever development of situation doesn't allow preventive approach to avoid the eruption of crises, it then activate all capacities and capabilities of every member of the organization, and the entire organization, into the fight against the threat and return to normality of the organizational practice.

Investment into good leadership and proactive followership of the organization is an investment into the resilience of the organization and the capability of the organization to fight and win all risks, challenges and threats it may be faced with.

## References

1. Cikotić, S. (2017). *Liderstvo, Teorija I Praksa*, Šahinpašić, Sarajevo.
2. Goleman, D. (2011). *What makes a leader, on leadership, HBR'S 10 must read*. Boston: Massachusetts.
3. Sergiovanni, T. J. (1992). Moral Leadership. *NASSP Bulletin*, 76(547), 121–121. <https://doi.org/10.1177/019263659207654719>.
4. Starratt, R. J. (2004). *Ethical leadership*. Jossey-Bass.
5. Etzkowitz, H., & Dzisah, J. (2011). The triple helix of innovation. *ATDF Journal*. (Newcastle University, 2011).



# Neurochaos: Analyzing the Brain and Its Disorders from a Physics Perspective



Mariam Kavakci

**Abstract** From stock market dynamics to biophysical variability, many investigations for understanding chaotic behaviors in complex systems have been undertaken. Mathematical models have been developed to reproduce the conditions and approximate end results in these systems with theoretical success albeit limited ecological validity. More recently, however, scientists have been pondering the role of chaos in neuroscience, especially in relation to pathophysiological mechanisms. Does chaos theory have a role in the central nervous system? Can it help explain why some individuals' brains go awry? Discussion of these and similar questions with potentially promising avenues of research are suggested in this chapter.

**Keywords** Neurochaos · Pathophysiological mechanisms · Brain disorders

## Introduction to Chaos Theory

The concept of chaos implies a state of confusion, or disorder. Chaos theory is the mathematical approach that aims to explain the state of such systems [29]. These are dynamic systems with apparent random states of irregularities and disarray, in which the states are governed by deterministic laws. In other words, what appears to be random in various systems, biological or otherwise, may not necessarily be stochastic in nature. Furthermore, the underlying patterns that are embedded in these systems are highly sensitive to the perturbations in the initial state of that system. A fractional change in a given non-linear deterministic system can result in significant changes to subsequent states, highlighting a dependence on initial conditions [12]. *Poincaré* summarizes this notion in his essay *Science and Method* writing:

*It may happen that small differences in the initial conditions produce very great ones in the final phenomena. A small error in the former will produce an enormous error in the latter. Prediction becomes impossible, and we have the fortuitous phenomenon.*

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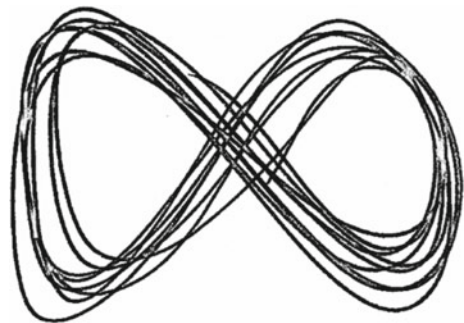
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Time and constant change are the fundamental variables that makeup chaos. The weather, food prices, population numbers, and industrial averages all change with time. With determinism originating from Laplace, Henri Poincaré developed chaos theory specifically to study the evolution of physical systems [31], and in the early 1960s, Edward Lorenz rebirthed the notion. Lorenz, a meteorology professor, wanted to evaluate his hypothesis that using mainframe computers in testing launching satellites and planning weapons would aid in giving error-free weather forecasts [27]. Given that weather is determined by a combination of variables such as pressure, wind velocity, and temperature, Lorenz constructed a series of equations and coded them into special vacuum-tube-based computers. Unlike other programs, Lorenz discovered that his program yielded somewhat different forecasts. He later discovered that the computer printout had rounded decimal values for the data, resulting in a minutely different set from the original data. This tiny alteration in the initial conditions resulted in drastically different results from what Lorenz had expected [14]. Lorenz coined the term “butterfly effect” to refer to the extreme sensitivity to initial conditions and its consequences (i.e., metaphorically the flapping of a butterfly’s wings resulting in a tornado elsewhere later in time).

Naturally, the presence of chaos means the absence of order, and this is where chaos can pose a problem. In the scientific world, forecasting future behaviors of a system, be it financial, political, or biological, is of critical importance. Chaotic behaviors can make it near impossible to forecast that particular system’s behavior. Deciphering the nature of chaos and the underlying patterns is essential as far as scientific inquiry is concerned [4].

Upon his discovery of chaos and identification of its key mechanisms, Lorenz described the theory as studying random and unpredictable behaviors in systems under deterministic laws [29]. The notion of “deterministic chaos” is well recapitulated by this phenomenon. When graphing his data on several axes, Lorenz noticed that plotting the trajectory of nearby points influenced their separation. The extent of the separation would continue until different regions appeared. Upon iteration, the plotted points would reorganize themselves, resulting in unexpected results which somewhat ironically resembled the shape of a butterfly (Fig. 1). Lorenz called these

**Fig. 1** Lorenz strange attractor



peculiar and complex formations “strange attractors” [40]. Numerous strange attractors would soon be discovered, including the Hénon attractor identified by mathematician Michael Hénon and the Poincaré–Bendixson theorem that posits a strange attractor can appear only in three or more dimensions.

Errors in measurement or numerical computation that change the initial conditions of a system can result in diverse outcomes or altered systems, rendering any long-term predictions useless [21]. Although determinism does not necessarily make a system better; it indicates that future behaviors follow a unique revolution determined by initial conditions with little involvement of stochastic behaviors [3]. As the terms suggests, deterministic chaos is somewhat of a paradox, connecting two scientific notions that were traditionally viewed as incompatible. Nonetheless, it is now understood that deterministic chaos is ubiquitous. Chaotic behavior exists in many natural systems such as heartbeat irregularities, fluid flow, and of course, the climate [19]. Likewise, chaotic behaviors occur spontaneously in some artificial components systems such as road traffic and the stock market. Behaviors in these systems can be examined with sophisticated mathematical models and other techniques such as Poincaré maps or recurrence plots.

Scientists have attempted to solve non-linear equations for several decades now, and from each discipline, valuable contributions have been made. From a meteorologist’s discovery of the first strange attractor in the process of understanding whether unpredictability to a biologist who promoted the study of the quadric map in understanding population dynamics [9] and later, the contributions of engineers, applied mathematicians, and computer scientists that spearheaded problems in their respective fields using non-linear dynamical system approaches. Perhaps the greatest appeal of non-linear dynamics is that it enables interdisciplinary research, incorporating views from different scientific fields such as mathematics and physics [43]. Although the conception of chaos theory was first through observing weather patterns, the theory has become applicable in various disciplines and situations. For example, it has been applied to the field of robotics, where the theory has aided in constructing new technologies [46]; psychology, where the theory is used to guide cognitive analysis of the mind [1]; and most recently in public health, where dynamics of pandemics such as COVID-19 have been investigated [32].

## **Non-linearity in Neurophysiology**

The CNS has often been praised as the primary home of all bodily functions and mental activities. In addition to life sustaining functions and cognitive abilities, the brain is what gives us special traits and skills. Some of the most complex traits of humans that traditional scientific approaches cannot explain in entirety include language, emotions, and mental illness.

The notion of regularity in natural processes is outdated, thus the continued use of linear approaches as the sole method of analysis is insufficient for understanding the brain and other biological systems. Many variables in biological data including

neural activity possess non-linear characteristics and temporal variability. In this context, chaos theory attempts to shed new light on cognitive functioning and the processes that lead to dysfunction. Instead of looking at the brain in traditional ways, researchers are now starting to examine the brain as a system of networks. A healthy brain establishes connections and ensures accuracy during the period of information transfer. When functioning properly, the numerous networks support cognitive abilities such as problem-solving, executive function, attention, and language.

For the brain to function effectively, it must adapt to the outside world, even though spontaneous brain activity emerges without external forces. Accordingly, the human brain must be gauged to reformulate its internal connections accurately [12]. In a relatively small network of neurons, each component is considered critical and in some cases discernible functions can be assigned to each. When examining the brain as a whole however, each neuron's contribution may appear insignificant in contrast to the complex operations of its larger networks [7]. Research in this context has focused on activity at both the neuron level and the network level. Chaotic phases, however, are typically properties of large networks which exhibit random-like activity [24, 39].

## Applications to Neuroscience

The interdisciplinary feature of non-linear systems theory provides an advantage for researchers interested the relationship between chaos and the brain. Indeed, need to understand the connections and the interactions between macroscopic and microscopic levels of the various activities investigated that involve cellular activity, behavioral patterns, neural assemblies, and other activities that are generated by nerve cells requires sophisticated tools and models to understand their functioning. It is critical that the models and methodologies employed are adapted to handle biological time-series data, both noisy and non-stationary [12].

When investigating chaos in the central nervous system (CNS), there is a need to determine how stochastic patterns can be distinguished from deterministic ones [41]. To this end, ascertaining whether the observed variability in neural activations is characterized by some underlying deterministic order or by true randomness is of critical importance. As Bob [4] points out, variability is an essential ingredient for survival and successful behavior in all living systems. This further implies the need to determine how the effects of noise can be separated or distinguished from those that come from multiple interacting non-linear elements.

The mind-brain relationship is an area of research that also has attracted a lot of attention over the last decade. In an attempt to understand this relationship, studies continue to investigate various trends in cognitive neuroscience and psychology with application of chaos theory and non-linear dynamics showing promise. In this realm, interesting areas of exploration have included determining the explanatory power of chaos theory on altered mental states and the transition between mental states leading to dissociation.

When the field of neuroscience was in its infancy, some researchers believed that the cognitive basis of human behavior was at the individual level of neurons. According to Hubel & Wiesel [16], the single unit approach to brain functioning or the neural doctrine presumed that behavior could be explained by activity of individual cells triggered by a stimulus. Chaos theory, however, doesn't completely support this view. While the neuron is the most basic unit of the brain, complex electromagnetic phenomenology, multiple neurotransmitters, and instability due to autonomous activities can have an overwhelming influence on neural activity. The brain does not function passively in reaction to stimuli and any theory assuming so would be over-simplistic. Rather, the brain is a chaotic system that must be studied as a whole taking into consideration factors such as internal feedback [11]. In this sense, chaos theory offers a more ideal and holistic view.

With the advent of neuroimaging technology, the existence of networks in the brain gained widespread support. The brain's collective dynamics have been investigated from a mathematical physics point-of-view with further support from empirical studies. For example, Haghghi and Markazi [38] investigated mechanisms of seizure generation in epilepsy and found evidence for the contribution of non-linear processes. Further evidence from electroencephalographic (EEG) recordings from the cortex of the brain (similar to electrocardiography data from the heart) have provided support for the hypothesis that brain activity is chaotic and, to an extent, unpredictable [8, 20]. Strange attractors have also been observed in data plotted on phase-space diagrams. These fractal strange attractors in the brain begin to reorganize themselves during cognitive process differentiation [6]. As Hebbian learning suggests, neurons and their connections must be used regularly to keep them alive [28]. Perhaps the unexpected firing of inactive neurons serves as a mechanism for maintaining brain health, making chaos essential for a healthy functioning brain. Furthermore, while background noise in the brain is stable, its electrical activity appears to be chaotic. Chaotic responses and activity allow rapid state transitions necessary for information processing [37]. In the absence of these transitions, cognitive processes such as sensation and perception would be extremely slow. Moreover, the human body is a dynamic and complex system; the body's physiology, including the brain, is similar to that of nature and takes on fractal dimensions. It is safe to say that human beings are creatures of chaos.

### ***The Complexity of Neuroscience and Chaos Theory***

The omnipresence of chaos is perhaps one of the many reasons why the search for chaotic patterns has occupied many researchers in the past few decades, including neuroscientists. As Friston [12] explains, future research on neural systems and other higher brain functions will most likely focus on combining traditional reductionist neuroscience with non-linear science. However, applying concepts and tools developed to describe noise-free and low dimensional mathematical models to biological systems such as the brain has not been easy [4]. The question of how neurons in the

human brain assemble and give rise to a complex biological machine that outperforms even the most advanced computers continues to motivate research in this area.

The CNS is infamously complex. This complexity emerges from the interaction of different elements and variables resulting in a non-linear dynamical system [13, 36]. The intricate interplay makes it challenging to understand even the healthy brain's functioning fully. Although significant advances have been made in the understanding of genetics and behavior of neural systems over the past decade, a plethora of questions remain unanswered.

Perhaps one of the most significant complexities is the structure and wiring of the human brain. Neurons, approximately  $8.6 \times 10^{11}$  of them in the human brain, emerge from a combination of extracellular signals and transcription gradient factors acting on neocortical cells [33]. These neurons connect with each other forming over one hundred trillion synapses [23]. Furthermore, new evidence for the brain's ability to produce new neurons adds to the already overwhelming complexity of the system [22].

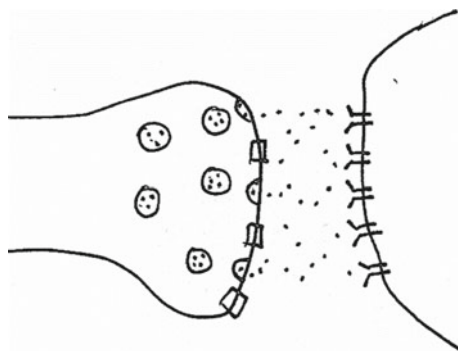
Developing in parallel with these complex connections are chaotic patterns. Using models such as the Huxley and Hodgkin model and the Hindmarsh and Rose model of bursting neurons, researchers attempt to determine the non-linear patterns in higher brain functions [24]. Based on a radical hypothesis, the brain's processing, perception, and storage capabilities may be the end-result of strange attractors. Thus, modifications in the system can result in variation of cognitive outputs. Once again, initial status is critical for the final product of a system. Regulation of excitatory and inhibitory activity in neural circuits is necessary for functional stability [25]. In other words, optimal brain functioning requires a healthy balance between inhibition and excitation processes and failure to maintain this balance may result in various neuropsychiatric conditions [15].

## *Chaos and Disorder*

An important question concerns the processes that characterize neurologic and psychiatric disorders. In this context, the application of chaos theory has been valuable for understanding a variety of pathologies [5, 34]. For example, principles of non-linear dynamics have been used to analyze and interpret EEG recordings in patient populations [8]. Chaos theory has also opened up possibilities for studying the relationship between environmental and genetic factors in various pathologies [4].

Non-linear system research has revealed critical functions and characteristics of both physical and biological systems. Findings in particular have highlighted the appearance of random events across time, resulting in identification of mathematical elements of different systems. Some examples of this phenomenon include the variability of heartbeats, the coding sequences of DNA, and the flow of information across neurons. Identification of these patterns is critical to understanding both

**Fig. 2** Neurotransmitter release



normal and pathological processes. With a solid understanding about complex functions and chaotic systems, it may be possible to differentiate between healthy and unhealthy levels of chaos in the brain [42].

In understanding disorders of the brain, neurotransmitters have a critical role. When released, these chemical molecules have the critical task of carrying messages between neurons via synapses (Fig. 2).

Neurotransmitters, namely dopamine, serotonin, glutamate, gamma-aminobutyric acid (GABA), and acetylcholine, are associated with different disorders of the CNS [18]. These neurotransmitters are responsible for behavioral, psychological and cognitive patterns of activity. Because dopamine has been implicated in a vast number of diseases, it has been one of the most widely researched neurotransmitters. Dopamine receptors are divided into two main categories. This first category consists of D1 and D5 receptors. These receptors are responsible for the activation of adenylyl cyclase enzymes. The second category of dopamine receptors is the D2, D3, and D4 receptors. Their primary function is to inhibit the adenylyl cyclase enzymes [42]. Given this complex interaction, it is not surprising that dopamine is associated with pathways linked to addiction disorders, psychosis, and bipolar disorder. Other conditions related to dopamine include Parkinson's disease [45], restless leg syndrome [44], and attention-deficit hyperactivity disorder [35].

Serotonin, another well-studied neurotransmitter, usually behaves as a multi-functional biochemical particle. This is demonstrated by its distinguishing role in behavioral and mood patterns. Serotonin imbalances are associated with epileptic seizures [2], migraine [17], and major depressive disorder [10] just to name a few examples.

GABA is defined as one of the primary inhibitory neurotransmitters. It is responsible for regulating excitement levels and muscle tones. Its receptors are usually associated with drugs that act as modulators. A surplus of GABA in the CNS is usually associated with anxiety reduction and anti-convulsion. Abnormally low levels of GABA are usually associated with anxiety disorders and convulsive disorders such as epilepsy [42].

Acetylcholine has a modulatory role in the CNS. It is present in the neuromuscular junction, the parasympathetic system, and the autonomic nervous system and has

been associated with issues of learning, motivation, attention, arousal, and addiction. Problems in the production and regulation of acetylcholine have also been linked to memory impairments, a hallmark of Alzheimer's disease [42].

Noradrenaline is a neurotransmitter in the catecholamine family. As such, it can be identified as both a hormone and a neurotransmitter. Noradrenaline is produced from different sources, including the sympathetic ganglia and is responsible for the mobilization of functions such as alertness, arousal, and attention. Based on the current evidence, noradrenaline plays a vital role in pathologies. Some of the health issues associated with this neurotransmitter include different psychiatric disorders and neuropathic pain [42].

The disorders mentioned above are associated with a malfunction in the production and/or regulation of different neurotransmitters. For instance, movement disorders such as Parkinson's disease are attributed to issues with dopamine and serotonin production [30, 42] and epilepsy, can be attributed to dysregulation of dopamine and GABA production. In addition to neurochemical factors, atypical electrical activity observed in epilepsy has also been shown to be consistent with chaotic systems [34].

Needless to say, the interaction of neurotransmitters through various receptors is notably complex, even in the normal brain. This vulnerability however, is not specific to neurotransmitters or just to healthy brains. Disruption in the fluid dynamics of the brain or electrical activity can play a role in mental illnesses. Moreover, application of chaos theory and non-linear analyses have proven to be a valuable approach for understanding psychiatric conditions including psychosis, bipolar disorder, depression, and schizophrenia [26, 42]. In concordance with chaos theory, a small imbalance or oscillation in the brain can result in a system that functions unpredictably. Based on the evidence to date, it appears that this may very well be the case in neuropsychiatric conditions.

## Summary

Neural activity, like other biological processes, is inherently non-linear. The application of chaos theory and non-linear system approaches to physiological processes has contributed to the field of neuroscience over the last few decades. While many questions still remain, theoretical and empirical evidence continues to grow rapidly. An interdisciplinary approach including physics, mathematics, neuroscience, and related fields will be beneficial for furthering our understanding of chaotic mechanisms in biological systems. Research on both healthy and disordered populations is needed to delineate the nature and function of chaos in the brain and to develop new models of neuropathology.



## References

1. Ayers, S. (1997). The application of chaos theory to psychology. *Theory & Psychology*, 7(3), 373–398. <https://doi.org/10.1177/0959354397073005>.
2. Bagdy, G., Kecskemeti, V., Riba, P., & Jakus, R. (2007). Serotonin and epilepsy. *Journal of Neurochemistry*, 100(4), 857–873. <https://doi.org/10.1111/j.1471-4159.2006.04277.x>.
3. Bishop, R. (2017). *The stanford encyclopedia of philosophy*. Metaphysics Research Lab, Stanford University.
4. Bob, P. (2007). Chaos, brain, and divided consciousness. *Acta Universitatis Carolinae. Medica Monographia*, 153, 9–80.
5. Boldrini, M., Placidi, G. P., & Marazziti, D. (1998). Applications of chaos theories to psychiatry: a review and future perspectives. *CNS Spectrums*, 3(1), 22–29.
6. Briggs, J. (1992). *Fractals: The patterns of chaos*. New York: Schuster Inc.
7. Buzsáki, G. (2006). *Rhythms of the brain*. Oxford University Press.
8. Dana, S., Roy, P. K., & Kurths, J. (2009). Complex dynamics in physiological systems: From heart to brain. <https://doi.org/10.1007/978-1-4020-9143-8>.
9. Devaney, R. L. (1989). Dynamics of simple maps in chaos and fractals: The Mathematics behind the computer graphics. In *Proceedings of Symposia in Applied Mathematics*.
10. Fakhoury, M. (2016). Revisiting the serotonin hypothesis: implications for major depressive disorders. *Molecular Neurobiology*, 53(5), 2778–2786. <https://doi.org/10.1007/s12035-015-9152-z>.
11. Freeman, W. J. (1994). Chaos in the CNS: Theory and practice. In *Neural modeling and neural networks* (pp. 185–216).
12. Friston, K. J. (2011). Models of brain function in neuroimaging. *Annual Review of Psychology*, 62, 57–87.
13. Glanz, J. (1997). Mastering the non-linear brain. *Science*, 1758–1760.
14. Gleick, J. (1987). *Chaos: Making a new science* (p. 17). London: Cardinal.
15. He, H., & Cline, H. T. (2019). What is excitation/inhibition and how is it regulated? A case of the elephant and the wisemen. *Journal of Experimental Neuroscience*. <https://doi.org/10.1177/1179069519859371>.
16. Hubel, D. H., & Wiesel, T. N. (1962). Receptive fields, binocular interaction and functional architecture in the cat's visual cortex. *The Journal of Physiology*, 160(1), 106–154. <https://doi.org/10.1113/jphysiol.1962.sp006837>.
17. Humphrey, P. P., Feniuk, W., Perren, M. J., Beresford, I. J., Skingle, M., & Whalley, E. T. (1990). Serotonin and migraine. *Annals of the New York Academy of Sciences*, 600, 587–600. <https://doi.org/10.1111/j.1749-6632.1990.tb16912.x>.
18. Ivancevic, T., Jain, L., Pattison, J., & Hariz, A. (2009). Non-linear dynamics and chaos methods in neuro-dynamics and complex data analysis. *Nonlinear Dynamics*, 56, 23–44.
19. Ivancevic, V. G., & Tijani, T. (2008). *Complex nonlinearity: Chaos, phase transition, topology change, and path integrals*. Berlin: Springer.
20. Ives, C. (2004). Human beings as chaotic systems. *Life Science Technology*, 1–7.
21. Kellert, S. H. (1993). In the wake of chaos: Unpredictable order in dynamical systems. University of Chicago Press.
22. Kempermann, G., Gage, F. H., Aigner, L., Song, H., Curtis, M. A., Thuret, S., et al. (2018). Human adult neurogenesis: evidence and remaining questions. *Cell Stem Cell*, 23(1), 25–30. <https://doi.org/10.1016/j.stem.2018.04.004>.
23. Korade, Ž., & Mirmics, K. (2014). Programmed to be human? *Neuron*, 81(2), 224–226. <https://doi.org/10.1016/j.neuron.2014.01.006>.
24. Korn, H., & Faure, P. (2003). Is there chaos in the brain? II. Experimental evidence and related models. *Comptes Rendus Biologies*, 326, 787–840.
25. Kozachkov, L., Lundqvist, M., Slotine, J. J., & Miller, E. K. (2020). Achieving stable dynamics in neural circuits. *PLoS Computational Biology*, 16(8), <https://doi.org/10.1371/journal.pcbi.1007659>.

26. Lainscsek, C., Sampson, A. L., Kim, R., Thomas, M. L., Man, K., Lainscsek, X., et al. (2019). Nonlinear dynamics underlying sensory processing dysfunction in schizophrenia. *Proceedings of the National Academy of Sciences of the United States of America*, 116(9), 3847–3852. <https://doi.org/10.1073/pnas.1810572116>.
27. Lorenz, E. (1963). Deterministic non-periodic flow. *Journal of Atmosphere Sciences*, 20(2), 130–141.
28. Munakata, Y., & Pfaffly, J. (2004). Hebbian learning and development. *Developmental Science*, 7(2), 141–148. <https://doi.org/10.1111/j.1467-7687.2004.00331.x>.
29. Oestreicher, C. (2007). A history of chaos theory. *Dialogues in Clinical Neuroscience*, 9(3), 279.
30. Paulus, M. P., & Braff, D. L. (2003). Neuroscience perspectives: Chaos and schizophrenia: Does the method fit the madness. *Society of Biological Psychiatry*, 53, 3–11.
31. Poincaré, H. (1899). New methods of celestial mechanics. Gauthier-Villars.
32. Postavaru, O., Anton, S. R., & Toma, A. (2021). COVID-19 pandemic and chaos theory. *Mathematics and Computers in Simulation*, 181, 138–149. <https://doi.org/10.1016/j.matcom.2020.09.029>.
33. Sansom, S. N., & Livesey, F. J. (2009). Gradients in the brain: The control of the development of form and function in the cerebral cortex. *Cold Spring Harbor Perspectives in Biology*, 1(2), <https://doi.org/10.1101/cshperspect.a002519>.
34. Sarbadhikari, S. N., & Chakrabarty, K. (2001). Chaos in the brain: a short review alluding to epilepsy, depression, exercise and lateralization. *Medical Engineering & Physics*, 23(7), 445–455. [https://doi.org/10.1016/s1350-4533\(01\)00075-3](https://doi.org/10.1016/s1350-4533(01)00075-3).
35. Sharma, A., & Couture, J. (2014). A review of the pathophysiology, etiology, and treatment of attention-deficit hyperactivity disorder (ADHD). *The Annals of Pharmacotherapy*, 48(2), 209–225. <https://doi.org/10.1177/1060028013510699>.
36. Siegelmann, H. T. (2010). Complex systems science and brain dynamics. *Frontiers in Computational Neuroscience*, 4(7). <https://doi.org/10.3389/fncom.2010.00007>.
37. Skarda, C. A., & Freeman, W. J. (1990). Chaos and the new science of the brain. *Concepts in Neuroscience*, 1(2), 275.
38. Sohanian Haghighi, H., & Markazi, A. (2017). A new description of epileptic seizures based on dynamic analysis of a thalamocortical model. *Scientific Reports*, 7(1), 13615. <https://doi.org/10.1038/s41598-017-13126-4>.
39. Sompolinsky, H., Crisanti, A., & Sommers, H. J. (1988). Chaos in random neural networks. *Physical Review Letters*, 61(3), 259–262.
40. Sparrow, C. (2012). *The Lorenz equations: Bifurcations, chaos, and strange attractors* (p. 41). Springer Science & Business Media.
41. Toro, M. G., Ruiz, J. S., Talavera, J. A., & Blanco, C. (1999). Chaos theories and therapeutic commonalities among depression, Parkinson's disease, and cardiac arrhythmias. *Comprehensive Psychiatry*, 40(3), 238–244.
42. Tsatsaris, A., Domenikos, S., Psychos, C., & Moutsionas, D. (2016). Chaos theory and behavioral patterns: A theoretical approach to psychosis, bipolar disorder, and depression. *Journal of Advanced Biotechnology and Bioengineering*, 4, 2–8.
43. Tuffillaro, N. B., Abbott, T., & Reilly, J. (1992). An experimental approach to non-linear dynamics and chaos (pp. 138–145).
44. Venkateshiah, S. B., & Ioachimescu, O. C. (2015). Restless legs syndrome. *Critical Care Clinics*, 31(3), 459–472. <https://doi.org/10.1016/j.ccc.2015.03.003>.
45. Warren, N., O'Gorman, C., Lehn, A., & Siskind, D. (2017). Dopamine dysregulation syndrome in Parkinson's disease: A systematic review of published cases. *Journal of Neurology, Neurosurgery and Psychiatry*, 88(12), 1060–1064. <https://doi.org/10.1136/jnnp-2017-315985>.
46. Zang, X., Iqbal, S., Zhu, Y., Liu, X., & Zhao, J. (2016). Applications of chaotic dynamics in robotics. *International Journal of Advanced Robotic Systems*. <https://doi.org/10.5772/62796>.

# Creativity with Big Chaotic Data



M. Şahin Bülbül

**Abstract** Big data is a concept that is more on the agenda with increasing data sources. One of the most important features of big data is that there is a structure that continues to flow continuously (streaming). It is not that the input of the same data is continuous. Big data is generated by the accumulation of variable data in a non-stop/continuous system. From this point of view, we cannot say that big data is in a regular structure. The chaotic structure should be examined with chaotic methods. The concept of creativity also has a chaotic structure. Neural networks formed by perceptions in the brain are stimulated by some other perceptions. The fact that neurons stimulate different networks with unexpected reactions creates ideas that may seem strange in our minds. If this formation is a new idea for us and others, this is called the creative idea. This unexpected behavior of the brain is related to the proximity of nerve cells and their transmission. The transmitting signals operate in different ways. Formal differences are also effective in signal formation. Neurons that are actively activated outside the neurons that are active in parallel to the perceptions are, in one aspect, similar to big data. This study aims to explain how to create brain creativity by using big data and artificial intelligence through the equivalence of chaotic structures in the informatics world. If we let two models of two different types of interdependencies depend on time and examine the states of change according to each other, the strange attractors to be determined by artificial intelligence will be the creative ideas that will be presented to the insurgency.

**Keywords** Chaos · Creativity · Artificial intelligence · Big data

## Introduction

The knowledge accumulated by humanity is increasing day by day. This increase in knowledge brings along some other problems, such as storing information and protecting information. Digital data which is constantly increasing, continuous and

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not able to analyze by classical methods is called big data [1]. Big data does not differ only in terms of analysis method. The two main reasons for the analysis of big data by different methods are that they are very large and very complex [2].

Big data has five basic components. These; variety, velocity, volume, veracity and value [3, 4]. Understanding these components is crucial to understanding big data. Variety, big data consist of data from many mediums and these differences make analysis difficult. For example, the data of the number of steps from the mobile-phone and the instantaneous temperature values at the location of the owner of the telephone can be combined to generate big data. For this reason, it is important that the data flowing into the system can be converted and integrated. Velocity is very important to process big data. In this sense, systems that store and process big data need to be sufficient for both high-speed software and hardware. The input speed of the data entering the system is another data. In addition, continuous, fast and large amounts of this data needs to verify the input. Big data without a validation system is polluted and analysis becomes difficult. When we want to think about the size of big data, we can give the example of social media. The social media used by millions can only be used to compute the loaded video and images, and to understand the magnitude of the data. If you add transaction data such as rating (like), deletion and removal on this data, big data can be better understood. Companies with big data are valued for this data. According to big data, other data are known as ordinary data that do not add value to the company or the institution.

The concept of creativity will be handled as a brain function of man in this study. A new connection between brain cells alone is not enough for a creative idea. If individuals who think or hear this idea do not find it meaningful and original, we cannot say creative for the idea. So creativity; it needs to be able to reveal what is needed in its original form [5]. A new and meaningful structure within big data, such as a new link in the brain, is an important clue to understanding the data source. Finding sequential, repetitive structures between data and revealing the relationship of these structures with other structures means learning artificial intelligence which analyzes big data. Therefore, the question “in which cases creativity resembles and separates for big data with a complex and chaotic structure?” constitutes the subject of this research.

## **Chaotic Big Data**

When it was analyzed, being natural is necessary and sufficient to be chaotic big data. If the data is not produced by a robotic system and is derived from natural structures, it will probably show a chaotic structure. Although it is difficult to obtain big non-chaotic data, data filters or data duplicators can make the data entered into the system substantially regulated. This is not a desired situation. Artificial intelligence can be used to learn more regular data. Of course, it is possible to develop chaotic data sensitive systems, but regular data can be coded. The ability to be codable makes the system learnable. Artificial intelligence can more easily analyze the data with regular structure and the existing algorithm can easily solve the structure behind

the event. In this sense, the most important difference between human and artificial intelligence is creativity.

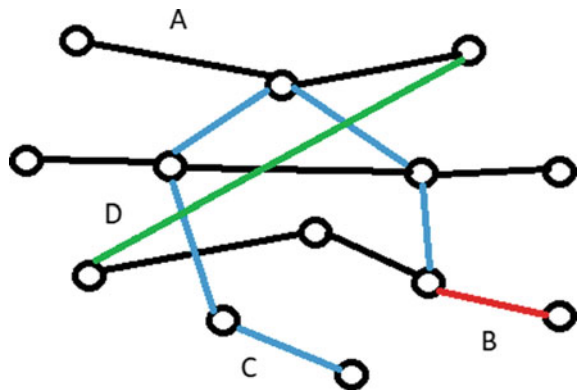
### Creative Robots

The process of creating an idea on big data is actually a process of establishing a new connection. However, not every new link may be defined as a creative action. Sometimes the new connection can be described as an unnecessary and useless link. In this sense, artificial intelligence, which will make a creative discovery on data, needs some features. These features can also make robots creative.

First of all, a creative idea is that there is an original connection that is not in parallel with the existing connections beyond a new connection. Unlike other connections, it should be outside of the general algorithm. An unusual and new connection doesn't mean that we have a creative connection. In addition to being a new and original connection, the connection should also be useful for the buildings that will use the idea. For example, it may be a creative idea to discover a short process instead of a long-running process for a robot that is programmed to use its energy economically. A longer-term operation with the same result is not considered to be the same creativity.

If we consider a concept network (Fig. 1), it is likely that the structure dominant on this network is parallel to one another (connection A). When we want to create a new connection, the connections that are appropriate for the current situation are perceived as being ordinary because they are new (for example B connection). Connections outside of the existing structure (such as C and D connections) must be a new and original connection. Both new and original connections are subjected to another process. The name of this new transaction is usefulness. If the new connection does not work, it is not used, and an unused innovation will not cause any transformation in the system, no matter how original. Artificial intelligence should solve the routine algorithm of big data, try / test all possible situations/connections and finally compare

Fig. 1 Creative connection



the old algorithm with the new algorithm if it will establish creative connections over big data. In this sense, instead of the A connection, the system will prefer the D connection and not the C connection. This is most likely because the C link requires more ports.

It starts the process of creating artificial intelligence, which solves the existing structure over big data, tries all other possibilities and selects the new structure that will benefit most from the possibilities revealed. For example; When collecting, instead of collecting the numbers in groups, instead of collecting artificial intelligence, it would have created a new process. When this process is ordinary for us, artificial intelligence will create a new concept in mathematics.

Create a new connection consisting of the most important issues in the new, original but are unused connections (such as C connection). The reason why these links are not selected as creative ideas is that they will not be used. The reason why these unselected connections are not selected may be meaningless in another context. For example, the C connection that is eliminated for fewer connections may be the reason for choosing another structure. This situation is related to the criteria that artificial intelligence will use. An idea for a society may not be of the same value to another. An idea that arouses a child's admiration may not have the same effect on adults. Therefore, the relationship between artificial intelligence systems is very important. The new link is in contact employees on different artificial intelligence systems will ensure that the big data work for another system. Thus, creativity will be possible through big chaotic data.

## Different Creation Methods

We can think of cell phones as a big data source. Three types of data can be obtained from these phones. The first is passive data including our own social character and network, the second is active data, which is our messages circulating in these social networks, and third, data that we allow to be produced but cannot be involved in its production, namely stolen data. It is possible for an application to instantly receive our location data and reach the point representation in the light of these data as in Fig. 2. This point data actually tells us that the cell phone owner is traveling over a circular area during the day. What is meaningful to the human brain is not the individual points, but the circle wandering in and why the circle is wandered.

**Fig. 2** From big data to meaning the data



Big data is chaotic data due to its production resources and the timing at which it is produced. The human brain is an organ that receives data from many sources such as eyes, ears, and nose in the process and evaluates these data in a time pattern. This organ tries to make sense of its perceptions by establishing instant regular structures. In order to be meaningful, harmony is checked with trusted structures that have been tried many times before. The brain, which is the most valuable organ of a person who wants to survive, is the organ that designs him for survival. In order to survive, the human brain systematically examines the data it perceives and records the patterns and meaningful networks it creates through brain cells. As he gains experience, he tries small changes to expand and differentiate the network without leaving the area where it is safe. The reason why the human brain behaves instantaneously but is chaotic in the process, is its need for meaningful creations. Creations that do not work in practical life can even be harmful to humans. In order to avoid possible damages, people care about other people's opinions and feedback. Innovation occurs after cost-benefit analysis.

Human is a self-thinking creature. As you deepen these thoughts, that is, as they focus on a subject and discover relationships between what they know and the subject and take more time for this, new thoughts are formed as well as invalid and ineffective network residual information. Brain cells, previously the strongest signal source in the network, can become inactive over time. If these cognitive wastes are not brought back to the system with their cognitive form, they may be in a threatening position to the network. Cognitive recycling means collecting, classifying/sorting all waste, and thinking about what and how to recycle it. Computer systems also have recovery features that can recover some files even though they are deleted. Thinking in the same way that files leave traces forms the way people think, and old ideas play a key role in the formation of new ideas.

The most interacting central element (most connected data) in the network is the most productive point of the system. It is possible for other elements to reach the same productivity, but society's thinking may prevent it. The leader concept diverged from other concepts during social interactions. There are, or will be, other societies in which other elements will also lead. Artificial intelligence can take all elements, regardless of social judgments or individual implications, and create new, untested, and also broader consistent networks. They can generate a new scientific method from cognitive waste or passive, less interacted items. While human puts the economics of the method as an evaluation measure, artificial intelligence can make discoveries/creations by trying all possible situations through probability testing independent of all criteria. Without being affected by the resistances and problems experienced in the transformation of the system, new methods can only be tried with artificial intelligence. The person who wears the umbrella on the cigarette rod so that his cigarette does not get wet has actually tried a possibility and discovered an innovation, but the dislike of this by the society causes this discovery to turn into intellectual waste. It is clear that the next generation of robots, which can endlessly experiment, associate every possibility with other possibilities, and share it with all other robots at the same time, have greater creativity than humans. Moreover, robots have no prejudices.

## Conclusion

Big data sources work like brain sensing centers. Various signals/data are collected in a center with sensors. The data collection and processing is carried out at the same time. The period in which the brain processes the data intensively is the sleep period. There is no sleep period in information technologies. In this sense, both the data entry and the data processing system can be heated. Sometimes, the main reason for computers to fail is that changes occur parallel to the usage of the structure.

When the human brain makes recollections to the past, they may not be able to remember certain situations or they may be wrong. A similar situation is possible in the video recording of information technologies. No matter how carefully the image is stored, some image disturbances can be found. The similarity of the brain and Information Technology (IT) systems raises the possibility of the creative structure of information systems. The main requirement for the formation of the creative structure is the formation of a chaotic structure. One of the environments in which ITs show chaotic structures is big data.

Cloud technologies, where big data is stored, are usually fed from data-gathering structures such as the Internet of things (IoT). For example; The egg container in your home can send you instantaneous temperature data. The first step is to send the temperature value from all eggs and store this data instantly. The second stage is the processing of the data. In the third stage, it should be decided whether the egg is decayed or not. In this sense, artificial intelligence is needed for the second and especially the third stage. Intelligence is our decision-making power. Artificial intelligence is designed to make decisions instead of human. These structures compare groups of data, and make a decision. If we want to make a decision about the egg according to the average temperature, we need a big data storage environment (cloud technology) and an artificial intelligence to process the data.

Continuous thoughts in the human brain are formed and disappear. Just as there are boundless and directed thoughts that we call imagination, sometimes prohibited and meaningless thoughts may also form and disappear. During the flow of this idea, consciousness makes some choices, some ideas are meaningful. We get creative ideas as a result of the selection of meaningful ideas from the ideas that have disappeared. If we want to produce some creative ideas on big data with ITs, or to allow artificial intelligence to be produced, it is necessary to introduce chaotic analysis methods to artificial intelligence. If we think that artificial intelligence produces pictures and produces new digital games, we make sense of the outputs of the nonlinear form of the algorithm.



## References

1. De Mauro, A., Greco, M., & Grimaldi, M. (2015). What is big data? A consensual definition and a review of key research topics. In *AIP Conference Proceedings* (pp. 97–104). AIP.
2. Sin, K., & Muthu, L. (2015). Application of big data in education data mining and learning Analytics—A Literature review. *ICTACT Journal on soft computing*, 5, 4.
3. Demchenko, Y, De Laat, C, & Membrey, P. (2014). Defining architecture components of the Big Data Ecosystem. In *2014 International Conference on Collaboration Technologies and Systems (CTS)* (pp. 104–112), IEEE.
4. Demchenko, Y., Ngo, C., & Membrey, P. (2013). Architecture framework and components for the big data ecosystem. *Journal of System and Network Engineering*, 1–31.
5. Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*, 24(1), 92–96.

# Forecasting Direction of BIST 100 Index: An Integrated Machine Learning Approach



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**Abstract** In recent years trends in analyzing and forecasting financial time series moves from classical Box-Jenkins methodology to machine learning algorithms because of the non-linearity and non-stationary of the time series. In this study, we employed a machine learning algorithm called support vector machine to predict the daily price direction of BIST 100 index. In addition, we use random forest algorithm for feature selection and showed that by removing some features from the model, performance of the model increases.

**Keywords** ISE 100 · Support vector machine · Random forest · Feature selection · Financial time series

## Introduction

Financial time series forecasting of stock markets are challenging due to non-linearity and non-stationarity. See the plot of the times series of BIST 100 closing price in Fig. 1. Underlying structure, which determines the stock price is complex. In general, stock price depends on general economic conditions, political risks and mostly on investor expectations. Because of this non-stationarity and non-linearity, more interests in forecasting financial time series moves from classical Box-Jenkins methodology to Machine Learning (ML) and Artificial Intelligence (AI) methods.

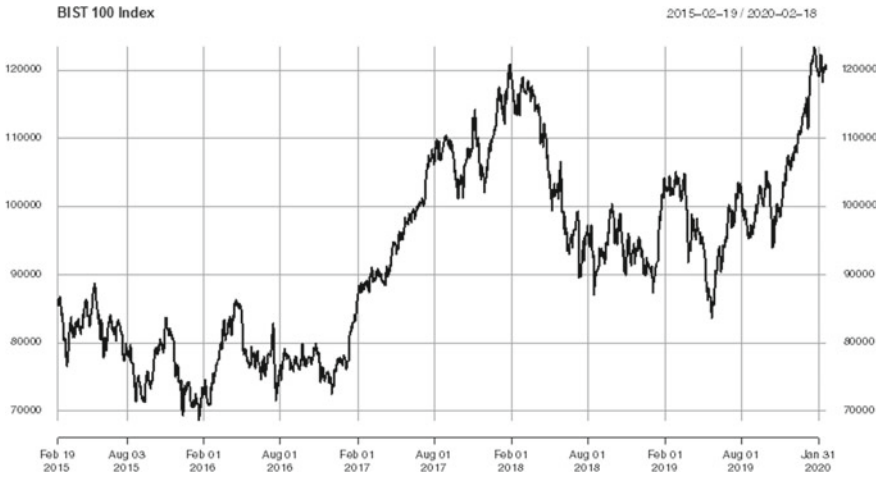
Support vector machine (SVM) is a supervised machine learning technique which provides learning algorithms in classification and regression. SVM performs

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**Fig. 1** BIST 100 index closing prices between Feb 19, 2015 and Jan 31, 2020

both linear classification and non-linear classification. Non-linear classifications are handled by kernel tricks. Kernels project the inputs to a higher dimension for ease of separation. To the best of our knowledge, the first applications of SVM to financial time series data are [1–3].

Kim [1] utilizes SVM to forecast direction of the price changes of Korea composite stock price index (KOSPI) by using technical indicators. Technical indicators are derived by using the price and volume of the index. In order to predict the index direction, the data first transform to binary data 0 and 1. 0 indicates that the next day's index is lower than the today's index while 1 indicates that the next day's index is higher than the today's index. In prediction phase the polynomial and the Gaussian kernel is used. The results show that with the selected input features SVM capable to predict the next day's direction with 50% accuracy for the worst case and 58% accuracy for the best case.

Huang et al. [2] uses SVM to analyze the weekly price movements of 225 highly capitalized stocks trading in Tokyo Stock Exchange index called NIKKEI 225. Also, [2] compares SVM performance with Linear Discriminant Analysis, Quadratic Discriminant Analysis and Elman Backpropagation Neural Networks. Results indicate that SVM outperforms other classification methods. As a data set [3] uses five different future contracts from Chicago Mercantile Exchange. These are Standard & Poor 500 Stock Index, United States 30 years government bond, United States 10 years government bond, German 10 years government bond and French government stock index futures. The Gaussian kernel is used to forecast the time series and results indicate that SVM is advantageous in financial time series forecasting. Forecasting financial time series is not restricted to SVM others learning algorithms like Artificial Neural Network (ANN) is also used such as [4–10].

The purpose of this study is to identify the direction of the Borsa İstanbul 100 Indices by utilizing SVM algorithm. Features for the model are chosen as the mostly

used financial indicators. Also, we employed Random Forest Algorithm (RFA) for the feature selection process. In section “[Methodology](#)”, we introduce basic information about SVM and RFA. Section “[Experimental Scheme](#)”, devoted to the experimental scheme, the financial indicators and the data. Also, in this section we give experimental results with performance metrics. Lastly, this work concluded in section “[Conclusion](#)” with future works and discussions.

## Methodology

### *Support Vector Machine*

SVM is a supervised learning algorithm which is used for classification and regression analysis. In this section we only focus on the classification case. Given the data sets, SVM separates the data into clusters by using hyperplanes. For example, if there is only two linearly separable data set, the algorithm finds a line that separates the data. For more than two sets, the algorithm finds a hyperplane that separates the set. There can be many hyperplanes which can separates the data. The aim of SVM is to find the best hyperplane that can be defined as the hyperplane with the maximum margins between the data sets. This algorithm does not work for the linear case, it also works efficiently in the nonlinear classification. In nonlinear classification it uses Kernels, which is a function of the features. In the rest of this subsection, we try to summarize SVM algorithm for both linearly separable and nonlinear classification cases. These ideas with more details can be found in [11–15].

Let the set  $\{x_k, y_k\}$  be the training set for  $k = 1, 2, 3, \dots, N$ , where  $x_k \in \mathbb{R}^n$  and  $y_k \in \{-1, 1\}$ . We define the linear classifier as

$$y(x) = \text{sign}(w^T x + b), \tag{1}$$

where  $\text{sign}(x)$  represents the signum function and  $T$  represents the transpose of a vector. If the two sets are linearly separable, the following hyperplane separates the two classes:

$$w^T x + b = 0, \tag{2}$$

so that  $w^T x^k + b \geq 1$  for  $y_k = 1$  and  $w^T x^k + b \leq -1$  for  $y_k = -1$ . These two inequalities can be combined in one inequality as

$$y_k(w^T x + b) \geq 1, \text{ for } k = 1, 2, 3, \dots, N. \tag{3}$$

Main idea of this algorithm is to maximize the margin  $M$  between the above two hyperplanes. The objective function of this optimization problem can be written as.  $\max M$

subject to

$$y_k(w^T x + b) \geq M, \quad w^T w = 1. \quad (4)$$

Then the margin is equal to.

$$\frac{2}{\|w\|} \quad (5)$$

The objective function (4) by using (5) can be rewritten as.  $\min \frac{1}{2} w^T w$   
subject to

$$y_k(w^T x + b) \geq 1. \quad (6)$$

Solution to the above optimization problem can be obtained by Lagrange's method as

$$L(w, b, \alpha) = \frac{1}{2} \|w\|^2 - \sum_{i=1}^n \alpha_i (y_i (x_i w^T + b) - 1), \quad (7)$$

where  $\alpha_i$  are nonnegative Lagrange multipliers. Equation (7) can be solved by using saddle point of the Lagrangian

$$\max_{\alpha} \min_{w, b} L(w, b, \alpha), \quad (8)$$

Differentiating the Eq. (7) with respect to  $\alpha$  and  $w$ , equating to zero one can obtain  $w = \sum_{i=1}^n \alpha_k y_k x_k$  and  $\sum_{i=1}^n \alpha_k y_k = 0$ . Thus, for the linearly separable case the classifier is

$$y(x) = \text{sign} \left( \sum_{i=1}^n \alpha_k y_k x_k^T \cdot x + b \right) \quad (9)$$

For the nonlinear classification case Eq. 8 become:

$$y(x) = \text{sign} \left( \sum_{k,l=1}^n \alpha_k y_k K(x_k \cdot x_l) + b \right) \quad (10)$$

where  $K(x_k, x)$  is the Kernel function of the form  $K(x_k, x_1) = \varphi(x_k, x_1)$ , Kernel itself is a function of input variable,  $x$ . Here, we list some of the kernel functions, which are mostly used in time series analysis.

Polynomial Kernel of degree  $d$ :

$$K(x_k, x_1) = (x_k x_1 + 1)^d \tag{11}$$

Gaussian Kernel:

$$K(x_k, x_1) = \exp(-\gamma \|x_i - x_j\|^2); \gamma = \frac{1}{\sigma^2} \tag{12}$$

Linear SVM:

$$K(x_k, x_1) = x_k^t x_1 \tag{13}$$

### ***Random Forest Algorithm***

Random Forest is an ensemble learning algorithm. Ensemble algorithms use large number of low accurate models and combine them to make inference, instead of one highly accurate model. It combines low accurate models to obtain high accurate models. Low accuracy models are obtained from weak learners. These are the learners that can predict complex models [16]. Decision trees are weak learners. It is a simple classification algorithm. It usually consists of one or more nested if-then statement to split the data [17]. Ensemble algorithms can be established by either bagging or boosting. The idea behind the bagging is to create large number of training set to apply weak learning algorithm, then combine these models to form one strong model. RFA is a bagging type learning algorithm.

In RFA, we first create  $N$  random sample, call  $S_n$  for  $n = 1, \dots, N$  for each  $n$ , of training set for modified decision tree model,  $f_n$ . Each  $S_n$  are sampled with replacement. After training and having  $N$  models, we average them to have prediction; that is

$$\widehat{f(x)} = \frac{1}{N} \sum_{n=1}^N f_n \tag{14}$$

In RFA modified decision tree is used to avoid correlation between the trees. In the algorithm there is only one parameter  $N$  to tune. Another strength of the model is that, multiple sample in the models reduces the variance of the model. It prevents overfitting [16]. More of these ideas can be found in [17]. In this study we will use RFA to identify the importance of the inputs. This information is used to reduce features of the SVM algorithm, so called feature selection.

**Table 1** Descriptive statistics

Statistics	Open	High	Low	Closing	Volume
Minimum	69308.74	69777.08	68230.47	685567.89	1.58*10 <sup>8</sup>
Maximum	124215.90	124536.63	122368.67	123556.10	3.41*10 <sup>9</sup>
Range	54907.16	54759.55	54138.20	54988.21	3.27*10 <sup>9</sup>
Median	9275.30	93765.56	91904.36	92763.21	8.91*10 <sup>9</sup>
Mean	92593.78	93242.03	91796.71	92488.12	1.01*10 <sup>9</sup>
Standard deviation	13592.77	13648.90	13504.30	13556.21	4.85*10 <sup>9</sup>
Number of observation	1257	1257	1257	1257	1257
Minimum	69308.74	69777.08	68230.47	685567.89	1.58*10 <sup>8</sup>

## Experimental Scheme

### *The Data Set*

The data set consists of the daily opening price (Open), daily highest price (High), daily lowest price (Low), daily closing price (Closing), and daily volume (Volume) of Istanbul Stock Exchange 100 Index (BIST 100) between the periods of 19.02.2015 and 18.02.2020. The data set is gathered from the Thomson Reuters Ikon of Atilim University. Descriptive statistics of the data set is given in Table 1.

The variables Open, High, Low, Closing and Volume are used to calculate financial indicator. We will use the following 13 financial indicators: Exponential moving average (EMA), rate of change (ROC), directional movement index (DMI), momentum indicator (MOM), MACD indicator (MAC), stochastic oscillator (STC), fast percentage K (FPK), fast percentage D (FPD), slow percentage D (LPD), William's percentage D (WPD), relative strength index (RSI), money flow index (MFI) and on balance volume (OBV). Computations of these indicator are made by [19, 20] and definitions of these indicators are given in the following paragraphs. These definitions with more detail can be found in [21].

### *Financial Indicators*

Exponential moving averages is like a moving average but it gives more weights to the recent prices. It responds faster to the recent price change than the simple moving average. Now let  $t$  represents today,  $t + 1$  represents yesterday,  $N$  represents number of days in EMA and  $k = \frac{2}{N+1}$  then EMA is calculated by

$$\text{EMA} = \text{Price}(t) * k + \text{EMA}(y) * (1 - k). \quad (15)$$

Rate of change indicator is a technical indicator which measures the change of prices between the most recent day and predetermined days price.

$$\text{ROC} = \frac{\text{Price}(t) - \text{Price}(t - n)}{\text{Price}(t)} * 100 \quad (16)$$

Directional movement index is developed to decide in which direction the price will move. It uses prior high and low prices. Now, let  $\text{DM}^+ = \text{High}(t) - \text{High}(t - 1)$ ,  $\text{DM}^- = \text{Low}(t) - \text{Low}(t - 1)$ ,  $\text{SDM}^{-/+} = \text{DM}^{-/+} - \left( \sum_{t=1}^{14} \frac{\text{DM}^{-/+}}{14} \right) + \text{CDM}$ ,  $\text{CDM} = \text{Price}(t) - \text{Price}(t - 1)$  by using these one can calculate DMI as

$$\text{DI}^+ = \left( \frac{\text{SDM}^+ + \text{DM}}{\text{ATR}} \right) * 100, \quad (17)$$

$$\text{DI}^- = \left( \frac{\text{SDM}^- + \text{DM}}{\text{ATR}} \right) * 100, \quad (18)$$

$$\text{DMI} = \left( \frac{|\text{DI}^+ - \text{DI}^-|}{|\text{DI}^+ + \text{DI}^-|} \right) * 100 \quad (19)$$

where ATR is the average true range which is another indicator measures the volatility of the market. Momentum indicator measures the velocity of the price changes by  $\text{MOM} = \text{prict}(t) - \text{price}(t - n)$ . The MACD indicator calculation is as follows:

- Calculate the simple moving average for n periods. Calculate 12 periods of exponential moving average.
- Calculate 12 periods of  $\text{EMA}_{12}$  by  $(\text{Price}_t - \text{EMA}_{t-1}) * 0.1538 + \text{EMA}_{t-1}$ .
- Subtract 26 periods of EMA from 12 periods of EMA for given period to create time series of MACD.

Stochastic oscillator is a ratio of price of certain market to a given periods price. By using  $\text{Low}_{t-14}$ ,  $\text{High}_{t-14}$  and  $\text{Price}_t$ , STC can be calculated as

$$\text{STC} = \frac{\text{Price}_t - \text{Low}_{t-14}}{\text{High}_{t-14} - \text{Low}_{t-14}} * 100 \quad (20)$$

Fast percentage K has almost same calculation procedure as STC but it uses  $\text{Low}_{t-3}$  and  $\text{High}_{t-3}$ . Fast percentage D is the moving average of STC while slow percentage D calculates the moving average of FPD. William's percentage D is also calculated similarly as STC:

$$\text{WPD} = \frac{\text{High}_{t-14} - \text{Price}_t}{\text{High}_{t-14} - \text{Low}_{t-14}} * 100. \quad (21)$$



**Table 2** Descriptive statistics

Indicators	Minimum	Median	Mean	Maximum	Standard deviation
MA	71236.52	93250.09	92313.98	120182.5	13177.75
ROC	-0.1545	0.0029	0.0012	0.0749	0.0299
DMI	0.0640	22.86	26.25	84.66	18.58
MOM	-9681.59	111.95	98.17	7372.98	2073.17
MAC	-5347.06	187.22	465.11	5983.75	2285.12
STC	0	0.5123	0.5093	1	0.2464
FPK	0	0.6044	0.5676	1	0.3079
FDD	0.2263	0.5119	0.5107	0.7984	0.1074
LPD	0.2596	0.5126	0.5105	0.7645	0.0949
WPD	0	0.6044	0.5676	1	0.3079
RSI	0	0.5289	0.5316	1	0.3095
MFI	0	0.6044	0.5676	1	0.3079
OBV	-332131.5	1966096	207240	6149579	1572581

Relative strength index is used to define the current and historical strength and weakness of the price by the following formula

$$RSI = 100 - \left( \frac{100}{1 + \frac{\text{AverageGain}}{\text{AverageLoss}}} \right) \quad (22)$$

Last two indicators are volume-based indicator. Money flow indicator and on balance volume uses price and volumes of the stock indices. More about these two indicators can be found in [21]. Descriptive statistics about these indicators are given in Table 2.

### *Experimental Setup*

The aim of this study is to predict the direction of the ISE 100 Index by using financial indicators. The data set of closing price is converted to binary data set, “0” means that next day’s price is lower than today’s price while “1” represents that next day’s price is higher than today’s price. That is

$$x_t = \begin{cases} 1, & \text{price}_{t-1} \leq \text{price}_t \\ 0, & \text{price}_{t-1} > \text{price}_t \end{cases}$$

Also, the calculated financial indicators are normalized to the range between -1 to 1. This is done to prevent the large valued input variables to suppress the model.

We divide randomly the data set as training set and test set. Training set consists %80 of the data set and test set consists %20 of the data. Training set consist of 1001 observation while test set consists of 242 observations. By using the training set we predict the model and the performance of the models are tested by using the test set. In the experiment, we first employed SVM algorithm by using all the features. In SVM there is only one parameter C to tune. It is called the penalty parameter. According to [22] it may take value between 1 and 100 for the best performance so as [23] we will employ SVM for difference values of C. As kernels, we will use Gaussian Kernel and Polynomial Kernel. In Gaussian Kernel there is one more parameter to tune,  $\sigma$ . A good combination of these two parameters is searched for a good performance. We evaluate the performance of the models by calculate the training error and test error by using the following equation:

$$\text{performance} = \frac{1}{n} \sum_{i=1}^n F_i$$

where  $F_i$  takes value 0 if the predicted and observed values are equal or take 1 if the predicted values are different than the observed. In first model we will use all financial indicators as features. Then we will use RFA to identify the importance of the features or for feature selection. Both the test and training data results for Gaussian and Polynomial Kernels with performance matric are given in Tables 3 and 4.

In Table 3, the best performance of the Gaussian kernel for the training data is achieved when  $\sigma^2 = 1$  and  $C = 10$ . With this parameters SVMs' hit ratio is 1, which implies that in the sample, it predicts all the observation correctly. For the test set, SVM has accuracy between 86 and 100%. For the test set, the best performance occurred when  $\sigma^2 = 50$  and  $C = 50$  or  $\sigma^2 = 75$  and  $C = 100$ . With this values SVM has accuracy of 87%. In overall, for the test data SVM has accuracy between 78 and 87%. Performance of the Polynomial kernel is given in Table 4. The best performance for the training data is achieved when  $C = 70$  with 91% accuracy while the best performance for the test data is achieved when  $C = 30$  with 85% accuracy. The performance of the polynomial kernel for the training data is between 87 and 91%. For the test data it has accuracy between 82 and 85%.

In the next step we will employ RFA to see the importance of the features. Next graph represents the importance of the features. By using this information, we are going to remove some features from the SVM and we will predict the direction of the BIST 100 Index.

According to the Fig. 2 we will remove the features which has the lowest mean decrease gini, EMA, OBV, MAC, DMI, MFI and re-employ the SVM to predict the direction of the BIST 100 Index. Our model will be of the form and the prediction by using the model is given in the Table 5.

$$x \sim f(\text{ROC, LPD, FDD, RSI, WPD, FPK, MOM, STC}) \tag{23}$$

**Table 3** SVM prediction performance for Gaussian Kernel

C	Training Data			Test data		
	Number of hit/total number	Hit ratio	Training error	Number of hit/total number	Hit ratio	Training error
Gaussian Kernel						
(a) $\sigma^2 = 1$						
1	985/1001	0.9840	0.0160	189/242	0.7810	0.2190
10	1001/1001	1.0000	0.0000	197/242	0.7603	0.2397
30	1001/1001	1.0000	0.0000	184/242	0.8214	0.1786
50	1001/1001	1.0000	0.0000	184/242	0.8214	0.1786
70	1001/1001	1.0000	0.0000	184/242	0.8214	0.1786
100	1001/1001	1.0000	0.0000	184/242	0.8214	0.1786
(b) $\sigma^2 = 25$						
1	879/1001	0.8781	0.1219	198/242	0.8393	0.1607
10	917/1001	0.9161	0.0839	206/242	0.8518	0.1485
30	945/1001	0.9441	0.0559	208/242	0.8595	0.1405
50	957/1001	0.9560	0.0415	207/242	0.8554	0.1446
70	957/1001	0.9560	0.0415	205/242	0.8471	0.1529
100	961/1001	0.9600	0.0400	205/242	0.8471	0.1529
(c) $\sigma^2 = 50$						
1	870/1001	0.8681	0.1319	198/242	0.8482	0.1518
10	907/1001	0.9061	0.0939	204/242	0.8430	0.1570
30	917/1001	0.9161	0.0839	206/242	0.8512	0.1488
50	928/1001	0.9271	0.0729	211/242	0.8719	0.1281
70	937/1001	0.9361	0.0639	210/242	0.8678	0.1322
100	944/1001	0.9431	0.0569	209/242	0.8636	0.1364
(d) $\sigma^2 = 75$						
1	868/1001	0.8681	0.1391	196/242	0.8099	0.1909
10	897/1001	0.8961	0.1039	203/242	0.8388	0.1612
30	911/1001	0.9100	0.0900	207/242	0.8554	0.1446
50	914/1001	0.9131	0.0869	208/242	0.8595	0.1405
70	920/1001	0.9191	0.0809	210/242	0.8678	0.1322
100	932/1001	0.9310	0.0690	211/242	0.8719	0.1281
(e) $\sigma^2 = 100$						
1	922/1001	0.9210	0.0790	210/242	0.8678	0.1322
10	890/1001	0.8891	0.1109	201/242	0.8306	0.1694
30	909/1001	0.9080	0.0902	207/242	0.8554	0.1446
50	913/1001	0.9120	0.0880	208/242	0.8595	0.1405
70	915/1001	0.9140	0.0860	208/242	0.8595	0.1405

(continued)

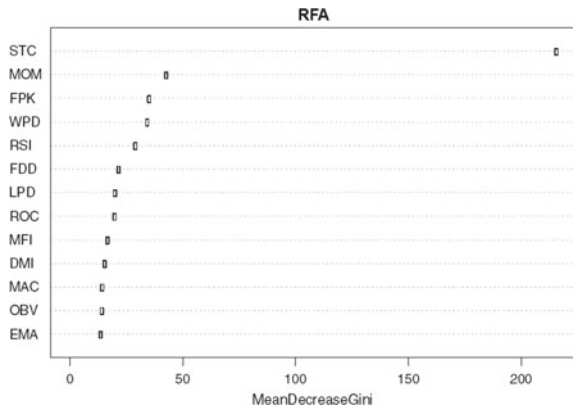
**Table 3** (continued)

C	Training Data			Test data		
	Number of hit/total number	Hit ratio	Training error	Number of hit/total number	Hit ratio	Training error
100	922/1001	0.9219	0.0781	210/242	0.8678	0.1322

**Table 4** SVM prediction performance for Polynomial Kernel

C	Training data			Test data		
	Number of hit/total number	Hit ratio	Training error	Number of hit/total number	Hit ratio	Training error
Polynomial Kernel						
1	880/1001	0.8791	0.1209	199/242	0.8223	0.1777
10	905/1001	0.9041	0.0959	205/242	0.8471	0.1529
30	915/1001	0.9140	0.0860	206/242	0.8512	0.1488
50	915/1001	0.9140	0.0860	206/242	0.8512	0.1488
70	914/1001	0.9130	0.0870	206/242	0.8512	0.1488
100	914/1001	0.9130	0.0870	207/242	0.8554	0.1446

**Fig. 2** Importance of feature by random forest algorithm



In Table 5, the best performance of the Gaussian kernel for the training data is achieved when  $\sigma^2 = 1$  and  $C = 10$ . With this parameters SVMs' hit ratio is 1. For the test set, SVM has accuracy between 86 and 100%. For the test set, the best performance occurred when  $\sigma^2=50$  and  $C = 70$ . With this values SVM has accuracy of 92%. In overall, for the test data SVM has accuracy between 89 and 90%. Performance of the Polynomial kernel is given in Table 6. The best performance for the training data is achieved when  $C = 30$  with 90% accuracy while the best performance for the test data is achieved when  $C = 1$  with 91% accuracy. The

**Table 5** SVM prediction performance for Gaussian Kernel of the model 21

C	Training data			Test data		
	Number of hit/total number	Hit ratio	Training error	Number of hit/total number	Hit ratio	Training error
Gaussian Kernel						
(a) $\sigma^2 = 1$						
1	989/1001	0.9850	0.0150	188/242	0.7866	0.2134
10	1001/1001	1	0	188/242	0.7866	0.2134
30	1001/1001	1	0	188/242	0.7866	0.2134
50	1001/1001	1	0	188/242	0.7866	0.2134
70	1001/1001	1	0	188/242	0.7866	0.2134
100	1001/1001	1	0	188/242	0.7866	0.2134
(b) $\sigma^2 = 25$						
1	875/1001	0.8715	0.1285	207/242	0.8661	0.1339
10	910/1001	0.9064	0.0936	216/242	0.9038	0.0962
30	934/1001	0.9303	0.0697	216/242	0.9038	0.0962
50	946/1001	0.9422	0.0578	217/242	0.9079	0.0921
70	946/1001	0.9422	0.0578	219/242	0.9163	0.0837
100	954/1001	0.9502	0.0498	218/242	0.9121	0.0879
(c) $\sigma^2 = 50$						
1	869/1001	0.8655	0.1345	208/242	0.8703	0.1297
10	899/1001	0.8954	0.1046	210/242	0.8787	0.1213
30	912/1001	0.9084	0.0916	217/242	0.9079	0.0921
50	918/1001	0.9143	0.0857	220/242	0.9205	0.0795
70	926/1001	0.9223	0.0777	221/242	0.9247	0.0753
100	932/1001	0.9283	0.0717	220/242	0.9205	0.0795
(d) $\sigma^2 = 75$						
1	866/1001	0.8625	0.1375	207/242	0.8661	0.1339
10	888/1001	0.8845	0.1155	212/242	0.8870	0.1130
30	903/1001	0.8994	0.1006	216/242	0.9038	0.0962
50	909/1001	0.9054	0.0946	218/242	0.9121	0.0879
70	917/1001	0.9133	0.0867	218/242	0.9121	0.0879
100	921/1001	0.9173	0.0827	219/242	0.9163	0.0837
(e) $\sigma^2 = 100$						
1	865/1001	0.8616	0.1384	208/242	0.8703	0.1297
10	890/1001	0.8865	0.1135	211/242	0.8828	0.1172
30	901/1001	0.8974	0.1026	216/242	0.9038	0.0962
50	901/1001	0.8974	0.1026	217/242	0.9079	0.0921
70	907/1001	0.9034	0.0966	217/242	0.9038	0.0962

(continued)

**Table 5** (continued)

C	Training data			Test data		
	Number of hit/total number	Hit ratio	Training error	Number of hit/total number	Hit ratio	Training error
100	915/1001	0.9114	0.0886	219/242	0.9163	0.0838

**Table 6** SVM prediction performance for Polynomial Kernel of the model 21

C	Training data			Test data		
	Number of hit/total number	Hit ratio	Training error	Number of hit/total number	Hit ratio	Training error
Polynomial Kernel						
1	894/1001	0.8904	0.1096	218	0.9121	0.0879
10	905/1001	0.9014	0.0986	217/242	0.9079	0.0921
30	905/1001	0.9014	0.0986	217/242	0.9079	0.0921
50	905/1001	0.9014	0.0986	217/242	0.9079	0.0921
70	905/1001	0.9014	0.0986	217/242	0.9079	0.0921
100	905/1001	0.9014	0.0986	217/242	0.9079	0.0921

performance of the polynomial kernel for the test data is between 90 and 91%. For the test data it has accuracy between 82 and 85%. From Tables 5 and 6, it can be easily seen that when some features remove the performance of the SVM for test set is increased that is the prediction accuracy of the algorithm is increased.

## Conclusion

In this study we have showed that SVM with various parameters has good performance to predict the daily BIST 100 Index direction. Also, we have used RFA for feature selection and showed that by removing some feature of the model, the performance of the SVM increased. This information is useful for investors, traders and economist to predict the movement of the BIST 100 Index. It is important to predict the direction because the index can be shown and perceived as a very strong indicator of the whole economy. In the future studies instead of machine learning some deep learning models like neural networks can be employed and compared with the SVM. Also, other machine learning algorithms like k-nearest network can be used for feature selection.

**Conflicts of Interest** No conflict of interest was declared by the authors.

## References

1. Kim, K. J. (2003). Financial time series forecasting using support vector machines. *Neurocomputing*, 55(1–2), 307–319.
2. Huang, W., Nakamori, Y., & Wang, S. Y. (2005). Forecasting stock market movement direction with support vector machine. *Computers & Operations Research*, 32(10), 2513–2522.
3. Tay, F. E., & Cao, L. (2001). Application of support vector machines in financial time series forecasting. *Omega*, 29(4), 309–317.
4. Bogullu, V. K., Cihan H. D., & David, L. E. (2002). Using neural networks and technical indicators for generating stock trading signals. In *ANNIE 2002, American Society of Mechanical Engineers (ASME)*.
5. Chen, A. S., Leung, M. T., & Daouk, H. (2003). Application of neural networks to an emerging financial market: Forecasting and trading the Taiwan Stock Index. *Computers & Operations Research*, 30(6), 901–923.
6. Wang, J. Z., Wang, J. J., Zhang, Z. G., & Guo, S. P. (2011). Forecasting stock indices with back propagation neural network. *Expert Systems with Applications*, 38(11), 14346–14355.
7. Ticknor, J. L. (2013). A Bayesian regularized artificial neural network for stock market forecasting. *Expert Systems with Applications*, 40(14), 5501–5506.
8. Thawornwong, S., & Enke, D. (2004). The adaptive selection of financial and economic variables for use with artificial neural networks. *Neurocomputing*, 56, 205–232.
9. Rather, A. M., Agarwal, A., & Sastry, V. N. (2015). Recurrent neural network and a hybrid model for prediction of stock returns. *Expert Systems with Applications*, 42(6), 3234–3241.
10. Chong, E., Han, C., & Park, F. C. (2017). Deep learning networks for stock market analysis and prediction: Methodology, data representations, and case studies. *Expert Systems with Applications*, 83, 187–205.
11. Vapnik, V. (2013). *The nature of statistical learning theory*. Springer Science & Business Media.
12. Cortes, C., & Vapnik, V. (1995). Support-vector networks. *Machine learning*, 20(3), 273–297.
13. Drucker, H., Burges, C. J., Kaufman, L., Smola, A. J., & Vapnik, V. (1997). Support vector regression machines. In *Advances in neural information processing systems* (pp. 155–161).
14. AK, S. J. (2002). *Least squares support vector machines*. World Scientific.
15. Alpaydin, E. (2020). *Introduction to machine learning*. MIT Press.
16. Burkov, A. (2019). *The hundred-page machine learning book*. Quebec City, Canada: Andriy Burkov.
17. Kuhn, M., & Johnson, K. (2013). *Applied predictive modeling*. New York: Springer.
18. Breiman, L. (2001). Random forests. *Machine Learning*, 45(1), 5–32.
19. Ulrich, J., Ulrich, M. J., & RUnit, S. (2019). *Package TTR*.
20. Diethelm, W., Tobias S., & Yohan C. (2017). *Package fTrading*.
21. Retrieved 20 February, 2020 from <https://www.investopedia.com/>.
22. Tay, F. E. & Cao, L. (2001). Application of support vector machines in financial time series forecasting. *Omega*, 29(4), 309–317.
23. Fatma, B. K., & Kamil, D. Ü. (2020). A two-step machine learning approach to predict S&P 500 bubbles. *Journal of Applied Statistics*. <https://doi.org/10.1080/02664763.2020.1823947>.

# Improving Fuzzy Time Series Approach by Using Machine Learning



Çağdaş Hakan Aladağ

**Abstract** Forecasting problem is a challenging problem on which many researchers from both field and academia work. This problem can also be considered as predicting the future. One of the most effective tools to predict the future is to utilize time series analysis. In real world, time series has uncertainty due to various situations. Conventional methods could not be sufficient to analyze such real world time series. Fuzzy time series methods have been proposed to analyze such time series. Many forecasting applications have been successfully performed by using various fuzzy time series forecasting models in the last decades. In fuzzy time series approach, determining fuzzy logic relationships between observation is a crucial process to reach accurate forecasting results. Determining fuzzy relations process is also called as fuzzy inference stage. In this stage, learning from the data is carried out by utilizing a method. Using a machine learning algorithm to accomplish this learning task would be a wise strategy. Therefore, there have been some fuzzy time series studies including machine learning algorithms in the literature. Artificial neural networks method is a core method in machine learning and this method has proved its success in many real world applications. In this study, it is explained how artificial neural networks method can be utilized to increase the forecasting performance of fuzzy time series approach. For the aim of this purpose, one of the basic fuzzy time series methods using artificial neural networks is examined. The algorithm of this fuzzy time series forecasting method based on machine learning is introduced. Also, by applying this method to a very well-known data, it is explained how this method works in details.

**Keywords** Artificial neural networks · Forecasting · Fuzzy time series · Machine learning

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## Introduction

By making accurate predictions for the future, crucial decisions can be made. In other words, the future can be managed by analyzing data correctly. Therefore, forecasting has been one of the most important topics studied by researchers for many years [10]. In today's information age, it is a well-known fact that reaching meaningful information by analyzing data in the most accurate way is the most important issue. Analyzing time series data is one of the most effective ways in order to forecast the future. On the other hand, predicting the future with challenging uncertainty is an extremely complex problem.

In the literature, there has been various time series studies to solve this complex problem [10]. The proposed approaches available in the literatures ranges from Box-Jenkins models [11] to artificial neural networks [33]. Another efficient solution approach is to utilize fuzzy time series [19]. It is a well-known fact that the data faced in the real world has uncertainty. A fuzzy time series model tries to analyze the data by taking the uncertainty into account. In other words, this effective approach analyzes the data by dealing with the uncertainty. And, fuzzy time series approaches deal with the uncertainty included in time series by utilizing fuzzy set theory firstly proposed by Zadeh [35]. When complex real world problems are analyzed by fuzzy logic based approaches, it is possible to obtain more satisfactory solutions. Therefore, it is wise to use fuzzy time forecasting models to analyze time series faced in the real world.

Fuzzy time series and its basic concepts and definitions were firstly introduced by Song and Chissom [28–30]. In general, it can be said that fuzzy logic based systems are composed of three main stages such as fuzzification, fuzzy inference, and defuzzification. Like in a fuzzy logic based system, fuzzy time series includes same main stages mentioned in the previous sentence [9]. In the first main stage namely fuzzification, the observations of time series are fuzzified by using a method [15]. In this stage, fuzzification is performed by taking uncertainty included in the time series into consideration. In other words, fuzzification means mapping crisp values of the observations into fuzzy sets. Thus, a fuzzy time series whose observations are fuzzy sets are obtained in the first stage. In the second stage, inference is performed by using fuzzy sets calculated in the previous stage. Fuzzy logic relationships between the observations are established by using a method over the fuzzy sets [7]. In this stage, the predictions are also computed based on the fuzzy logic relationships. Finally, in the third stage called defuzzification, obtained predictions, which are fuzzy sets, are defuzzified by using a method [2–4]. That is, fuzzy values for the predictions are mapped into crisp values in the final stage.

In the literature, many fuzzy time series approaches have been introduced to get more accurate forecasts [34]. Various fuzzy time series approaches have been proposed by improving the stages of fuzzy time series mentioned before. In many fuzzy time series studies available in the related literature, by using more effective methods for the stages, hybrid fuzzy time series approaches have been proposed in order to reach high forecasting accuracy. In these studies, it has been observed that

using a hybrid fuzzy time series method produces very accurate forecasts for real world time series [19].

Nowadays, Machine Learning and Artificial Intelligence are much trending and also confused terms. John McCarthy a researcher from Standford says that “*Artificial Intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs. Artificial Intelligence is related to the similar task of using computers to understand human intelligence, but Artificial Intelligence does not have to confine itself to methods that are biologically observable.*” Artificial Intelligence’s goal can be basically considered as to make computer programs smart enough to imitate the human mind behavior.

Machine Learning is a subset of Artificial Intelligence. Machine learning can be defined as a science that designs and applies algorithms which can learn meaningful knowledge from the past observations. These algorithms can predict patterns or behaviors exists in past. That is, these algorithms can not produce predictions if there are no past cases. In machine learning, complex algorithms are repeatedly run on large data sets. By analyzing the patterns in data, these algorithms facilitating machines to respond different situations for which they have not been explicitly programmed. The systems using these machine learning algorithms can learn from the history to produce reliable results. Machine learning algorithms utilize Statistics and Computer Science to predict reasonable outputs. Therefore, the most appropriate statistical methods should be used correctly in order to design an effective machine learning algorithm.

Like in almost all modelling methods, learning from the data is a crucial part for fuzzy time series modeling. In the second stage namely fuzzy inference, learning is performed over fuzzy observations of time series. Thus, using a machine learning algorithm in this stage would be wise in order to reach more accurate predictions. In the literature, there have been already some studies in which some machine learning algorithms are used in various fuzzy time series approaches [16]. For example, Genetic Algorithms [14, 24], Particle Swarm Optimization [6, 26], Artificial Bee Colony [32] are employed in different fuzzy time series approaches. In the second stage, artificial neural networks were firstly used by Huarng and Yu [22]. In this study, a very simple neural network model was used to determine fuzzy relationships [22]. Aladag et al. [1] used more complex artificial neural network models to establish fuzzy relationships between the observations. This fuzzy time series approach proposed by Aladag et al. [1] produced very accurate forecasting results. Later on, different fuzzy time series approaches in which artificial neural networks are employed in the second stage were proposed in the related literature [7, 16, 17].

## Fuzzy Time Series

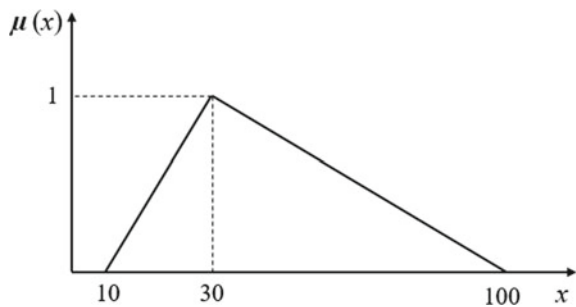
Many real world time series such as stock exchange market prices, exchange rates, weather temperature values or number of deaths in traffic accidents has uncertainty in itself. For example, let a stock share daily prices are tried to be forecasted. In order to

determining a forecasting time series model, daily observations must be used for the computations. In other words, parameters of the forecasting model are determined by using daily prices in the calculations. At this point, the crucial question is “What can be represent the daily price of stock share?” For each day, a value must be taken. On the other hand, it is a well-known fact that a stock share takes many values in a same day. In conventional time series analysis, only mean value of prices is used for a day instead of using all values of stock share prices. That is, there is a big information loss in this case. To explain better, let’s consider for a two different days with same mean value 30. For instance, the prices change between 10 and 100 for day 1 while the prices for day 2 take values between 20 and 70. In other words, for day 1, minimum and maximum prices of stock share are 10 and 100, respectively. On the other side, the mean values for these two different days equal to 30. In addition to the difference between limits for days, the prices fluctuations for these days could also be very different. Even in this case, a conventional time series model behaves in a same way for these two days although there are important differences between the days in terms of the stock share prices. Because, these two different days are represented with a same value. This is an uncertainty. Thus, such a model leads to misleading results because of not taking this uncertainty into account. In order to reach accurate predictions, a forecasting model that can also deal with this uncertainty should be used instead of using a traditional model.

In order to model time series which has uncertainty Song and Chissom [28] introduced the fuzzy time series. A fuzzy time series is series whose observations are fuzzy sets or fuzzy numbers. For the example given above, each prices for every day can be defined by a fuzzy number. For instance, day 1 and 2 can be represented by triangular fuzzy numbers  $\tilde{A} = (10 - 30 - 100)$  and  $\tilde{B} = (20 - 30 - 70)$ , respectively. Fuzzy numbers are given in parametric form. In this parametric notation, 10, 30, and 100 are respectively left spread, center, and right spread values for day 1. Membership function for the observation of day 1 can be given like in Fig. 1. In this figure, horizontal axis  $x$  represents all prices of stock share recorded for day 1. Vertical axis  $\mu(x)$  represents the corresponding membership function values.

After all prices of each day are mapped into a fuzzy number, this stock share time series is a fuzzy time series now. That is, fuzzification stage is performed. This process is very crucial step in fuzzy time series. All crisp values are represented

**Fig. 1** Membership function for triangular fuzzy number  $\tilde{A}$



fuzzy values and it is very important to perform this operation correctly. Selection of membership function is also very important decision which is directly affect the performance of fuzzy systems. In fuzzy time series, fuzzification stage should be carried out successfully by using proper parametric forms or membership functions in order to get accurate forecasting results. In the related literature, there have been various methods for fuzzification stage [34].

After fuzzification stage is performed, the second stage namely fuzzy inference is carried out. In the second stage, relationships between observations are learned by using fuzzy values calculated in the first stage. Fuzzy logic relationships between the observations of fuzzy time series are determined by using a method. Song and Chissom [29] firstly suggested use a method based on complex matrix operations to establish fuzzy relationships. Then, [12] proposed a fuzzy time series forecasting method in which fuzzy logic relation tables are used for fuzzification stage. Chen's [12] method was more practical than [29] method since his method does not require complex matrix calculations. Instead of dealing with complex matrix operations, Chen's [12] suggested to utilize fuzzy logic relation tables. Chen's [12] this suggestion made fuzzy inference stage easier although [29] method is based on a more solid fuzzy logic theory.

Both fuzzy time series models proposed by Song and Chissom [29] and Chen [14] are first order fuzzy time series models. Later on, Chen [12] introduced a high order fuzzy time series forecasting model based on fuzzy logic relation tables. In Chen's [13] paper, it is shown how these tables can be used to determine fuzzy relations between observations for high order models. On the other hand, the higher the order of fuzzy time series forecasting model is, the harder to use fuzzy logic relation tables for fuzzy inference stage.

Machine learning algorithms have proved their success at learning from data after especially usage of artificial neural networks in various real world problems. Therefore, for the second stage in which relationships between the fuzzy observations is learned, using a machine learning method would be a wise strategy. Then, Huarng and Yu [22] firstly used artificial neural networks to determine fuzzy relationships. In Huarng and Yu's [22] method, a very simple artificial neural network model was utilized. Aladag et al. [1] also proposed a fuzzy time series forecasting model in which fuzzy relationships are established artificial neural networks. Aladag et al. [1] managed to success at improve the forecasting accuracy by using more complex artificial neural network models. Besides the high forecasting accuracy, the method proposed by Aladag et al. [1] can easily applied to high order fuzzy time series. Later on in the related literature, various fuzzy time series approaches that utilize different artificial neural network models to determine fuzzy relations were suggested [7, 16, 17].

In the second stage, after fuzzy relations are determined, fuzzy predictions are also calculated based on these obtained relations. In other words, outputs of the fuzzy logic based system are also calculated in this stage. Then, finally, predicted fuzzy values are mapped into crisp values in the third stage namely defuzzification. While crisp values are transformed to fuzzy sets or numbers by using a method in the fuzzification stage, fuzzy sets or numbers obtained for predictions are mapped into crisp values

by using another method in the third stage. Like in the first stage, selection of the method used in the third stage has very important effect of the performance of fuzzy time series [2]. As a result of the defuzzification stage, predicted fuzzy values are represented by crisp values. That is, a fuzzy set or number is mapped into a crisp value. In order to obtain accurate forecasts, the crisp value that can best represent all the information carried by the corresponding fuzzy set should be determined.

It would be better to give basic concepts and models of fuzzy time series in this section. Yolcu et al. [32] briefly give fuzzy time series’ basic concepts and its models as follows:

*The concept of fuzzy time series was first proposed by Song and Chissom[28–30]. Following Song and Chissom’s forecasting model based on complex matrix operation. Chen [12] proposed a simpler approach based on fuzzy relation tables. Besides, Chen [13], Aladag et al. [1] and Huang et al. [20] used high order fuzzy time series model. Basic concepts and definitions related to fuzzy time series which have attracted many researchers’ attention due to their widespread usage and which have been intensively studied recently can be summarized as follows;*

*Let  $U$  be the universe of discourse, where  $U = \{u_1, u_2, v, u_n\}$ . A fuzzy set  $A_i$  of  $U$  can be defined as,*

$$A_i = \frac{\mu_{A_i}(u_1)}{u_1} +, \frac{\mu_{A_i}(u_2)}{u_2} + v + \frac{\mu_{A_i}(u_n)}{u_n}$$

*where  $\mu_{A_i}$  is the membership function of the fuzzy set  $A_i$  and  $\mu_{A_i}; U \rightarrow [0, 1]$ . Also,  $\mu_{A_i}(u_j)$ ,  $j = 1, 2, v, n$  denotes is a generic element of fuzzy set  $A_i$ ;  $\mu_{A_i}(u_j)$  is the degree of belongingness of  $u_j$  to  $A_i$ ;  $\mu_{A_i}(u_j) \in [0, 1]$ .*

**Definition 1** Let  $Y(t)$  ( $t = \dots, 0, 1, 2, \dots$ ), a subset of real numbers, be the universe of discourse on which fuzzy sets  $f_j(t)$  are defined. If  $F(t)$  is a collection of  $f_1(t), f_2(t), \dots$  then  $F(t)$  is called a fuzzy time series defined on  $Y(t)$ .

**Definition 2** Fuzzy time series relationships assume that  $F(t)$  is caused only by  $F(t-1)$ , then the relationship can be expressed as:  $F(t) = F(t-1) * R(t, t-1)$ , which is the fuzzy relationship between  $F(t)$  and  $F(t-1)$ , where  $*$  represents as an operator. To sum up, let  $F(t-1) = A_i$  and  $F(t) = A_j$ . The fuzzy logical relationship between  $F(t)$  and  $F(t-1)$  can be denoted as  $A_i \rightarrow A_j$  where  $A_i$  (current state) refers to the left-hand side and  $A_j$  (next state) refers to the right-hand side of the fuzzy logical relationship. Furthermore, these fuzzy logical relationships can be grouped to establish different fuzzy relationship.

**Definition 3** Let  $F(t)$  be a fuzzy time series. If  $F(t)$  is a caused by “ $F(t-1), F(t-2), \dots, F(t-m)$ ”, then this fuzzy logical relationship is represented by

$$F(t - m), v, F(t - 2), F(t - 1) \rightarrow F(t)$$

and it is called the  $m$ th order fuzzy time series forecasting model. Where  $F(t-m), \dots, F(t-2), F(t-1)$  refers to the current state and  $F(t)$  refers to the next state.”

## Artificial Neural Networks

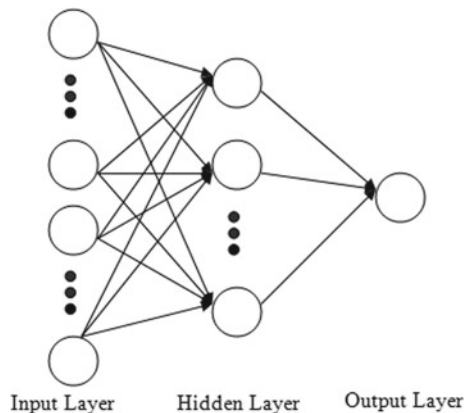
Artificial neural networks approach has been one of the most popular machine learning methods in last decades. This effective machine learning method can model both the linear and the nonlinear structures of the data by learning complex relationships involved in the data [7]. Algorithms that imitate the human brain’s features, which are generating new knowledge and exploring by learning, compose the artificial neural networks approach [3]. It can be said that artificial neural networks are synthetic networks that mimic biological neural networks. An artificial neural network that is a mathematical algorithm is a very effective tool for modeling complex relationships between input and output datasets [4]. Park and Lee [27] also present a definition of artificial neural networks as follows:

An artificial neural network is a computational procedure which is able to acquire, represent, and compute a mapping from one multivariate space of information to another with a set of data representing that mapping. Artificial neural networks can handle imperfect or incomplete data and can capture nonlinear and complex relationships among variables of a system. The artificial neural network is emerging as a powerful tool for modeling with these abilities.

This machine learning algorithm is composed of some components such as architecture structure, learning algorithm, and activation function. These components have important effect on the performance of the algorithm. Selection of these components according to data is a vital process since artificial neural networks method is data driven approach [5]. In the literature, there are various types of artificial neural network approaches such as feed forward or recurrent artificial neural networks. In many real world application, it is observed that feed forward neural networks produce very good results. Eđriođlu et al. [18] give the basic components of feed forward neural networks as follows:

“Feed forward artificial neural networks consist of input, hidden and output layers. An example of feed forward artificial neural network architecture with one output neuron is shown in Fig. 2. Each layer consists of units called neuron and there is no connection

**Fig. 2** Multilayer feed forward artificial neural network with one output neuron



between neurons which belong to same layer. Neurons from different layers are connected to each other with a corresponding weight. Each weight is shown with directional arrows in Fig. 2. Bindings shown with directional arrows in feed forward artificial neural networks are forward and unidirectional. An activation function is used for each neuron in hidden layer and output layer of feed forward artificial neural networks. Inputs incoming to neurons in hidden and output layers are made up multiplication and addition of neuron outputs in the previous layers with the related weights. Data from these neurons pass through the activation function and neuron output are formed. Activation function enables curvilinear match-up. Therefore, non-linear activation functions are used for hidden layer units. In addition to a non-linear activation function, linear (pure linear) activation function can be used in output layer neuron.

In feed forward artificial neural networks, learning is the determination of weights generating the closest outputs to the target values that correspond with the inputs of artificial neural network. Learning is achieved by optimizing the total errors with respect to weights. There are several types of training algorithms in literature used for learning of feed forward artificial neural networks. One of the widely used training algorithms is Levenberg–Marquardt algorithm [25].

## Using Machine Learning in Fuzzy Time Series

Fuzzy time series is an effective forecasting tool for real world time series includes uncertainty. One vital process in fuzzy time series approach is to determine fuzzy relationships between the observations of time series. That is, this process is a learning stage at the same time. In this learning process, using an effective machine learning method such as artificial neural networks would provide advantage. Aladag et al. [1] improved a new high order fuzzy time series method based on this motivation. In the method proposed by Aladag et al. [1], feed forward neural networks are utilized to determine fuzzy relationships between the observation.

Huang and Yu [22] firstly use an artificial neural networks model to define fuzzy relation for first order fuzzy time series. Because of the first order, Huang and Yu [22] suggested a fuzzy time series method includes a simple feed forward neural network model. This simple model has one input neuron, two neurons in hidden layer, and one output neuron. It is a good idea to use a feed forward neural network model in the fuzzy inference stage to establish fuzzy relations. Then, Aladag et al. [1] proposed a fuzzy time series method based on more complex feed forward neural network models and, they reached a high accuracy level. Also, the fuzzy time series approach proposed by Aladag et al. [1] is a high order method.

There have been some fuzzy time series approaches based on machine learning algorithms in the literature. Some of these approaches are given in the introduction section of this study. In order to explain how such an approach using a machine learning algorithm works, the algorithm of the fuzzy time series method proposed by Aladag et al. [1] is given in the next subsection section. For the same purpose, the application of the method proposed by Aladag et al. [5] over the Alabama enrollment data is also presented in the other subsection.

**The algorithm of the fuzzy time series method enhanced by machine learning.**

Aladag et al. [1] introduce the stages of their high order fuzzy times series algorithm that uses feed forward neural networks to establish fuzzy relations as follows:

Stage 1. Define and partition the universe of discourse.

The universe of discourse for observations,  $U = [starting, ending]$ , is defined. After the length of intervals,  $l$ , is determined, the  $U$  can be partitioned into equal-length intervals  $u_1, u_2, \dots, u_b, b = 1, \dots$  and their corresponding midpoints  $m_1, m_2, \dots, m_b$ , respectively.

$$u_b = [starting + (b - 1) \times l, starting + b \times l],$$

$$m_b = \frac{[starting + (b - 1) \times l, starting + b \times l]}{2}$$

Stage 2. Define fuzzy sets.

Each linguistic observation,  $A_i$ , can be defined by the intervals  $u_1, u_2, \dots, u_b$ .

$$A_i = f_{A_i}(u_1)/u_1 + f_{A_i}(u_2)/u_2 + \dots + f_{A_i}(u_b)/u_b$$

Stage 3. Fuzzify the observations.

For example, a datum is fuzzified to  $A_i$ , if the maximal degree of membership of that datum is in  $A_i$ .

Stage 4. Establish the fuzzy relationship with feed forward neural network.

An example will be given to explain stage 4 more clearly for the second order fuzzy time series. Because of dealing with second order fuzzy time series, two inputs are employed in neural network model, so that lagged variables  $F_{t-2}$  and  $F_{t-1}$  are obtained from fuzzy time series  $F_t$ . These series are given in Table 1. The index numbers (i) of  $A_i$  of  $F_{t-2}$  and  $F_{t-1}$  series are taken as input values whose titles are Input-1 and Input-2 in Table 1 for the neural network model. Also, the index numbers of  $A_i$  of  $F_t$  series are taken as target values whose title is Target in Table 1 for the neural network model. When the third observation is taken as an example, inputs values for the learning sample [ $A_6, A_2$ ] are 6 and 2. Then, target value for this learning sample is 3.

Stage 5. Defuzzify results.

The defuzzified forecasts are middle points of intervals which correspond to fuzzy forecasts obtained by neural networks in the previous stage.

**Table 1** Notations for second order fuzzy time series

Observation	$F_{t-2}$	$F_{t-1}$	$F_t$	Input-1	Input-2	Target
1	–	–	$A_6$	–	–	–
2	–	$A_6$	$A_2$	–	–	–
3	$A_6$	$A_2$	$A_3$	6	2	3
4	$A_2$	$A_3$	$A_7$	2	3	7
5	$A_3$	$A_7$	$A_4$	3	7	4
6	$A_7$	$A_4$	$A_2$	7	4	2



## The Application

In the papers [28, 29] in which fuzzy time series was firstly introduced, the first fuzzy time series application is performed over the enrollment data of University of Alabama. The Alabama enrollment data is the most well-known data in the fuzzy time series literature since this data was the first one analyzed with fuzzy time series. Therefore, Aladağ et al. [1] applied their high order fuzzy time series method to the Alabama enrollment data which is shown in Table 2.

In the application, the lengths of intervals are chosen as 200, 300, 400, 500, 600, 700, 800, 900 and 1000 as Huarang [21] did. Since it is a high order fuzzy time series method, first, second, third, and fourth order fuzzy time series models are examined. In the stage 4 of the algorithm, feed forward neural networks models are generated by changing the number of neurons of hidden layer from 1 to 4 not to lose generalization ability of neural network models. These feed forward neural networks models are used to determine fuzzy relations. Thus, for 9 interval lengths, 4 model orders, and 4 number of neurons in hidden layer, computations are performed for 144 different cases totally. All rounded mean square error (MSE) values obtained for each case are presented in Table 3. According to Table 3, second order fuzzy time series model produces better results than those obtained from other models with orders 1, 3, and 4. It is seen that the best result is obtained from the second order fuzzy time series model in which fuzzy relation is defined by 2-4-1 neural network architecture and when the length of interval is 200. For this best case, MSE value is 78073 which is the smallest one among all obtained results.

To evaluate the performance of the enhanced fuzzy time series method using machine learning [1], this method is compared to other fuzzy time series methods available in the literature. The other methods used in the comparison are proposed by Song and Chissom [28], Song and Chissom [30], Sullivan and Woodall [31], Chen [12], Hwang et al. [23], Chen [13]. All obtained MSE values are summarized

**Table 2** The enrollment data

Years	Actual	Years	Actual
1971	13,055	1982	15,433
1972	13,563	1983	15,497
1973	13,867	1984	15,145
1974	14,696	1985	15,163
1975	15,460	1986	15,984
1976	15,311	1987	16,859
1977	15,603	1988	18,150
1978	15,861	1989	18,970
1979	16,807	1990	19,328
1980	16,919	1991	19,337
1981	16,388	1992	18,876

**Table 3** The results of the enhanced fuzzy time series method using machine learning

		MSE values			
Interval	Neurons number	–	–	–	–
Length	In hidden layer	First order	Second order	Third order	Fourth order
200	1	288,659	197,413	764,552	1,174,929
300	1	293,983	227,093	301,715	1,216,368
400	1	299,602	221,413	278,531	1,221,962
500	1	377,040	310,943	242,315	1,289,190
600	1	355,897	270,833	282,721	1,319,485
700	1	516,602	420,843	307,600	927,535
800	1	475,659	394,693	509,394	1,187,540
900	1	429,297	285,593	368,094	1,196,301
1000	1	574,659	462,893	420,236	1,144,107
200	2	11,547,935	170,493	11,021,773	1,222,640
300	2	11,846,068	201,263	11,318,600	1,355,101
400	2	12,149,202	215,973	11,620,426	1,258,674
500	2	11,254,802	207,343	10,729,947	1,201,357
600	2	12,770,468	224,513	12,239,079	1,310,085
700	2	11,846,068	355,743	11,318,600	1,233,201
800	2	13,411,735	327,893	12,877,731	1,373,940
900	2	13,739,868	208,463	13,204,557	1,405,501
1000	2	12,770,468	364,193	12,239,079	942,662
200	3	176,545	10,479,673	369,015	1,392,885
300	3	188,011	10,763,903	392,063	1,128,468
400	3	202,040	11,053,133	508,594	1,112,585
500	3	217,421	207,343	459,368	1,163,079
600	3	225,783	11,646,593	515,394	1,526,485
700	3	334,335	367,013	355,126	1,012,779
800	3	302,554	269,093	571,457	1,688,429
900	3	344,868	253,913	460,652	1,360,001
1000	3	530,849	361,193	246,973	2,064,551
200	4	175,973	78,073	396,847	1,318,640
300	4	194,583	117,413	421,084	1,433,035
400	4	193,278	132,533	450,742	1,202,585
500	4	215,992	168,743	414,631	1,270,635
600	4	218,468	142,733	9,410,110	1,490,485
700	4	334,335	151,693	274,147	1,068,468
800	4	345,754	243,173	449,857	1,366,562
900	4	330,297	226,283	510,010	13,932,701

(continued)

**Table 3** (continued)

		MSE values			
1000	4	522,754	387,193	246,973	12,917,551

**Table 4** The comparison of the results

Method	Order	MSE
Song and Chissom [28]	1	412,499
Song and Chissom [30]	1	775,687
Sullivan and Woodall [31]	1	386,055
Chen [12]	1	407,507
Hwang et al. [23]	5	278,919
Chen [13]	3	86,694
Aladag et al. [1]	2	78,073

in Table 4. According to this table, the forecasting result obtained from the method proposed by Aladag et al. [1] has the smallest MSE value.

## Conclusion

Machine learning is one of the most striking concepts of our age. Machine learning is a branch of artificial intelligence focused on building applications that learn from data and improve their accuracy over time without being programmed to do so. In machine learning, systems can learn from data, identify patterns and make decisions with minimal human intervention.

Forecasting problem is one of the most studied topics. Many researchers from different fields have been working on this challenging problem for a long time. One of the most efficient ways to solve this problem is to use time series analysis. Time series consists of observations is the data. There is a dependence on time in time series. And, there is successive structure between observations. Time series forecasting is composed of some process. The data obtained from the past cases is analyzed. Meaningful information is obtained by learning the patterns and important connections in the data. Then, predictions for the future are calculated by using the obtained meaningful information. In forecasting, success is evaluated by looking at the difference between observed values and corresponding predictions.

It is well-known fact that time series faced in real world can have uncertainty. And, traditional methods can not satisfactory forecasting results for such time series since these methods can not deal with uncertainty. On the other hand, Fuzzy time series that can take uncertainty into account can produce very accurate forecasts for time series including uncertainty. Therefore, in the last decades, one of the most effective time series methods has been fuzzy time series. Like in other fuzzy logic

based systems, fuzzy time series can be considered as a system composed of three main stage namely, fuzzification, fuzzy inference, and defuzzification. In the second stage, fuzzy relationships between observations are established and predictions are calculated by using these relations. That is, learning from data is performed in this stage. In the literature, many different methods have been utilized for this stage. Using a machine learning technique in stage would increase the performance of fuzzy time series. Therefore, there have been various fuzzy time series methods utilizes machine learning algorithms. Especially, artificial neural networks method is the heart of machine learning. Hence, using this effective machine learning algorithm in fuzzy time series would be a wise strategy to increase the forecasting accuracy. One of the important and basic fuzzy time series method that uses artificial neural networks was proposed by Aladag et al. [5]. In this study, fundamental concepts of fuzzy time series are presented by giving real world application examples. Also, how the main stages of fuzzy time series work are clarified. Using a machine learning algorithm in fuzzy time series approach is explained. For the aim of this purpose, firstly, high order fuzzy time series method that utilize artificial neural networks to determine fuzzy relations proposed by Aladag et al. [5] is introduced. Secondly, the application of this method over the very well-known data namely the enrollment data of University of Alabama is given in details.

## References

1. Aladag, C. H. (2014). Using artificial neural networks in fuzzy time series analysis. In L. A. Zadeh, et al. (Eds.), *Recent Developments and New Directions in Soft Computing, Studies in Fuzziness and Soft Computing* (vol. 317, pp. 443–451). Switzerland: Springer. [https://doi.org/10.1007/978-3-319-06323-2\\_28](https://doi.org/10.1007/978-3-319-06323-2_28). ISBN 978–3–319–06322–5.
2. Aladag, C. H. (2011). A new architecture selection method based on tabu search for artificial neural networks. *Expert Systems with Applications*, 38, 3287–3293.
3. Aladag, C. H. (2013). Using multiplicative neuron model to establish fuzzy logic relationships. *Expert Systems with Applications*, 40(3), 850–853.
4. Aladag, C. H. (Ed.). (2017). *Advances in Time Series Forecasting* (Vol. 2). Bentham Science Publishers Ltd. eISBN: 978–1–68108–528–9, ISBN: 978–1–68108–529–6.
5. Aladag, C. H., Başaran, M. A., Eğrioğlu, E., Yolcu, U., & Uslu, V. R. (2009). Forecasting in high order fuzzy time series by using neural networks to define fuzzy relations. *Expert Systems with Applications*, 36, 4228–4231.
6. Aladag, C. H., Eğrioğlu, E., & Kadılar, C. (2010). Modeling brain wave data by using artificial neural networks. *Hacettepe Journal of Mathematics and Statistics*, 39(1), 81–88.
7. Aladag, C. H., Yolcu, U., Eğrioğlu, E. (2010). A high order fuzzy time series forecasting model based on adaptive expectation and artificial neural networks. *Mathematics and Computers in Simulation*, 81, 875–882.
8. Aladag, C. H., Eğrioğlu, E., & Yolcu, U. (2010). Forecast combination by using artificial neural networks. *Neural Processing Letters*, 32(3), 269–276.
9. Aladag, C. H., Yolcu, U., Eğrioğlu, E., & Dalar, A. Z. (2012). A new time invariant fuzzy time series forecasting method based on particle swarm optimization. *Applied Soft Computing*, 12, 3291–3299.
10. Aladag, C. H., Kayabaşı, A., & Gökçeoğlu, C. (2013). Estimation of pressuremeter modulus and limit pressure of clayey soils by various artificial neural network models. *Neural Computing & Applications*, 23(2), 333–339.

11. Bas, E., Eğrioglu, E., Aladag, C. H., & Yolcu, U. (2015b). Fuzzy-time-series network used to forecast linear and nonlinear time series. *Applied Intelligence*, 43(2), 343–355.
12. Bas, E., Yolcu, U., Eğrioglu, E., & Aladag, C. H. (2015). A Fuzzy time series forecasting method based on operation of union and feed forward artificial neural network. *American Journal of Intelligent Systems*, 5(3), 81–91.
13. Box, G. E. P., & Jenkins, G. M. (1976). *Time series analysis: Forecasting and control*. San Francisco, CA: Holden-Day.
14. Chen, S. M. (1996). Forecasting enrollments based on fuzzy time series. *Fuzzy Sets and Systems*, 81, 311–319.
15. Chen, S. M. (2002). Forecasting enrollments based on high order fuzzy time series. *Cybernetics and Systems*, 33, 1–16.
16. Chen, S. M., & Chung, N. Y. (2006). Forecasting enrolments using high order fuzzy time series and genetic algorithms. *International Journal of Intelligent Systems*, 21, 485–501.
17. Eğrioglu, E., Aladag, C. H., & Yolcu, U. (2012). Comparison of feed forward and Elman neural networks forecasting ability: Case study for IMKB. In Aladag, C. H. & Eğrioglu, E. (Eds.) *Advances in Time Series Forecasting*. Bentham Science Publishers, USA. eISBN: 978–1–60805–373–5.
18. Eğrioglu, E., Uslu, V. R., Yolcu, U., Başaran, M. A., & Aladag, C. H. (2009). A new approach based on artificial neural networks for high order bivariate fuzzy time series. *Applied Soft Computing*, 58, 265–273.
19. Guney, H., Bakir, M. A., & Aladag, C. H. (2018). A novel stochastic seasonal fuzzy time series forecasting model. *International Journal of Fuzzy Systems*, 20(2), 729–740.
20. Huang, Y. L., Horng, S. J., He, M., Fan, P., Kao, T. W., Khan, M. K., Lai, J. L., & Kuo, I. H. (2011). A hybrid forecasting model for enrolments based on aggregated fuzzy time series and particle swarm optimization. *Expert Systems with Application*, 38, 8014–8023.
21. Huang, K. (2001). Effective length of intervals to improve forecasting in fuzzy time-series. *Fuzzy Sets and Systems*, 123, 387–394.
22. Huang, K., & Yu, H. K. (2006). The application of neural networks to forecast fuzzy time series. *Physica A: Statistical Mechanics and its Applications*, 363, 481–491.
23. Hwang, J.R., Chen, S.M., & Lee, C.H. (1998). Handling forecasting problems using fuzzy time series. *Fuzzy Sets and Systems*, 100(2), 217–228.
24. Lee, L. W., Wang, L. H., Chen, S. M., & Leu, Y. H. (2006). Handling forecasting problems based on two factor high-order fuzzy time series. *IEEE Transactions on Fuzzy Systems*, 14(3), 468–477.
25. Levenberg, K. (1944). A method for the solution of certain non-linear problems in least squares. *The Quarterly of Applied Mathematics*, 2, 164–168.
26. Park, H. I., & Lee, S. R. (2011). Evaluation of the compression index of soils using an artificial neural network. *Computers and Geotechnics*, 38, 472–481.
27. Park, J. I., Lee, D. J., Song, C. K., & Chun, M. G. (2010). TAIEX and KOSPI 200 forecasting based on two factors high order fuzzy time series and particle swarm optimization. *Expert Systems with Applications*, 37, 959–967.
28. Song, Q., & Chissom, B. S. (1994). Forecasting enrollments with fuzzy time series—Part II. *Fuzzy Sets and Systems*, 62(1), 1–8.
29. Song, Q., & Chissom, B. S. (1993). Fuzzy time series and its models. *Fuzzy Sets and Systems*, 54, 227–269.
30. Song, Q., & Chissom, B. S. (1993). Forecasting enrollments with fuzzy time series-Part I. *Fuzzy Sets and Systems*, 54, 1–10.
31. Sullivan, J., & Woodall, W. H. (1994). A comparison of fuzzy forecasting and Markov modeling. *Fuzzy Sets and Systems*, 64(3), 279–293.
32. Yolcu, U., Yolcu, O. C., Aladag, C. H., & Eğrioglu, E. (2014). (2014). An enhanced fuzzy time series forecasting method based on artificial bee colony algorithm. *Journal of Intelligent and Fuzzy Systems*, 26(6), 2627–2637.
33. Yolcu, U., Bas, E., Eğrioglu, E., & Aladag, C. H. (2015). A new multilayer feedforward network model based on trimmed mean neuron model. *Neural Network World*, 25, 587–602.

34. Yolcu, O. C., Yolcu, U., Eđriođlu, E., & Aladag, C. H. (2016). High order fuzzy time series forecasting method based on an intersection operation. *Applied Mathematical Modelling*, 40(19–20), 8750–8765.
35. Zadeh, L. A. (1965). Fuzzy sets. *Information and Control*, 8, 338–353.

# The Double Life of Virtual: Emancipation as Immobilization in an Isolated Age



Jasmin Hasanović and Emina Adilović

**Abstract** Considering the increasing reliance on technology during the outbreak of COVID-19 pandemics, the aim of this paper is to analyze the relationship between the specific state of isolation and the possibility of using digital technologies being perceived as the then-dominant free space for acting. Starting with the assumption that virtual space is not given by itself, but rather diabolical in the middle of reflecting the existing power relations and the parallel inscribing of the potential for their resolution, the paper seeks to examine the (im)possibility of anticipating wider socio-political alternatives with the emphasis of Bosnia and Herzegovina during the pandemics. In other words, acting on the Web is both immobilizing and emancipatory. Based on the attempt to read chaos theory from a dialectical perspective, the significance of this paper is reflected in the application of theoretical assumptions about the influence of technology towards the affirmation of radical democratic practices. The interdependence of liberating and limiting as emancipating and immobilizing in the context of information and communication technologies will show that emancipation is not to be seen as a linear, eschatological process. Instead, it depends on different, unpredictable, and nonlinear outcomes, as well as the complexity of the interpenetration of global and localized phenomena.

**Keywords** Bosnia and Herzegovina · COVID-19 · Digital technologies · Emancipation · Immobilization

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## Introduction: Virtual Space as Diabolical

Starting from the diabolical assumption while thinking about the virtual, we can approach the explanation in a diachronic and synchronic way.<sup>1</sup> The diachronic sequence represents an observation in historical line, starting from the beginnings of information and communication technologies and the techno-utopianism that we associate with the '90s. At the time, the general thought was that the new virtual space would solve if not all, then most of the existing social injustices simply by moving action into the unused, newly discovered digital cosmos and therefore its unknown applications and uses. However, around ten years later, it began to be seen that the existing injustices and social ways of functioning not only spill over, but create additional phenomena that coexist in parallel with the current problems.

In fact, the whole story can be viewed in relation to other phenomena, which would mean that it, indeed, began much earlier.

In text *From the Electronic Frontier to the Anthropocene*, answering questions from Petar Jandić, American journalist, scientist and historian, Fred Turner (2017) explains the relationship between counterculture and technology. In reflections on the counterculture of the '60s, the established association most often becomes the well-known historical outcome of the New Communalist movement; giving up the principle of living in communes as communities of common property, they soon return under the roof of social mechanisms from which they initially tried to distance themselves politically. Utopian spaces never fully came to life, and their implementation was incomplete, delusional, and ultimately, pragmatically unchanneled and short-lived. It would be wrong to claim that this movement ended when most of its members re-accepted the norms of the state regime, excluding the possibility of transforming and intertwining the noble ideals of the 1960s with policies in a post-industrial networked society. Starting with the unexpected discovery that the '60s counterculture *hero* in *Wired* magazine in the '90s was promoting computers as a tool for countercultural change, Turner [91, 92] points out that thus, a seeming contradiction emerges because information technology had until then been linked to military operations in the Vietnam War, standing on the opposite side of the pacifist views of members of the counterculture.

The second-line counterculture approach of the 60's and beyond contributes to an understanding of thinking about the possibilities of participatory rather than individual, lonely and consumerist action; The New Left opposes techno-optimistic views that simply moving into the digital space will suppress or at least reduce the gap between existing and real social mechanisms. Barbrook and Cameron [10] In the efforts of the New Left movement, the participatory aspect plays a key role in the processes of democratization online, including action in communities as well

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<sup>1</sup> The concept of synchrony and diachrony was first developed by the Swiss linguist Ferdinand de Saussure to explain the observation of language in the present state as synchronic, while diachronic observation would represent language in the historical field. However, outside the framework of structural linguistics, these terms can be used to describe the way of observing a certain phenomenon that has developed throughout history, whose implications we have in the present.



as in political state institutions because the borders of the *state* and the *market* are blurred, as Frank Pasquale claims in the book “The Black Box Society: The Secret Algorithms That Control Money and Information” [70, 10]. In such an environment, it is necessary to connect individuals into effective online communities inspired by the possibility of meeting and learning from the other and different and building “communities that last longer than a blog post” [92].

Did the memory of the counterculture communes from the previous century really serve as the proper inspiration for modern communities if we take into account the current consumption of the free will exiles from then existing regime? By asking this question, we come to a synchronous cross-section observation of virtual space which is diabolical at a certain point in the present, focusing on several existing ways of using virtual space and their implications. Consuming the cultural and technological patterns of hippies is opposed to active political activity, as it has remained only as a consumerist ideal, a fascination with the possibilities of technology as well as a desire to own all gadgets—“Just think about the marketing of the iPhone, or any number of other devices. And think about the frenzies that have greeted the release of these things” [92, 65]. The difference between the New Communalist and the New Left is reflected today in the way they use network technologies; communalists to connect individuals through communication on the Internet and at the same time believing that the use of high-tech will lead to a better society, or new leftists for understanding the relationship between the individual and institutions and activistly promoting democratization within the existing system in order to try to view and overcome the problems of privacy, oversight, and unpaid online work.

Hence, virtual space is diabolical because the ideas, concepts and opinions on the way of use have moved from completely optimistic, idealizing and humane to increasingly critical, postdigital and, moreover, often techno-pessimistic understandings and analyzes. Nevertheless, they exist side by side today. However, if we look at virtual space and information and communication technologies through a synchronous prism, then what are the challenges in the new technological space based on and how are they presented? Equally, without completely rejecting the idea of techno-utopianism, it is possible to notice those events, movements and protests that were closely related to acting on social networks. Therefore, the determination of network space as diabolical can be viewed in detail through the prism of activism on social networks as the most dominant way of using digital technologies if the construction of virtual communities and communication channels among citizens is taken into account. With the beginning of the COVID-19 pandemic the use of the Internet has noticeably increased by *the Lockdown Effect* [35], where in the BiH context a large part of the time was spent on social networks as synthesizers of news, events, but also riots, comments, mockery of political problems as well as problematizing the quarantine state.<sup>2</sup> In this way, the old ideals of techno-utopianism have now emerged as ideas of a *new normality*: Slavoj Žižek noticed the hope that physical distance would only increase the intensity of our connections with

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<sup>2</sup> About the intensity of the use of Internet, social networks and smartphones in Bosnia and Herzegovina, in general and among youth before the pandemic, see: [80]

others [105, 3], which in fact tried to justify the inevitability of being *in the same* (virtual) *boat*. However, what is this online space like: in the case of BiH, acting in an online environment has emerged predominantly as a statement/declaration rather than as a productive communication and dialogue which is explained by Siva Vaidhyanathan when he says that social networks do not encourage conversation, but provoke “shallow reactions” because “they do not allow for deep deliberation” [93, 144]. In addition to comments on Twitter and Facebook, such reactions mostly emerged as mimes, new ways of expression that served as a distraction, relief and vaporization of anger, and the need for mobilization. Although mimes often contain a subversive line, they nevertheless remain sarcastic and humorous with no visible action in reality. Activities in the online environment in BiH during the pandemic were predominantly “activism from the armchair”, or “hashtag activism” as it is called in the book “Superconnected: The Internet, Digital Media, and Techno-Social Life” by Mary Chayko when she talks about seeking support on social networks [21, 107–110]. In content sharing, not all the potential of a participatory culture is fulfilled, just as not every communication achieves conversation.

“But what do we forget when we speak through machines? We are tempted to forget the importance of face-to-face conversations, organization and discipline in political actions. We are tempted to forget how political change often goes two steps forward and one step back. And that it usually takes a long time.” [88, 295].

## Dialectical Materialism and the Complexity of Social

It is precisely this original tension between techno-utopianism and techno-optimism, between escapism into virtual micro-communities and the affirmation of depoliticized and disengaged free initiative brought the values of the web closer to the liberal ideology behind cognitive capitalism whose monopolistic protagonists are Facebook or Google, who “manage to make huge profits by selling advertisers access to content which the internauts produced themselves and applying freedom that the pioneers of Internet dreamed of” [52, 34]. If we think of *engagement* as a symbiosis of activity and attention [101], it becomes a business model of virtual, supervisory, cognitive capitalism whose algorithms tend to keep our attention based on information and subjectivizing us on our digital footprints on the Web, thus creating the illusion that the whole world is like our news feed, made up of like-minded people, though, without real communication between them.

Žarko Paić notices that modern science as techno-science, is no longer knowledge as *episteme*, reflection on the world or some object, but it becomes “the metatheory of knowledge about the world and the project of changing the world itself from the practical character of technology” [69, 204]. Transcoding power, he emphasizes, mediates between being and event—a change of state is predicted by applications based on a database, they are not only a practical reality, but at the same time serve to create a future event. By removing man as a being of practice, one gets the impression that change and the creation of new is no longer in the people and their actions, but

in the technology and science that construct the world and transfer practice from the *human* to the *posthuman* and *transhuman* spheres. In the age of *scientism* and the prevailing scientific view of the world, it does not only give the impression that all major social and political issues have been resolved, such as living in time of *reflexive modernization* of a kind of *global risk society* in which we are fighting against the side effects of new forms of production, so politics has been reduced to *micro-politics*—politics of life decisions, choice and individual lifestyle (cf. [12, 13, 40]), but it also changes the whole ontological picture of history and man as a subject.

That is why social media platforms, as emphasized by the author Jamie Barlett, with their attempt to *keep us online* are seen as “the latest iteration of the behaviourist desire to manage society through scientific observation of the mind [11, 14] reminding on the thesis of Chris Anderson from 2008, the then editor-in-chief of *Wired*, hailing the “end of theory” which are unnecessary with the possibility of tracking of human activity and behaviour with the help of big data [4]. The Scientocratic invocation of the *end of theory* reminds us of similar debates conducted primarily within the Anglo-Saxon context during the ‘50s and ‘60s under the influence of the behavioral revolution about the death of political theory [56] or the unproductiveness, boredom and uselessness of politics in general (cf. [28, 59]) in which the knowledge about the world and the study of society attempted to be subordinated to the strict demands of natural sciences—favoring quantitative methods, experiment and in general, empirical data accumulation, neglecting and denying the possibility of any *scientific change of the world*.<sup>3</sup>

With the global quarantine, the COVID-19 pandemic best demonstrated and reminded that science, like technology, does not have absolute answers to all social questions, challenges and problems we face, just as technology cannot solve them. No matter how communicatively and economically interconnected at the same time, economically divided and culturally diverse world reacted differently to the same *emergency state*. In the Western world, the former techno-optimism now seemed to return with the potential to accelerate the creation of new forms of collectivity and sociability as opposed to conventional, dominant, and established practices. And while on some micro-examples solidarity, collective actions and a kind of self-organization from the bottom up strengthened, the idea of state sovereignty has also returned in a very Schmittain way. Not only have the authoritarian and despotic tendencies of the government been strengthened, but the policies of state control and supervision, aided by technology, have become present and visible even in Western, liberal-democratic societies, which are already facing a crisis of democratic legitimacy, right-wing populism and democratic backsliding (cf. [5, 66, 87, 102, 106]).

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<sup>3</sup> A paradigmatic political-philosophical conflict on this issue was the positivism dispute (German: *Positivismusstreit*) in 1961 between the representatives of critical rationalism on the one side, claiming that social sciences have to keep the scientific method and dealing with empirical questions as the main subjects of scientific investigation while the members of Frankfurt school of critical theory on the other side advocated that the role of sociology should be discovering the fabrics of society for the purpose of liberating the society from domination and thus changing it.

Just by referring to the examples from the past decade<sup>4</sup> it is evident how certain events, even in the time of creating the *new reality* managed to penetrate from the analog into the digital space, and then materialize from the digital back to the analog, taking in that context the case of George Floyd protests and Black Lives Matter movement as being the most representative. But, also, it didn't take long from the global lockdown from the beginning of 2020 to make it clear how the *new normality* does not dissect the reality sharply into the state before or after it, but rather, it is being reproduced simultaneously. With the alienation of the people from political processes and the overall democratic deficit by the radical center (cf. [2, 26]) social networks created the illusion of *free space* as *public space* uncolonized by the *mainstream media* serving the political establishment. Thus, the anger on social networks could be seen as anger on the impossibility to act and to participate within the *political agora*. In other words, while contributing to the dangerous trap of seeing the engagement on the Web as a political engagement, it is simultaneously creating individual experiences collided with many other such experiences, generating *fidelity* depending on the situation as a dialectic between *being and event* [9] and anticipating subjects through which the Event could be transformative. It allows the Event to take place as a non-Event, appearing in some other form, on other place, by other occasion or in some other circumstance.

Thus, changes cannot be simply viewed through the prism of a mere, linear way of thinking, but rather as a *dialectical concept*, acknowledging that things do not change in isolation from each other but in their inter-connection. As Engels put it, dialectics is “the science of interconnections” [33, 62].<sup>5</sup> The appearance of *mathematics of chaos* in the '60s together with the experiment of meteorologist Edward Lorenz referring more often lately to the so-called “chaos theory”, with all controversies and debates around this compound [16], has not contributed to anything significant for the study of social phenomena in particular, except confirming their *dialectic* which underlined the existence of dynamic, non-observable and unpredictable structures that cannot be covered by the application of an essentialist as well as positivist approach of deductive method, qualitative data, experiment or rationalization. As James Gleick would stress out: “chain of events can have a point of crisis that could magnify small changes. But chaos meant that such points were everywhere. They were pervasive.” [42, 23] pointing to their multifacility and complexity, as nonlinear relations where the smallest differences in input could cause overwhelming differences in the output.

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<sup>4</sup> We take as examples the Occupy movement, the Arab spring, Beppe Grillo and the Five Star Movement in Italy and the emergence of *Podemos* in Spain, *Syriza* in Greece or the recent *Gilets jaunes* movement in France.

<sup>5</sup> The basis of scientific positivism is that social processes are observed and studied analogously to natural ones—they are subordinated to the positive facts within social problems can be solved by a scientific approach, thus imposing the thesis that society itself, as well the physical world, is subjected to acts in accordance with certain *immutable*, absolute and universal natural *laws* that cannot be changed [24, 203], so the essence of the being merges with the phenomenon itself. In other words, it is a linear approach to reality grounded in the Galilean-Newtonian tradition of science—in the concept of *scientific optimism* that accepts Newtonian mechanics as an example of all knowledge—his “revolutionary innovatin was a physics consisting exclusively of observable phenomena and the logical relations among them” [32].

Unlike earlier mechanistic, linear worldviews that start from opposing relations to the external, objective, world as being chaotic *versus* the subjective mind as rational and ordered giving so meaning to the external world where possibility remains trapped in the fixation of predetermined laws—the so-called *new science* shows “that processes that were considered to be random (...) are nevertheless driven by an underlying determinism—not the crude mechanical determinism of the 18th century but *dialectical determinism*” [98]. Understanding society as perhaps the best example of a complex and dynamic system, the theory of chaos and complexity points to the unpredictability of change and its complexity within material reality. This kind of analogies between non-linear dynamics, chaos and complexity opened up a space not only to apply dialectics to scientific study (*cf.* [7, 57, 68, 77]), but also applying it as a method of understanding and knowing material changes and their interdependencies to human society. Noting the limits to the predictability of linear, scientific approach, it also encourages the acceptance of a *dialectical approach to materialism*, as a philosophical analysis derived by Karl Marx and Friedrich Engels, affirming that our reality is to be understood as a product and reflection of material conditions (*cf.* [33, 34, 62]).<sup>6</sup>

Quoting Marx’s notion that we make our own history not under circumstances chosen by us, but encountered, given and transmitted from the past, it opens space to perceive humans as “active agents in the creation of history, interacting with nature, both as a source of life (...) and as a force influencing social development” [100, 436]. In other words, favourizing dynamic interactions emerging in collision of diverse and variable factors, anticipates theories of complex systems, leaving the reductionism of isolated, causal forces and natural “laws” governing both natural as well as social world aside. It does not only allow the foresight of possibilities that is essential in understanding causation and context dependence in the social world but also enlightens the potential for social change even in the pervasiveness of everyday happenings in people’s lives [100, 431] focusing rather on the *process of becoming* than the *state of being*.

It is important to underline that the intention here is not to extract and deliver our arguments from and through *chaos theory*, *dialectical materialism* or elaborating our claims and findings using analogies deriving out of the natural sciences and on the basis of their prudence. Merely as a *conceptual tool* beyond any particular disciplinary restriction which importance lies in a new way of contemplating about the social and reaching political and human questions in the first way. Therefore, it allows us that as a process of liberation from domination and power relations, emancipation should not be viewed metaphysically or eschatologically, but rather as Ernesto

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<sup>6</sup> It is to note that the term “dialectical materialism” was never used by Karl Marx or Friedrich Engels unlike “historical materialism”, “dialectics” or “materialist dialectics”. It was, however, coined by Joseph Dietzgen and later developed by many other Marxist and socialist theoreticians, thus being used as a conceptual tool and philosophical approach to reality.

Laclau [55] understood it, as emancipation(s)—synchronization of different emancipatory struggles that constantly unite and separate thus creating new discourses of liberation.<sup>7</sup>

Here we start from a slightly different aspect. Not only can the dynamism and dialectic of social relations indicate to us that the least things can be the triggers for greater change, as chaos theory is warning us, but equally, that change does not have to happen at all. This thesis opens the possibility to ask why the perceived emancipatory potentials and reflections on *alternative, counter-hegemonic spaces* in the states of lack of freedom and emergency do not succeed. Therefore, there is a significant insight into the diabolical nature of technology, dynamism of society, hegemony and the hegemonic relations of domination within society that simultaneously open and close fields of possibilities. Therefore, the need for theoretical reliance on empirical reality in terms of understanding different relationships and processes, as well as what lies behind them, seems a key task in considering new forms of social and political theorizing, opening opportunities for alternative thinking of reality, new social and political institutions and democratic practices. In other words, it allows us to question the perception of the role of social networks and the Internet as a space of freedom and social change on one localized example.

### ***Like and Share if You Agree!:* The Case of Bosnia and Herzegovina**

While being in the new reality of pandemics and lockdown that exposed structural inequalities, horizontally and vertically, it also pointed to numerous, mostly suppressed paradoxes of today's developed global society. The market logic of commodification of public goods, primarily health care, showed how the struggle against a common enemy was reduced by shifting responsibility to individuals, imposing, paradoxically, as the greatest act of sociability and expressing solidarity the absence of physical contact. Leaving us alone, the isolated age of the emerging *new normal* reminded us on the words of Marx that technology could act as a tool of emancipation, but only a tool and not emancipation per se. With restrictions such as ban on gatherings, curfews and other crisis measures, the issue of freedom has been reduced to a security issue in which the contagion and danger of the outside world could, at least temporarily, be replaced by the purity and security of the virtual. It collides all our interactions, and with the rise of immaterial work, underlines the question of property in terms of owning and using digital technologies, protocols and information.

This problem, certainly, goes beyond the context of Bosnia and Herzegovina or any other particular state. In a theoretical sense, we can see it through the universality of the *scientocratic endism* of contemporary, Western liberal democracies claiming

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<sup>7</sup> See also: Laclau, E. & Mouffe, C. (2014). *Hegemony and Strategy. Towards a Radical Democratic Politics*. London/New York: Verso.

that history and ideology have come to an end, together with the idea of emancipation that, in its eschatological and linear understanding, is unnecessary today. In her book “Marx in the Digital Age” Katarina Peović will link such an attitude with Foucault’s idea of *technologies of the self*—the idea of producing and inventing identity as differentiation, creation and innovation beyond the dominant power relations. Peović pulls out similarities between his emancipatory understandings of politics of self-creation and the creation of self on the Internet—today they are “co-opted and becoming the foundation of the hegemonies of the self that Foucault intended to reveal (...) although new ‘distrubuted’ techologies of the self, liberalization of production and creations of identity emerge, hegemonic power does not wane. Indeed, it is precisely the liberalization of identity production on Internet services, self-creation, plurality, multiculturalism and emergent identity policies that produce a non-egalitarian society of prosumers and audience-goods” [73, 157–158]. Instead of communicative, Peović sees technology in Marx’s sense as a place of *culture of resistance*, that is, technology that is been considered as a product and reflection of material conditions.

With the outbreak of COVID-19 pandemic in Bosnia and Herzegovina<sup>8</sup> the forced escape from the analog space, perceived as contaminated, ends in self-isolation in which *physical distancing* is now being replaced by *digital closeness* of the virtual space. Like anywhere else, this turn to a deeper reliance on digital technologies, social media in the first place, brought them to the foreground of our social and political relations, playing an omnipresent and unavoidable role in our lives. Utilizing Internet for informing us about new cases, disseminating and facilitating authorities and Crisis Staffs measures and responses to the crisis, it also made a delusion of an inclusive and immediate *democratic space* allowing open and public debate and communication, a real time and peer to peer information change which do not depend both on already distrustful media in circumstances of political corruption and unprofessionalism [90] as the consequence of its dysfunctional political framework tailored within the Dayton Peace Treaty based on *consensual ethnocracy* and *ethno-deterministic biopolitics* on the other side [47]—as a decentralized state made up on two entities, Republic of Srpska and Federation of Bosnia and Herzegovina being further divided into 10 cantons.

Stronger impact on social interaction through written, visual or audible communication virtually transcends systemically limited political and social engagement by discriminatory provisions of the Bosnia-Herzegovinian Constitution in favor of the three ‘Constituent Peoples’ of ethnic Serbs, Croats and Bosniaks.<sup>9</sup> The anticipation of an alternate, more direct political framework for citizens participation is an attempt seen most expressive in February 2014 protests, attempting to overcome the imposed and materialized ethnic divisions for the first time by organizing plenums as the most radical experiment in non-institutional politics since the collapse of Yugoslavia, as noticed by Igor Štiks and Srećko Horvat: “Enraged citizens simply

<sup>8</sup> While the pandemic is still ongoing, here we put focus on the first year of the COVID 19 pandemics, starting from March 2020 after the WHO declared a pandemic [99].

<sup>9</sup> See, for instance the cases of Sejdić and Finčič (2009), Zornić (2014), Pilav (2016) and Pudarić (2020) versus Bosnia and Herzegovina.



rebelled against the degrading conditions of social and political life and spontaneously adopted citizens' assemblies and horizontal forms of democracy as a way to articulate their demands and organize themselves autonomously" ([86], cf. [8, 14, 54, 67, 77]). Hence, the congruent fluidity and horizontality of social networks provokes the need for questioning them as a new possible tool for opening new spaces of social and political action deprived from the limitations of the political order?

With a decentralized and complex governance system of power-sharing to entity and cantonal governments regarding health care, it does not only aggravated coordination but also illuminated other vulnerabilities coming out of it—such are politized, weak and corrupt public sector. Despite the prompt declaration of restrictive preventive measures<sup>10</sup> by both entities indicated, at that time, “better control of pandemic in Southeastern European countries compared to some Western and high-income European countries” [6] it also emboldened despotic tendencies of the, mainly ethno-nationalist political elites. The introduction of curfew, securitization of society and encouraging citizens to report others violating the measures soon turned the narrative from an epidemiological, safety and preventive, to a purely political question. This can be contextualized through another argument—while retiring home for some meant only adapting to the new circumstances of working from home which is for precarious immaterial workers the only form of work they know, it left others jobless, while it led the third—primarily health workers—to burnout. Health facilities are reaching their limits and threatening to collapse, cutting other—regular services in a situation where one nurse cared for 20 patients infected with the virus [36].

Armed by information and communication technologies in their hands, questioning their use as the then-dominant free space of acting, we do not assume or underline that the acting of citizens should be in mobilizing against the preventive measures aiming to stop the spread of the disease, but rather, supposing the expansion and empowerment of public space which allows them freely and inclusively to act politically. In other words, the presumed techno-utopianism and an uncritical perception of digital spaces as “networks of outrage and hope” [20] would anticipate the unification of different voices transformed into demands for systemic change after numerous political scandals that came to light—and whose participants are the highest representatives of the political elite.

On March 11th 2020, only two days after banning all gatherings for over 250 persons, five days from the first confirmed case of COVID-19 in Bosnia and Herzegovina and six days from declaring natural or other disaster on the territory of Bosnia and Herzegovina by the Council of Ministers, congress of the “Igman” company was held in Konjic, marking its 70 anniversary. As one person from Serbia, present at this event among 200 other guests, confirmed positive for COVID-19, this case got media attention as well as federal prime minister Fadil Novalić was present at the celebration together with the federal industry minister Nermin Džindić and the company

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<sup>10</sup> The measures included “movement restrictions for those younger than 18 and older than 65; closure of national borders and curfews; closure of preschools, school institutions, universities, all public gatherings, and ordered cafes, bars, restaurants, and cultural institutions; public and city transport ban; comprehensive patient care reorganization in the public health system, etc.” [6, 398].



management [43]. At the same time, corrupted public sector made possible that “a politically connected local tycoon (...) pulled strings to skip the prescribed safety protocols during hospital admission, bringing the coronavirus to the worst possible place—the Department for Pulmonary disease” [60]. The biggest political scandal comes soon after, after the abuse of emergency public procurement procedures by both entity governments. While in Republic of Srpska the government officials were accused for suspicious use of public money in purchasing a mobile hospital near Banja Luka [61], a small agricultural, raspberry growing company, having ties with political establishment of Federation of Bosnia and Herzegovina government officials was charged into purchasing 100 medical ventilators from China, not only overpaying them by public money<sup>11</sup> but also being defective and useless for COVID-19, arriving without pre-approved technical specifications and import permissions [27, 31].

Responsive engagement to the new circumstances of the virtual Bosnian-Herzegovinian community certainly existed and it included various online practices through the use of satire,<sup>12</sup> humor and irony, as well as photo and video montages, creating the illusion of *hyperactivism* through the medium of digital memeologisation,<sup>13</sup> commentaries and, in general, the spread of news—information as much as misinformation. Though strong public reactions contributed to the opening of an investigation on possible corruption and fraud, the public pressure that existed during the lockdown is nothing new or different that has been seen before in other and similar situations. Moreover, in such a combination of mockery it may have encouraged criticism in cyberspace, but by relying on the algorithms behind the business models of social networks, simultaneously, it has lulled society into passivity, realizing its virtual reality both as a simulacrum for the reality as well as an exhaust for all the affairs, complaints but also a *moral decision*<sup>14</sup> to stay *within four walls*.<sup>15</sup> Our need

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<sup>11</sup> 10,5 million Bosnian marks (around 5,4 million euros, based on the exchange rate for January 7th, 2021).

<sup>12</sup> Satire is defined as “a way of criticizing people or ideas in a humorous way, especially in order to make a political point, or a piece of writing that uses this style” (Cambridge Dictionary), while the “Dictionary of Literary Terms” states that its main goal is to point out social or moral weaknesses, vices and evils, subjecting them to disgrace and ridicule them thus contributing to their elimination [103]. The goal of satire in Bosnia and Herzegovina within the COVID-19 pandemics is not fully fulfilled, as its content remained a goal to itself.

<sup>13</sup> For an informative insight on the rise of meme culture in Bosnia and Herzegovina, see [96].

<sup>14</sup> It would be wrong to claim that only coercion kept people inside their homes. Instead, in the dilemma between *security* and *freedom*, the victory was taken by *security*. Perhaps this *humane gesture* of the citizens of Bosnia and Herzegovina could be read as a response to the general insecurity in various fields, so the humane decision to respect the measures appears as a pursuit of the necessary security.

<sup>15</sup> The first LGBTQ Pride in Bosnia and Herzegovina was held on September 8th, 2019 under the official slogan “Ima izać” (roughly translated as “Coming out”), but at the same time, a connotative meaning was added to the syntagm “within four walls” since members of LGBTQ community are living between four walls unable to publicly declare their identity. The second Pride was held on August 23th, 2020 under the slogan “No life within four walls” with participants passing with cars through the cities all over of Bosnia and Herzegovina. During the pandemics, the feeling of being within four walls expanded beyond the boundaries of this marginalized group. By postponing the march, it could be seen how the issue of LGBTQ community is not only an identity issue, but above

for attention has been turned into a code throwing out content and satisfying us with the feeling that we have done something significant by commenting, sharing, liking, contributing to the critique of the social order and impacting change.

The most ironizing example could be read from the spontaneous actions of applauding for health care personnel, starting first in Italy which footages were spread through social media and thus becoming a new global phenomenon also affecting Bosnia and Herzegovina. Stepping out on our windows and balconies exactly at 8 pm to pay tribute to doctors, medical and technical staff by clapping has been presented as a collective experience of empathy during distancing [72], but which seemed precisely as its very consequence, a situation in which the individual is transformed only into a spectator, trivializing the whole scene as a performance from which the individual is alienated by his passive role of observer from the lodge of his or hers apartment. Although these videos were shared through social media and have been perceived as evidence of joint (and short-term) rapprochement of people in a mutual quarantine activity, such support has resulted in passive activism. It moved after the windowpane back into activism from the armchair, with the attempt to share proof of her or his own participation with friends and followers in digital space.

As Christian Juri notes it in the text “Applause as a form of social distancing”, it is that “by taking on the role of the audience, we have found a place that accounts for and naturalizes our passivity” [50]. Hailing their efforts in extreme circumstances this way also separated us from our responsibility to take account in the importance of public sector as a common, deprived both of clientelist parasitism as well as of market logic and commercial thirst, as destructive ambivalences they’re facing beyond the pandemic.

## **The Dialectical Chaos of Digital (Im)Mobilization**

Therefore, the consequences of online activism due to increased use and reliance to social media are not reflected only in their possibility of wider social mobilization or preparation for concrete political action, but equally in shaping our behavior and affecting the way how we view our world. The content shared by social network users depended on media advertising and the flow of information through media channels such as web portals, television (whose shows mostly all-day focused on reporting on COVID-19 pandemic) and radio channels as well. It would be wrong to think that during this process of commenting and sharing media content and satirizing texts, statements and actions of political officials and the whole situation with the pandemic situation on social networks was uniform. In other words, the further sharing of content was influenced by the news itself, being already shared

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all, an issue that depends on the mutual forces of material conditions. It is not only a question of being contaminated by the virus, but also the fact that many have lost their jobs, sent to work from home, or their job is just set on hold. For those depending on precarious work, projects have also been postponed, thus complicating the existential conditions on all sides of society.

or satirized by users on Facebook, Twitter, Instagram, etc. Although Facebook, for example, is not media by itself, the phenomenon that the virtual masses view it as such is not new, but it comes to the fore especially in a crisis, for the purpose of everyday and real time informing. By liking certain online media pages where they share news, Facebook users limit the content of their own news feed to almost exclusively media content that supports their personal interests, ideological views and in this specific case, views and opinion on the pandemic.

Being understood as *outrage machines*, injecting and spreading outrageous performance into the online space is not only a recipe for success and a business model hijacking more attention on social media [39], but it also encourages outrage allowing it to explode virtually, together with the lack of democratic distrust towards the authorities thus reinforcing “disinformation about social and political issues, such as the epidemic of falsehoods and conspiracy theories concerning the COVID pandemic” [23]. It could be seen in the way Facebook and Twitter contributed to it; Facebook by introducing News Feed in 2009 and Twitter adding the “Retweet button”, together with the Facebook’s “Like” button, being used as a public metric for the popularity of content—“an algorithm that determined which posts a user would see, based on predicted ‘engagement’” [44]. The algorithm of social networks puts our behavior as a central place on the Web—so the goal was to enhance the visibility of our interaction—that other users see that we share our dissatisfaction which we quantify by the number of shares, likes, comments and interactions in general. Such a commodification of emotion allowed an accelerated and undisturbed spread of outrage, becoming both an unavoidable and unpredictable political tool in matter of its consequences.

Reducing the possibility of achieving analog change within the digital framework, the question of political acting places it in the coordinates of their diabolicality. Between techno-optimism and techno-utopianism, online activism in the context of Bosnia and Herzegovina has undoubtedly remained highly engaged in terms of critical reflection on emerging circumstances and their consequences—the way it fights pandemics, securitization of society, and scandals that illuminate the corrupt basis of post-conflict system in Bosnia and Herzegovina. Although the responsive engagement was outward-looking—the question is how much did it, not only with satire, but with the entire meme culture, manage to penetrate outside, and how much did it remain a goal to itself? The example of Bosnia and Herzegovina shows that the free space for acting which society has recognized in the online environment during quarantine does not necessarily provoke and end in broad citizen mobilizations offline or in general demands for changing local or global social, economic and political relations. Even if so, global protests that occurred during and immediately after the global lockdown, but also earlier, were actually responsive events fueled by localized political problems to which the new circumstances clung.<sup>16</sup> The collision between current and previous experiences and political requests, created a non-linear,

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<sup>16</sup> For the anti-government protests in, for example, Hong Kong that have been going since 2019, the outbreak of COVID-19 pandemic together with the issue of public health was just one of a series of arguments confronting Chinese authorities in their demands for more democracy. It is similar with other protests against government measures, which opposition forces used as a tool against the government.

unpredictable network of both possibilities as well as obstacles in acting that did not seem to follow from the logic of situation or predicted but rather a matter of a dialectical fact that were dynamically inscribed in material reality.

Although the responsive activism on social networks virtually engaged the citizens in Bosnia and Herzegovina, this did not concurrently imply that it, by itself, opens opportunities for wider organization, mobilization or any political alternatives. The use of humor, irony or satire on social networks as much as it can contribute to the strengthening so much it can undermine participation contributing both to alienation from the political process as well as entertaining rather than engaging citizens [22]. Without further elaborating different ways, approaches, factors or strategies that can politicize subversion towards liberation and emancipatory policies and practices, especially where censorship is strong, a question that is rarely asked and being ignored by focusing on the speed certain political internet campaigns like #MeToo or #BlackLivesMatter are spreading, is the question of their longevity, sustainability, success and political impact they have. In other words, the existence of concrete political forces that would materialize such engagement. Not only is the opening and expansion of democratic field in Bosnia and Herzegovina outside the ethno-determined framework that digital networks provide significant, primarily in empowering alternate political forms of civic participation, but is it really possible to escape into the virtual just by leaving the context we are aside, missing to inscribe it into digital space? The interaction of space colonized by material circumstances and mass media, together with the constant re-production of its content by users, reduces social networks to the communicative aspect, making us not only more furious in our algorithmic bubbles of like-minded people, but it also transcends into an alienating experience—being connected, we are in fact disconnected from the everyday experience of material world and action [63] while man, labor (manual or immaterial) and “his human activity became a saleable object, a commodity to be bought and sold to the highest bidder” [85, 87]. This tragical experience is exactly that what was seen in the ironical play of solidary applauding to health care workers during the lockdown—a joint action of alienated individuals with no political impact on anything while believing they’re changing the world.

It is a broader problem of a liberal view of politics, as a space of deliberation, compromise and the *moralization of politics* emptied of conflicting concepts and different views of the world. In such a world without alternatives, we are talking about a post-emancipatory world—the universalization of only one, hegemonic view of the world is at work—the world of post-politics—life politics, micro-politics and sub-politics in which the question of gaining freedom is answered by the possibility of having freedom to choose and the space of democracy no longer corresponds to the dynamism of social world. Alienating masses from political elites and decision making is an increasingly desirable framework within which it is possible to synchronize different, opposite and conflictual demands providing compromise through dialogue. A massive army of silent and unrepresented majorities avowedly seek for the expansion of democracy even though they less and less believe in it [95, 9] allowing collective forms of identity to mobilize political passions. It is also

followed by the danger that the crack of trust and identification with the predominant mode of democracy is going to be fulfilled by different essentialist forms of identification and non-negotiable moral values [65, 30, 70] whereby social networks provide them the illusion of being politically recognized. Precisely this opened the possibility that the circumstances of isolation and pandemics are being exploited by far-right populists, anti-vaccers and conspiracy theory advocates, encouraged by the spread of misinformation and the noise of infodemics on digital information and communication platforms [64].

Although there has been no open mobilization towards the exposed dysfunctional and corrupt system arising from its biopolitical post-conflict ethnocentrism, the inputs of online engagement towards it have resulted in different outputs. On the other hand, it would be pretentious to imagine the possibility that in a relatively short period of the emergence of new normality, a sufficiently strong material force capable for political organizing against the existing reality would appear. In this fact that we justify our methodological and epistemological approach to this topic—instead of dealing with empirical data, data collection and quantitative indicators in general, we approach the reflection of phenomena from the angle of theoretical practice.—the collision of theory and matter, with the help of dialectical approach to material reality which, unlike strict empiricist approaches, allows us mapping of background, structural conditions and their influences on the everyday experience of society which are invisible to empirical and statistical analyses since they are pervasive and change over time with unpredictable and multiple, nonlinear and dynamic impacts on the social world. Therefore, it may seem that the Square 2020 (bos. *Kvadrat 2020*) quarantine project of networking activists, intellectuals and students to discuss, polemicize, theorize, and open questions about existing and taboo social and political topics and problems was a weapon in the hands of the oppressed [74], as well as only one point of *possibility* that is inscribed in the cartography of critical thinking and engagement in Bosnia and Herzegovina—from the JMBG protests and plenums until today. In the same way, it can be read that the largest offline mobilization during quarantine in Bosnia and Herzegovina was actually a protest against the remembrance of Nazi collaborators in World War Two [81].

In her book “Twitter and Tear Gas: The Power and Fragility of Network Protest” techno-sociologist Zeynep Tufekci deals with the problem of progressive online activism and their breakdowns, underlying that “to understand dissident social movements and their protests, it is crucial to understand the dynamics of the public sphere” [89, 8]. Using the term *digitally networked public sphere*, in the dizzying speed of digital networks and technologies playing a critical role in all stage of protests, Tufekci notes the importance of both online and offline, recognising that the whole public sphere has been reconfigured by digital technologies being not “online-only” or “online-primarily”.<sup>17</sup> Instead of using a techno-utopian, escapist dream towards the understanding political and economic reality and their implications on the Internet, Tufekci’s insight allows us to type the *material means of production* in the coordinates

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<sup>17</sup> It is a “interaction of publics, online and offline, all intertwined, multiple, connected, and complex, but also transnational and global” [89, 6].

of digital spaces. Thus, the digital landscape of cognitive and surveillance capitalism collecting our data, targeting our digital activity and being determined by rules of Silicon Valley high-tech companies raise the question of their role in being a toll of the people and revolutionary base. In her text “The Problem with Hashtag Activism” Amber A’lee Frost sees how the speed of horizontalism only seems to foster a specific kind of social formation: the undifferentiated mass whose movements are expanding into erratic, unwieldy, unstable blobs, incapable of specialization or coordination, rather becoming “movements that are unable to move, so they stall out, then dissolve” [38].<sup>18</sup>

Frost also talks about the transformation of the former Occupy Wall Street movement and the end of it which is hinted at in the disappearance of the website itself: “I do remember that the website *occupywallstreet.org* (taken down only a few weeks after this review was written) now advertises one—“The End of Protest: A New Playbook for Revolution”, from the “co-creator of Occupy Wall Street”. However, what is happening with the protest pages and activities that are not related to real, analogous (previous) events, but are trying to gather members of (future) analog protests in the digital space? Such example from the BiH context is the Facebook event *Protest 2.0* (2020), which was created and deleted on the same day. Only a few hours after its founding, this group/event had over 3 000 members, and as a reason for its closure, the founder cited attacks, insults and threats from party bots and general disorganization where pluralism of votes led to the group’s news feed being overwhelmed by expressing their own opinions and individual problems without any goal towards gathering and acting in terms of defining the requirements towards the authorities.

Although the therapeutic role of the fusion between satire and algorithm of social networks anesthetizes and self-gratificates, for instance, marginalized communities in their illusion of participation in which *hashtag* becomes something like a *biolink*—linking the embodiment of their movement—it mobilizes as much as it allows control, being also a marker that can easily be tracked.<sup>19</sup> For an example, the starting points of cyberfemism, which reached its peak at the time of techno-utopianism, are based on the impotence of online campaigns that are being replaced by activism. In fact, an opinion stating that it is sufficient to provide online support by creating and sharing specific content, partially hides the reason why this online form of counterculture promotion has failed and the trap because of which we have not had a lot of online discussions about it in recent years. With the development of Web 2.0 technologies, cyberfeminism has primarily turned to communication and action between rights defenders: “Online feminism on the one hand engages with concerns directly related to the Internet, and on the other caters to a much wider range of interests

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<sup>18</sup> It should be taken into account that not all citizens use the social network and that there is a certain generation gap among their users: younger generations use Instagram and TikTok more, and the older ones use Facebook or Twitter [25, 45]. This stratification reduces the possibility of a further, joint action.

<sup>19</sup> Thus, organizing the JMBG protests in 2013 and February protests and plenums in 2014 enabled at the same time their relative massification as well as the investigative bodes to monitor the protesters [41, 71], and spreading of fabricated misinformation in order to criminalize and compromise the protests and citizens (*cf.* [3, 53, 83]).

that use the Internet as a platform for organising, communicating and raising funds and awareness.” [79, 1] Using the Internet and social networks as a medium, less attention is paid to the Internet policies themselves, such as access to content, property rights, security, privacy, etc. As a special and currently neglected aspect, Nicole Sheprad states net neutrality: “Decisions on what content is considered appropriate or offensive are made by corporate entities and materialised in code, often to the detriment of feminist content, for example when Google excludes bitch media from its services, in Facebook’s rather troubled relationship to breastfeeding mothers or feminist activism.” [79, 2]. In other words, this affirms differences rather than finding common causes of their subordination.

By shortening the engagement exclusively to the engagement through social networks, their emancipatory ability remains primarily on the communicative aspect—digital algorithms may be *fabricating singularities* [76, 229] but, what is missing is their quest for a different political and economic organization of society that cannot be subdued solely to the task of digital technologies. In other words, subducting information and communication technologies as emancipatory only through their communication role neglects their material background, their ownership structures as well as the social, economic and political system within which they operate and are being used. Thus, technologies—digital in particular—are not mere *communication instruments*—their virtuality is a *construction* whose inputs are from the material sphere of dominant and hegemonistic social, political and economic relations. No matter how dominant the digital space may be, it is only a virtual reflection of the analogous real—and as long as it is driven by commercial interests in which governments and capital have more power than its users, it can hardly be any alternative, countercultural, democratic and subversive place of resistance ([38]; cf. [37, 49]).

## **Accentuations: Impossibilities as Opportunities and the Dialectics of Emancipation**

While “the web reshapes our world, we have a responsibility to make sure it is recognised as a human right and built for the public good”, as pleaded by Tim Berns Lee [97], the final results are usually different. Because of their perception as public good, digital technologies can be presented and understood as a rhizome, “a philosophical concept of the rhizome, a paradigm opposed to the existing method of metaphorical reduction that uses the root-tree paradigm.” [30, 332]. In other words, guided by the theory on rhizome that stands as a metaphor for de-hierarchical, multiple structures, the tree, among other things, signifies rigid, centralized, one-way communications [29] and due to the way it is designed, the Internet could be anticipated as opposed to undemocratic principles and a market economy. What actually happens in the reality is that the rhizome tree of digital technologies goes through a process of *woodening*



precisely because of its attachment to what it should oppose; unequal rights to participate and use the opportunities of digital technologies. Therefore, the diabolicity of the virtual is only a part of the dialectic and complexity of social relations themselves, as a relation of power and material forces of production.

The issue of redistribution became a pivotal economic and political issue with the global pandemic. The state of social reality in the context of COVID-19, like any other type of social crisis, emphasized among others the need to reflect on market weaknesses, public goods and the impacts of technology, being a moment that calls for collective forms of action [46]. This kind of a *historical lesson* puts the relationship between the market economy, collectivity, existing and possible technological impacts to the center of debates. Since the constant drive for accumulation and commodification that dissipated and penetrated into all social pores, demands for deepening democratization instead of conserving it into self-sufficient and monolithic communities of identity are increasing, fostering a more active society respecting its internal and local specificities, heterogeneity and plurality [1, 75]. The idea towards the socialization of democracy in context of the applying theoretical assumptions on the influence of technology and affirming radical democratic practices, attempts to democratize Internet which is managed by its users, not the state or corporations, as an indispensable part of socializing the politics in the broadest sense—contributing to various forms of participation, mobilization and engagement, because it would, at the same time, provide space for autonomous self-organization.

However, digital technologies alone cannot lead to *heretical alter-politics* that want to change the very social, political and economic circumstances within which we find ourselves. As the inner space of capital, Peter Sloterdijk sees the Western world as a world of exclusion, it “is not an agora or a trade fair beneath the open sky, but rather a hothouse that has drawn inwards everything that was once on the outside” [82, 12]. Because of that it is impossible to imagine Internet as an escapist, utopian and open protocol that eliminates hierarchy, organization and control where “the promise of emancipation through the openness of rhizomatic network nodes indicates how the rhetoric about the decentralization of the Web as a liberating, anti-hierarchical force ultimately disables and obscures its notion of a highly structured virtual bureaucracy” [48, 57].

This shows how the simplified questions, hopes and expectations of whether society will reinvent itself in times of isolation with the help of social networks are wrong in their setting. Rather, they are based on the eschatology of liberal ideology and sacralized free choice to which networks, with the help of attention algorithms, significantly contribute. In his book “Like a Thief in Broad Daylight: Power in the Era of Post-Humanity” Slavoj Žižek notes their (im)mobilizing character: “Since, in our society, free choice is elevated into a supreme value, social control and domination can no longer appear to infringe on the subject’s freedom—it has to appear as (...) the very experience of individuals being free. (...) Constantly bombarded by so-called ‘free choices’ (...) increasingly we experience our freedom as that it effectively is: a burden that deprives us of the true choice of change” [104, 43].

So is our second part of the paper title—“Emancipation as Immobilization in an Isolated Age”, in fact, the irony of the very delusion that we are isolated since the



pandemics and that the use of information and communication technologies will help overcoming this state. Failures are not problematic as much it is the blurred vision of domination being perceived as liberating—the belief that the greatest reach of our struggles is in the anesthetic relief of illusive participation which seeks recognition and that extending freedom beyond the current is no longer possible. Rather, emancipatory practices and attempts are endless fields of possibilities and impossibilities, theoretical practices that depend on social dynamics, context and interpenetrating variables that cannot be separated from the complexity of material reality, their causalities and interdependences.

Emphasizing the case of Bosnia and Herzegovina, no matter how different it may be from global or local experiences, it also shares their imprints in some respects at the same time. It is therefore taken as an exhaustive, and to us most immediate indicator of the way internet culture and online activism are taking into account the contradictory and chaotic nature of digital human experience, and (do not) go in favor of wider democratization of society. The existence of crises is immanent to the capitalist mode of production. While between 28–30 000 people lost their jobs in the Federation of Bosnia and Herzegovina alone in the first half of 2020 [15, 51] US billionaires such as Elon Musk or Jeff Bezos are getting richer during the ongoing pandemic [84]. The precarization of labor and market logic have made jobs increasingly uncertain. The supremacy of economic rationality subordinated it to its laws, mystified market relations, so it seems that people no longer have any active role in society—neither within their workplace nor within political institutions. The crisis of capital became a crisis of democracy reduced exclusively to its deliberative and representative form. Therefore, demands for deepening participatory practices from bottom-up and the radicalization of democracy are being heard more constantly.

To think of radical change is to encompass the root of that what needs to be changed, as it is the problem of today's inequality itself. Global crises seem to outline a new form of relationship between man, labor, technology and the distribution of goods—the outlines of which digital technologies are only one part, one of the tools to be engraved into the map of possibilities, one of the determinants of the social dynamism contributing to the changes of the very functioning of democracy, whether *reinventing it digitally* [18] as *algorithmic* [94], *liquid* [17, 75] or simply *e-democracy* [58] and which do not determine any predeterminate outcomes, but being plotted as additional variables. So are the outlines of constant, everyday production of emancipatory theories and practices drawn which are being synchronized, united and separated. Deprived of eschatological predetermination, they do not focus on the final outcome, but rather, the processes of dynamic possibilities and contingency, where randomness is dialectical. In order to be political, engagement must conflict within the very relations of power and thus actualizing itself within the material.

## References

1. Adilović, E. (2020). Koncept članstva u bh. bibliotekama: od samoupravljanja k participaciji. *Bosniaca*, 25(25), 60–77. <https://doi.org/10.37083/bosn.2020.25.60>.
2. Ali, T. (2015). *The extreme centre: A warning*. London/New York: Verso.
3. Anadolija. (2014). *Sarajevo: Policija tokom protesta zaplijenila 12 kg droge, privedeno 37 izgrednika*. <https://www.klix.ba/vijesti/bih/sarajevo-policija-tokom-protesta-zaplijenila-12-kg-droge-privedeno-37-izgrednika/140208035>. Accessed 10 Jan 2021.
4. Anderson, C. (2008). *The end of theory: The data deluge makes the scientific method obsolete*. <https://www.wired.com/2008/06/pb-theory/>. Accessed 15 Oct 2020.
5. Applebaum, A. (2020). *Twilight of democracy: The seductive lure of authoritarianism*. New York: Doubleday.
6. Arapović, J., & Skočibušić, S. (2020). The first two months of the COVID-19 pandemic in Bosnia and Herzegovina: Single-center experience. *Bosn J of Basic Med Sci*, 20(3), 396–400. <https://doi.org/10.17305/bjbm.2020.4838>.
7. Arditi, D., & Miller, J. (2019). *The dialectic of digital culture*. London: Lexington Books.
8. Arsenijević, D. (2014). *Unbridable Bosnia and Herzegovina. The fight for the commons*. Baden-Baden: Nomos.
9. Badiou, A. (2005). *Being and event*. London/New York: Continuum.
10. Barbrook, R., & Cameron, A. (1996). The Californian ideology. *Science as Culture*, 6(1), 44–72. <https://doi.org/10.1080/09505439609526455>.
11. Bartlett, J. (2018). *The People Vs Tech: How the internet is killing democracy (and how we save it)*. London: Penguin.
12. Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage Publications Ltd.
13. Beck, U. (2009). *World at risk*. Cambridge: Polity Press.
14. Belyaeva, N. (2017). Citizen Plenums in Bosnia Protests: Creating a Post-Ethnic Identity. In E. Arbatli, & D. Rosenberg (Eds.), *Non-Western social movements and participatory democracy: Protest in the age of transnationalism* (pp. 115–138). Springer.
15. Beta. (2020). *U BiH više od 30.000 ljudi ostalo bez posla zbog epidemije*. Accessed 04 Jan 2021. <https://www.danas.rs/svet/u-bih-vise-od-30-000-ljudi-ostalo-bez-posla-zbog-epidemije/>.
16. Bishop, R. (2017). “Chaos.” In E. N. Zalta (Ed.), *The stanford encyclopedia of philosophy*. Accessed 12 Oct 2020. <https://plato.stanford.edu/archives/spr2017/entries/chaos>.
17. Blum, C., & Zuber, C. I. (2016). Liquid democracy: Potentials, problems, and perspectives. *The Journal of Political Philosophy*, 24(2), 162–182. <https://doi.org/10.1111/jopp.12065>.
18. Boehme-Neßler, V. (2020). *Digitising democracy: On reinventing democracy in the digital era - a legal, political and psychological perspective*. Cham: Springer Nature Switzerland.
19. Cambridge Dictionary. n.d. *Satire*. Accessed 04 Jan 2021. <https://dictionary.cambridge.org/dictionary/english/satire>.
20. Castells, M. (2015). *Networks of outrage and hope: Social movements in the internet age*. Cambridge: Polity Press.
21. Chayko, M. (2018). *Superconnected: The internet, digital media, and techno-social life*. Thousand Oaks: SAGE Publications Inc.
22. Chen, H.-T., et al. (2017). How does political satire influence political participation? Examining the role of counter- and proattitudinal exposure, anger, and personal issue importance. *International Journal of Communication*, 11, 3011–3029.
23. Cocchiarella, C. (2020). *From outrage to disinformation: It's time to reform social media*. <https://www.minnpost.com/community-voices/2020/07/from-outrage-to-disinformation-its-time-to-reform-social-media/>. Accessed 10 Jan 2021.
24. Comte, A. (2000). *The positive philosophy* (Vol. II). Kitchener: Batoche Books.
25. Cox, T. (2019). *How different generations use social media*. <https://themanifest.com/social-media/how-different-generations-use-social-media>. Accessed 02 Jan 2021.
26. Crouch, C. (2004). *Post-democracy*. Cambridge: Polity Press.

27. Cuckić, N. (2020). "Ventilators" affair in BiH – fight against corruption or another political quarrel?. <https://europeanwesternbalkans.com/2020/06/05/ventilators-affair-in-bih-fight-against-corruption-or-another-political-quarrel/>. Accessed 09 Jan 2021.
28. Dahl, R. A. (1956). *A preface to democratic theory*. Chicago: University of Chicago Press.
29. Deleuze, G., & Guattari, F. (1987). *A thousand plateaus: Capitalism and schizophrenia*. Minnesota: University of Minnesota Press.
30. Dundović, B. (2014). "Gilles Deleuze, Félix Guattari: "Kapitalizam i shizofrenija 2: Tisuću platoa"." *Prostor* (Arhitektonski fakultet Sveučilišta u Zagrebu) 22 (2 (48)). [https://www.academia.edu/10265162/Gilles\\_Deleuze\\_F%C3%A9lix\\_Guattari\\_Kapitalizam\\_i\\_shizofrenija\\_2\\_Tisu%C4%87u\\_platoa\\_Gilles\\_Deleuze\\_F%C3%A9lix\\_Guattari\\_Capitalism\\_and\\_Schizophrenia\\_2\\_A\\_Thousand\\_Plateaus\\_](https://www.academia.edu/10265162/Gilles_Deleuze_F%C3%A9lix_Guattari_Kapitalizam_i_shizofrenija_2_Tisu%C4%87u_platoa_Gilles_Deleuze_F%C3%A9lix_Guattari_Capitalism_and_Schizophrenia_2_A_Thousand_Plateaus_). Accessed 05 Jan 2021.
31. Đugum, A. et al. (2020). *How did a bosnian raspberry farm get a state contract to acquire 100 ventilators?* <https://www.rferl.org/a/bosnia-ventilators-scandal-covid-19-raspberry-farm-multimillion-deal-procurement/30594315.html>. Accessed 09 Jan 2021.
32. Eidlin, F. (2014). "Positivism." In M. T. Gibbons (Ed.), *The encyclopedia of political thought, first edition*, (pp. 1–11). <https://doi.org/10.1002/9781118474396.wbep0811>.
33. Engels, F. (1972). *Dialectics of nature*. Moscow: Progress Publishers.
34. Engels, F. (1978). *Anti-Dühring*. Beograd: Prosveta.
35. Feldmann, A. et al. (2020). "The lockdown effect: Implications of the COVID-19 pandemic on internet traffic." *Internet Measurement Conference (IMC '20)*, October 27–29. Virtual Event. 18 pages. <https://doi.org/10.1145/3419394.3423658>.
36. FoNet. (2020). *Apel u BiH da se zaposle lekari, zdravstveni sistem pred kolapsom*. <https://rs.n1info.com/region/a671277-apel-u-bih-da-se-zaposle-lekari-zdravstveni-sistem-pred-kolapsom/>. Accessed 05 Jan 2021.
37. Fraser, N. (1990). Rethinking the public sphere: A contribution to the critique of actually existing democracy. *Social Text* (25/26), 56–80. <https://doi.org/10.2307/466240>.
38. Frost, A. A. L. (2020). *The problem with hashtag activism*. <https://jacobinmag.com/2020/12/hashtag-activism-review-twitter-social-justice>. Accessed 10 Jan 2021.
39. Ghezae, I. (2020). *The Social Media Outrage Machine: How Our Digital Worlds Distort Political Discourse and Why This Matters*. <https://www.independent.com/2020/10/01/the-social-media-outrage-machine/>. Accessed 10 Jan 2021.
40. Giddens, A. (2006). *Modernity and self-identity: Self and society in the late modern age*. Cambridge: Polity Press.
41. Glas Srpske. (2013). *Ispitano sedam lica u vezi sa protestima o JMBG*. [https://www.glasrpske.com/lat/novosti/vijesti\\_dana/Ispitano-sedam-lica-u-vezi-sa-protestima-o-JMBG/128037](https://www.glasrpske.com/lat/novosti/vijesti_dana/Ispitano-sedam-lica-u-vezi-sa-protestima-o-JMBG/128037). Accessed 10 Jan 2021.
42. Gleick, J. (1987). *Chaos: Making a new science*. New York: Viking Penguin Inc.
43. Gutić, A. (2020). *Zatvorena tvornica Igman: Zbog proslave, kojoj je prisustvovao premijer Novalić, proširen virus među radnicima!* <https://zurnal.info/novost/22862/zbog-proslave-kojoj-je-prisustvovao-premijer-novalic-prosiren-virus-medu-radnicima>. Accessed 10 Jan 2021.
44. Haidt, J., & Rose-Stockwell, T. (2019). *The dark psychology of social networks*. <https://www.theatlantic.com/magazine/archive/2019/12/social-media-democracy/600763/>. Accessed 29 Nov 2020.
45. Hamilton, I. A. (2019). *Instagram has avoided Facebook's trust problem, beating its parent as app of choice for Generation Z*. <https://www.businessinsider.com/instagram-is-more-popular-among-generation-z-than-facebook-2019-3>. Accessed 03 Jan 2021.
46. Harvey, D. (2020). *We need a collective response to the collective dilemma of coronavirus*. <https://jacobinmag.com/2020/4/david-harvey-coronavirus-pandemic-capital-economy>. Accessed 20 Oct 2020.
47. Hasanović, J. (2020). Dijalektika etnodeterminizma: biopolitičko konstruiranje narativa otpora. *Politička misao: časopis za politologiju*, 57(1), 26–46.
48. Hibert, M. (2018). *Digitalni odrast i postdigitalna dobra: Kritičko bibliotekarstvo, disruptivni mediji i taktičko obrazovanje*. Zagreb: Institut za političku ekologiju.

49. Jackson, S. J., et al. (2020). *#HashtagActivism: Networks of race and gender justice*. Cambridge/London: The MIT Press. <https://doi.org/10.7551/mitpress/10858.001.0001>.
50. Juri, C. (2020). *Applause as a form of social distancing*. <https://www.opendemocracy.net/en/can-europe-make-it/applause-form-social-distancing/>. Accessed 09 Jan 2021.
51. Karabeg, O. (2020). *Most: Korona po leđima radnika i sirotinje*. <https://www.slobodnaevropa.org/a/most-korona-po-leđima-radnika-i-sirotinje/30721073.html>. Accessed 03 Jan 2021.
52. Kardon, D. (2013). *Internet demokratija: Obećanja i granice*. Beograd: Fabrika knjiga.
53. Klix.ba. (2014). *Irfan Nefić: Droga nije pronađena na protestima, već na Ilidži i u Novom Gradu*. <https://www.klix.ba/vijesti/irfan-nefic-droga-nije-pronadjena-na-protestima-vec-na-ilidzi-i-u-novom-gradu/140208074>. Accessed 10 Jan 2021.
54. Kurtović, L. (2018). Conjuring 'the people'. The 2013 Babylution protests and desire for political transformation in postwar Bosnia and Herzegovina. *Focaal – Journal of Global Historical Anthropology* (80), 43–62.
55. Laclau, E. (2007). *Emancipation(s)*. London/New York: Verso.
56. Laslett, P. (1956). *Philosophy, politics and society*. Oxford: Basil Blackwell.
57. Lewontin, R., & Levins, R. (2016). *Biology under the influence: Dialectical essays on ecology, agriculture, and health*. New York: Monthly Review Press.
58. Linder, R., & Aichholzer, G. (2020). "E-Democracy: Conceptual foundations and recent trends." In L. Hennen et al. (Ed.), *European E-Democracy in Practice*, (pp. 11–45). Cham: Springer. <https://doi.org/10.1007/978-3-030-27184-8>.
59. Lipset, S. M. (1960). *Political man: The social bases of politics*. New York: Doubleday & Company Inc, Garden City.
60. Ljubas, Z. (2020). *bosnians blame corruption for allowing coronavirus to spread*. <https://www.occrp.org/en/daily/11874-bosnians-blame-corruption-for-allowing-coronavirus-to-spread>. Accessed 09 Jan 2021.
61. Marković, A. (2020). *Bosnian Serb opposition questions purchase of mobile hospital*. <https://ba.n1info.com/english/news/a433848-bosnian-serb-opposition-questions-purchase-of-mobile-hospital/>. Accessed 09 Jan 2021.
62. Marks, K. (1978). *Kapital*. Beograd: Prosveta.
63. McChesney, R. W. (2013). *Digital disconnect: How capitalism is turning the internet against democracy*. New York: The New Press.
64. Miller, J. M. (2020). Psychological, political, and situational factors combine to boost COVID-19 conspiracy theory beliefs. *Canadian Journal of Political Science*, 53(2), 327–334. <https://doi.org/10.1017/S000842392000058X>.
65. Mouffe, C. (2005). *On the political*. London/New York: Routledge.
66. Mounk, Y. (2018). *The people vs. democracy: Why our freedom is in danger and how to save it*. Cambridge: Harvard University Press.
67. Murtagh, C. (2016). Civic mobilization in divided societies and the perils of political engagement: Bosnia and Herzegovina's Protest and Plenum movement. *Nationalism and Ethnic Politics*, 22(2), 149–171.
68. Ollman, B., & Smith, T. (Eds.). (2008). *Dialectics for the new century*. New York: Palgrave Macmillan.
69. Paić, Ž. (2013). *Sloboda bez moći: Politika u mreži entropije*. Zagreb: Udruga Bijeli val.
70. Pasquale, F. (2015). *The black box society: The secret algorithms that control money and information*. Cambridge/London: Harvard University Press.
71. Patria. (2014). *SIPA prati društvene mreže i ima saznanja da će biti okupljanja građana 7. februara*. <https://nap.ba/news/7865>. Accessed 10 Jan 2021.
72. Patria. (2020). *Sarajevo aplaudiralo za ljekare i medicinsko osoblje u borbi s koronavirusom*. <https://source.ba/mobile/clanak/BiH/517962>. Accessed 05 Jan 2021.
73. Peović Vuković, K. (2016). *Marx u digitalnom dobu. Dijalektički materijalizam na vratima tehnologije*. Zagreb: Durieux.
74. Prometej.ba. (2020). *Kvadrat 20: Vrijeme je za provjetranje ustajalih krugova*. <http://www.prometej.ba/clanak/vijesti/kvadrat-20-vrijeme-je-za-provjetranje-ustajalih-krugova-4358>. Accessed 11 Jan 2021.

75. Ramos, J. (2015). Liquid democracy and the futures of governance. In J. Winter & R. Ono (Eds.), *The future of internet: Alternative visions* (pp. 173–191). Cham: Springer.
76. Rechwitz, A. (2019). *Die Gesellschaft der Singularitäten*. Berlin: Suhrkamp.
77. Rosser, B. J. (2000). Aspects of dialectics and non-linear dynamics. *Cambridge Journal of Economics*, 24(3), 311–324. <https://doi.org/10.1093/cje/24.3.311>.
78. Sejfija, I., & Fink-Hafner, D. (2016). Citizens' protests innovations in a consociational system: The case of Bosnia-Herzegovina. *Teorija in praksa*, 53(1), 184–202.
79. Shephard, N. (2013). *Where have all the cyberfeminists gone? Part 2*. <https://blogs.lse.ac.uk/gender/2013/06/10/where-have-all-the-cyberfeminists-gone/>. Accessed 10 Jan 2021.
80. Silajdžić, L., & Dudić, A. (2020). Mladi i ovisnost o informacijsko-komunikacijskim tehnologijama: internet, društvene mreže i mobilni telefoni. *CM - Communication and Media*, 15(47), 57–84. <https://doi.org/10.5937/cm15-26423>.
81. Sito-Sucic, D. (2020). *Sarajevo protests Mass for slain Nazi allies with march for their victims*. <https://www.reuters.com/article/us-bosnia-church-protests/sarajevo-protests-mass-for-slain-nazi-allies-with-march-for-their-victims-idUSKBN22S0NY>. Accessed 10 Jan 2021.
82. Sloterdijk, P. (2013). *In the world interior of capital*. Cambridge: Polity Press.
83. SRNA. (2014). *Dodik: Protesti u FBiH politički motivisani*. [http://www.glassrpske.com/lat/novosti/vijesti\\_dana/Dodik-Protesti-u-FBiH-politicki-motivisani/147566](http://www.glassrpske.com/lat/novosti/vijesti_dana/Dodik-Protesti-u-FBiH-politicki-motivisani/147566). Accessed 28 Oct 2020.
84. Stebbins, S., & Suneson, G. (2020). *Jeff Bezos, Elon Musk among US billionaires getting richer during coronavirus pandemic*. <https://www.usatoday.com/story/money/2020/12/01/american-billionaires-that-got-richer-during-covid/43205617/>. Accessed 10 Jan 2021.
85. Swingewood, A. (1975). *Marx and modern social theory*. London: Macmillan.
86. Štiks, I., & Horvat, S. (2015). Postscript: The future of radical politics in the balkans - protests, plenums, parties. In H. Srećko & I. Štiks (Eds.), *Welcome to the desert of post-socialism: Radical politics after Yugoslavia* (pp. 265–281). London/New York: Verso.
87. Taylor, A. (2019). *Democracy may not exist, but we'll miss it when it's gone*. New York: Metropolitan Books.
88. Terkl, Š. (2020). *Zajedno sami*. Beograd: Clio.
89. Tufekci, Z. (2017). *Twitter and tear gas: The power and fragility of network protest*. New Haven/London: Yale University Press.
90. Turčilo, L., et al. (2017). *Mladi, politika i mediji: Priručnik za razvijanje političke i medijske pismenosti mladih*. Sarajevo: Friedrich-Ebert-Stiftung.
91. Turner, F. (2008). *From counterculture to cyberculture: Stewart Brand, the whole earth network, and the rise of digital utopianism*. Chicago: University of Chicago Press.
92. Turner, F., & Jandrić, P. (2017). From the electronic frontier to the anthropocene. In M. A. Peters (Ed.), *Learning in the digital age of digital reason*, (pp. 59–74). Rotterdam/Boston/Taipei: Sense Publishers. <https://library.memoryoftheworld.org/#/book/1f96d3f8-422d-4b0a-9254-1fe03827bf25>.
93. Vaidhyanathan, S. (2018). *Antisocial media: How facebook disconnects us and undermines democracy*. New York: Oxford University Press.
94. Vajzović, E. (2021). Digitalna transformacija sigurnosti i algoritamska demokratija. *Sarajevski žurnal za društvena pitanja* [in print].
95. van Reybrouck, D. (2017). *Gegen Wahlen: Warum Abstimmen nicht demokratisch ist*. Göttingen: Wallstein Verlag.
96. Vučetić, V. (2020). *Meme kultura u BiH: Od satire do političkog postera*. <https://www.media.ba/bs/magazin-novinarstvo/meme-kultura-u-bih-od-satire-do-politickog-postera?fbclid=IwAR3TXvoWpEHvfcrlLo5Uu-XDAISv3dTI1Agy0Ngw1mVMbPPmNTdYhVQCeQuo>. Accessed 13 Jan 2021.
97. Web Foundation. (2019). *30 years on, what's next #ForTheWeb?*. <https://webfoundation.org/2019/03/web-birthday-30/>. Accessed 04 Jan 2021.
98. Woods, A., & Grant, T. (2012). *Reason in revolt: Marxist philosophy and modern science*. London: Wellred.

99. World Health Organisation. (2020). Coronavirus disease 2019 (COVID-19). Situation Report - 51. *World Health Organisation*. <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200311-sitrep-51-covid-19.pdf>. Accessed 10 Jan 2021.
100. York, R., & Clark, B. (2006). Marxism, positivism, and scientific sociology: social gravity and historicity. *The Sociological Quarterly*, 47, 425–450.
101. Zaharijević, A., & Vasiljević, J. (Eds.). (2017). *Angažman: Uvod u studije angažovanosti*. Beograd: Institut za filozofiju i društvenu teoriju.
102. Ziblatt, D., & Levitsky, S. (2018). *How democracies die*. New York: Crown.
103. Živković, D. (Ed.). (2001). *Rječnik književnih termina*. Banja Luka: Romanov.
104. Žižek, S. (2019). *Kao lopov usred bela dana: Moć u doba postčovečanstva*. Beograd: Laguna.
105. Žižek, S. (2020). *Pandemic! COVID-19 shakes the world*. New York/London: OR Books.
106. Haggard, S., & Kaufman, R. (2021). *Backsliding. Democratic Regress in the Contemporary World*. Cambridge: Cambridge University Press.

# Fractalization of Chaos and Complexity: Proposition of a New Method in the Study of Complex Systems



Cristina Serpa and Amir Forouharfar

**Abstract** Proposition of new methods for the study of complex systems and chaos is working on the frontiers of knowledge and hence it calls for philosophical contemplation besides well-set empirical researches. Complex system studies still suffer methodological paucity. Hence, the research goal is proposing a new generic methodology in the domain of chaotic and complex systems' behavior study. The research in the theorization section discusses the epistemology of the proposed method (philosophic belief, logical justification and mathematical warrant) for pattern formation in chaos and complexity. Later, in the section on how to use the method in practice, the procedures of finding recursions and their fractalization are illustrated for organizational power. Our discussions deepen generic understanding of the connections between chaos/complexity and fractalization and thus the potential disciplines for the implementation of the introduced method could be a large spectrum embracing the humanities to the natural sciences.

**Keywords** Chaos · Complexity · Fractal · Mathematics · Philosophy · Logic · Methodology · Pattern formation

## Introduction

The pivotal problem in studying complexity as a ubiquitous phenomenon in our world is initially the scarcity of consensus on what complexity is and what its universal characteristics are [2, 8, 16, 35]. Logically this dearth of knowledge (epistemology) on 'what complexity in reality is', in comparison to the other fields of scientific knowledge, has also transferred into the realm of complexity analysis. Hence, it "still lacks of a coherent frame of analysis" [27: p. 1] and there is no

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all-embracing unifying ‘Theory of Complexity’ yet [14, 33]. Compensating for this fundamental lack, different methodologies were proposed so far. However, studying Complexity inherently leads to complexity in choosing appropriate methodologies and approaches and soon we understand the inescapable dullness and inefficacy of our research tools. For example, any endeavor for understanding complexity within systems could not escape the concurrent *representationism*<sup>1</sup> and *reductionism*.<sup>2</sup> In other words, any approach for studying complexity not only tries to represent the reality out there by a representational medium, e.g. mathematical formula, computational procedures, digitalization, etc., which could be only a partial and incomplete image of the reality in the best condition, but also falls simultaneously into an inevitable reductionist approach, since even if we could understand and sketch complexity in reality, which is hardly possible and hence it is called ‘Complexity’, we could not define complexity in its stupendous accurate size. Therefore, all approaches to complexity (e.g. modeling, neural approaches, visualization, etc.) and the methodologies defined within specific discipline (as diverse as the game theory, collective behavior studies, nonlinear dynamics, systems theory, networks study, evolution and adaptations to pattern formations) are more or less reductionist approaches. On the other hand, nonlinear dynamics of complex systems aggravates the situation and reflects the ever-changing, evolutionary and self-organizing propensities in complex systems. Thus, in any moment we should expect the emergence of a new system with new characteristics. *Emergence* as unpredictable new properties which had not been initially in the system [24, 41] is another problem which makes the study of complex systems hard and in many cases impossible, at least in our era and with the current capabilities. We have to move on and propose new insightful methods of studying complex systems with the hope first to understand complex systems more scientifically and then to surmount the difficulties and in some cases catastrophes which have risen out of the unknown complexities; although all complexities (e.g. our body or the world ecological system) are not catastrophes and most of them are blessings which have made our existence and that of our world possible.

To introduce the fractalization methodology to the realm of complex and chaotic systems, the research has been divided to the theory and practice sections. In the theorization section, first the research mainly reviews the general features of complex systems as the true foundation for defining and understanding of what complex systems have in common. In addition, major epistemological and ontological dimensions of complexity are going to be reviewed to unfold the philosophical big picture in studying and addressing complexity for the readers. Then the research reviews general approaches to studying complexity, besides the concept of pattern formation in the study of complex systems. In the methodology section, the epistemic entities of the philosophical approach in this study (*belief*, *justification*, and *warrant*) are going to be introduced. Later in the discussion section, the authors are going to express their

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<sup>1</sup> “Philosophical theory of knowledge based on the assertion that the mind perceives only mental images (representations) of material objects outside the mind, not the objects themselves” [12].

<sup>2</sup> “A view that asserts that entities of a given kind are identical to, or are collections or combinations of, entities of another (often simpler or more basic) kind or that expressions denoting such entities are definable in terms of expressions denoting other entities” [11].



research propositions and support their ideas through epistemology (philosophy of knowledge), logic and mathematics. Finally, the research ends with an example of how the generic methodology introduced in this research could be used in practice.

## Literature Review

### *General Features of Complex Systems*

According to Bar-Yam [1: p. 1], “as a discipline, complex systems is a new field of science studying how parts of a system and their relationships give rise to the collective behaviors of the system, and how the system interrelates with its environment.” Nevertheless the main problem in studying complex systems is their tendency not to be principled at the system level even if they show some principles at the constituting components. Thus, as [46: p. 1] put it, “whether it be physical, biological or social processes, complex systems exhibit dynamics that are exceedingly difficult to understand or predict from underlying principles”. Furthermore, in the scientific world and among academia there is not a unanimous definition of what complexity and chaos are yet and each scientific discipline ranging from physics to economics defines the terms of “complexity” and “chaos” based on their own epistemic understanding that is according to their own understanding of the nature and source of knowledge/expertise. Hence, “complexity still lacks a commonly accepted strict definition” [17: p. 133]. Chaos “can readily be defined as systems that exhibit so-called strong mixing” [25: p. 1] but there is not any unanimity in defining chaos either. Thus, any definition of “complexity” and “chaos” could not escape from the human perception, interpretation and in general human cognition. In other words, what our perception defines as a complex or chaotic phenomenon could be different if we had different inherent cognitive system (i.e. mind) or cognitive tools (i.e. our senses and faculty of deduction). Therefore, since “there is no concise definition of a complex system, let alone a definition on which all scientists agree” [25: p. 1], we need to rely on general features of complex or chaotic systems to define them. Complex systems generally have the following necessary but not sufficient features:

1. “[A] structure with variations” [22: p. 87],
2. Evolutionary trend that is “very sensitive to initial conditions” [45: p. 89],
3. Self-organization, i.e. “large populations of units can self-organize into aggregations that generate pattern” [32: p. 99],
4. Emergence, i.e. “This property implies new collective behaviors due to the interaction and self-organization among elements in the system, which cannot be produced by a single unit” [47: p. 1],
5. And thus “predisposed to unexpected outcomes (so-called emergent behaviour)” [19: p. 410],
6. Nonlinearity [44: p. 102],
7. “Multiple interactions between many different components” [36: p. 105],

8. Besides, “multiple elements adapting or reacting to the pattern these elements create” [3: p. 107],
9. “Characterized by the fact that [the] dynamics emerging at the macroscopic level cannot be easily explained from the microscopic dynamics of the individual constituents of the system” [9: p. 1],
10. And finally “lack the order and stability required to produce universal rules about behavior and outcomes” [23: p. 1].

We could find some organizing principles in complex systems [34]. Complex systems share the following organizing features [33: pp. 3–6]:

1. *Constituted rationally*, i.e. “complex behaviour and structures emerge as a result of the recursive and aggregate patterns of the relations that exist between the component parts of the systems”.
2. *Adaptive*, i.e. “complex systems have adaptive capacities to self-organize and to co-evolve in relation to contextual changes”.
3. *Dynamic nonlinear relations*
4. *Radically open*, i.e. “we cannot clearly discern the boundary line between the system and its environment, because the environment co-constitutes the identity of the system”.
5. *Contextual*, i.e. “the function(s) of a complex system is contingent on context”.
6. *Complex causality* that is “the outcome of circular and interrelational, nonlinear and dynamic interactions” which defines their emergence.

It is noteworthy that the above ‘six organizing principles of complex systems’ have philosophic tone and could contribute to the ontological perception of complex systems.

### ***Major Philosophical Dimensions of Complexity***

Two major philosophical dimensions of complexity are *epistemic complexity* (hence i.e. knowledge of complexity) and *ontological complexity* (i.e. complexity as a being or complexity as it exists with its plethora of formations and manifestations in different entities and contexts). Furthermore, if we only assume complexity as a structural phenomenon or complexity as structural modes then again we could define the structural modes of complexity within the following two realms [21: 3, 35: 9, 37]:

1. Epistemic modes (related with knowledge, and embraces formulaic complexity)
2. Ontological modes (connected to reality itself).  
These *epistemic modes* of complexity could fall within one the following types of complexity:
  1. *Descriptive Complexity*: The minimum length of the account that is accurate and sufficient to provide an adequate description of the system.

2. *Generative Complexity*: The minimum length of the set of characteristics and instructions necessary to generate a complex system.
3. *Computational Complexity*: “Where the scientific foundations and relevance of complexity are derived from the capacity to quantify and simulate the behaviour, connections, structures, and phases of complex systems by means of mathematical equations, algorithms, and computational models” [43].  
The *ontological modes* of complexity also fall within the following categories and their relevant subcategories:
  1. *Compositional Complexity*:
    - (a) *Constitutional Complexity*: The number of constituent elements making up a system.
    - (b) *Taxonomical Complexity*: The heterogeneity of constituent components.
  2. *Structural Complexity*:
    - (a) *Organizational Complexity*: The different possibilities for the arrangement of the components
    - (b) *Hierarchical Complexity*: The elaborateness of hierarchical (sub-orientation) relationships between levels.
  3. *Functional Complexity*:
    - (a) *Operational Complexity*: The variety of modes of functioning.
    - (b) *Nomic Complexity*: The elaborateness and intricacy of the laws governing a system.

Furthermore, there is another philosophical domain in complexity studies scrutinizing qualitative and pragmatic aspects of the complex systems in human life and delving deep into understanding them. This domain of complexity studies is called “critical complexity” [6, 15] and according to Preiser [33: p. 3], “this approach is not directed towards observing and analysing complexity but explores what it means to participate in and creatively co-construct the phenomenological experiences of everyday instances and encounters of a messy, complex reality [10].”

### ***General Approaches to Study Complexity***

Mazzocchi [27: p. 1], suggests three approaches for “refining the scheme of complexity: analyzing it at the right level, i.e. not focusing on single principles or theories (e.g. network theory), but rather on the overall frame; including both ontological and epistemological considerations; and recognizing how the epistemological implications of complexity foster the adoption of a pluralist stance in scientific research (and beyond).” Once we refined the scheme of complexity by either of the above-mentioned approaches then we could choose among at least three possible “approaches to the modern study of complex systems” [7: p. 3]:

1. How interactions give rise to patterns of behavior,
2. The space of possibilities, and
3. The formation of complex systems through pattern formation and evolution.

This research falls within the third approach, i.e. defining a new approach for pattern formation via fractalization.

## ***Pattern Formation***

In complexity studies, in any discipline and field of science, we usually search within the complex systems for finding or forming meaningful patterns either pre-existent or emerging. In other words we could grasp, define, develop and expand our new theories on the concept of complexity through the patterns which have perceived within the complex systems. Hence, Arthur [4: p. 107] believes: “common to all studies on complexity are systems with multiple elements adapting or reacting to the pattern these elements create.” On the other hand, “self-organized structures can spontaneously emerge from a complex sea of microscopic, interacting constituents. This is a widespread observation in nature, now accepted as a paradigmatic concept in science, with many applications ranging from biology to physics” [5: p. 2]. These structures in a broad terminology are patterns.

## **Methodology**

In any epistemological proposition at least three major entities should be considered: 1. *Belief*, 2. *Truth*, and 3. *Justification*.<sup>3</sup> That is, “false propositions cannot be known. Therefore, knowledge requires truth. A proposition S doesn’t even believe can’t be a proposition that S knows. Therefore, knowledge requires belief. Finally, S’s being correct in believing that p might merely be a matter of luck. Therefore, knowledge requires a third element, traditionally identified as justification” [42: p. 1]. Thus,

*Knowledge is justified true belief.*

In other words, “S knows that p if and only if p is true and S is justified in believing that p. According to this analysis, the three conditions—truth, belief, and justification are individually necessary and jointly sufficient for knowledge” [42: p. 1]. However, epistemological warrant is a rational or reason added to the epistemically true beliefs, i.e., “epistemic warrant is whatever, when added to truth and belief, makes knowledge” [26: p. 1]. Thus, ‘justified belief’ is equal to ‘epistemically warranted belief’, and hence:

*Knowledge is true, epistemically warranted belief.*

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<sup>3</sup> Besides *Warrant* which could be interchangeably used in place of *Justification*.

**Table 1** The entities of the philosophical approach in this study

Epistemology of the method	
Belief	Fractalization of chaos and complexity
Justification	Logic
Warrant	Mathematical approach

*Source* Authors' own work

Table 1 has summarized the mixed approach in this research with the intention of introducing the possibility of *fractalization* of chaos and complexity for pattern formation in the study of complex systems.

### Discussions (the methodology in theory)

For the epistemological discussions of the *Belief*, *Justification* and *Warrant* of the fractalization of chaos and complexity, the authors have proposed four propositions to present a systematic discussion of the paper's subject matter:

#### Belief

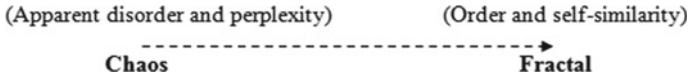
Belief is the starting point in epistemology and it is a kind of attitude. Hence, “most contemporary philosophers characterize belief as a ‘propositional attitude’. Propositions are generally taken to be whatever it is that sentences express...” [38: p.1]. Nevertheless, proposition has a very broad meaning and it could be granted as “the primary bearers of truth-value, the objects of belief and other “propositional attitudes” (i.e., what is believed, doubted, etc.), the referents of that-clauses, and the meanings of sentences” [28: p. 1]. Here, all the propositions in this research fall within the category of propositional attitudes, i.e. as the objects of belief. Therefore, if we propose the following  $P_1$ , then we need to justify and warrant the following proposed belief to be epistemologically defensible:

$P_1$ : *Chaos and complexity in the systems could be fractalized.*

#### Justification

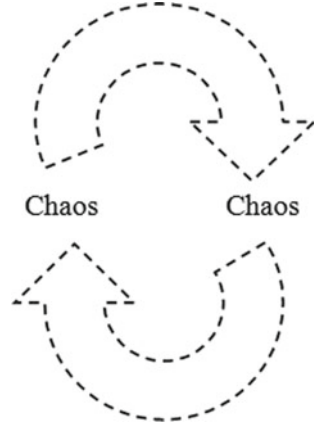
First, chaos is apparent disorder. But, mathematically, chaos represents complex order. Fractal represents self-similarity order. A class of chaotic phenomena may be understood as a structured order, by a fractal and its self-similarity construction, i.e., fractals are a way to give structure to something difficult to analyze such as chaos. Fractals are a formalization to understand some chaotic systems. In Fig. 1 there is the structuring link between Chaos and Fractals.

Second, at the first glance and based on human cognition it is paradoxical to claim that chaos could be fractalized. But, the core concept in fractalization that could solve this superficial paradox is the concept of *recursion*. Recursion is “the determination



**Fig. 1** The structuring link between Chaos and Fractals *Source* Authors’ own work

**Fig. 2** Circularity of chaos/complexity *Source* Authors’ own work



of a succession of elements (such as numbers or functions) by operation on one or more preceding elements according to a rule or formula involving a finite number of steps” [31: p. 978]. The question that could be raised is how chaos and complexity could be recurred?

*P<sub>2</sub>: If we could find identical recursions in chaotic/complex system then we could define a possible structure in the system which could lead to system structuration and hence fractalization of the system.*

To discuss *P<sub>2</sub>* and present a justified defense of *P<sub>1</sub>* (the Belief) we need to discuss the *circularity of chaos/complexity* (Fig. 2) and propose the logical proposition of *P<sub>3</sub>*.

Thus, the propositional logic (*P<sub>3</sub>*) of the study could be posed as the following (Fig. 3):

*P<sub>3</sub>*<sup>4</sup>:

$$Chaos \wedge Chaos \Rightarrow Circularity \Rightarrow Vicious Circle.$$

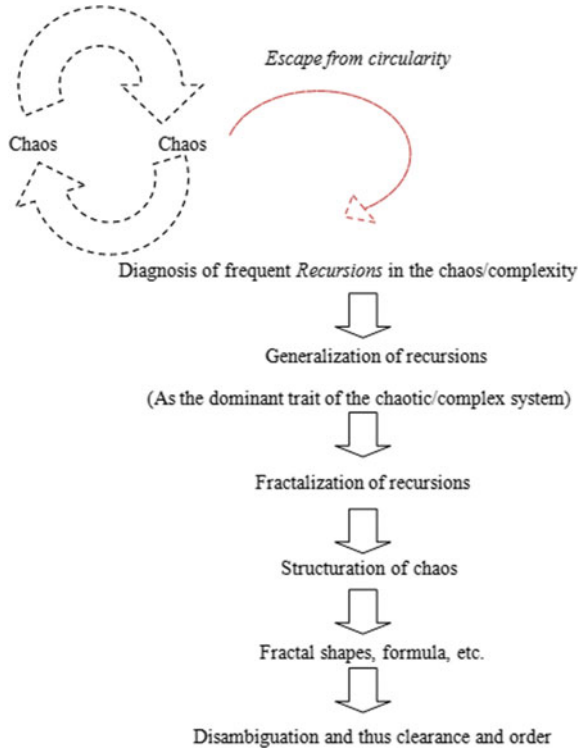
$$Chaos \wedge \neg Chaos \Rightarrow Non - Circularity \Rightarrow Virtuous Circle.$$

$$\neg Chaos \Leftrightarrow order \Leftrightarrow Fractal.$$

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<sup>4</sup> In Logic, the symbols:  $\wedge$  (logical conjunction) means ‘and’,  $\neg$  (negation) means ‘not’,  $\Rightarrow$  (material implication) means ‘implies’,  $\Leftrightarrow$  (material equivalence) means ‘the same as’.

**Fig. 3** Escaping the circularity of chaos by finding recursions (as the dominant system trait) in the complex systems' data sets, reactions, developments, behaviors, etc. *Source* Authors' own work



Order  $\Leftrightarrow$  Recursions

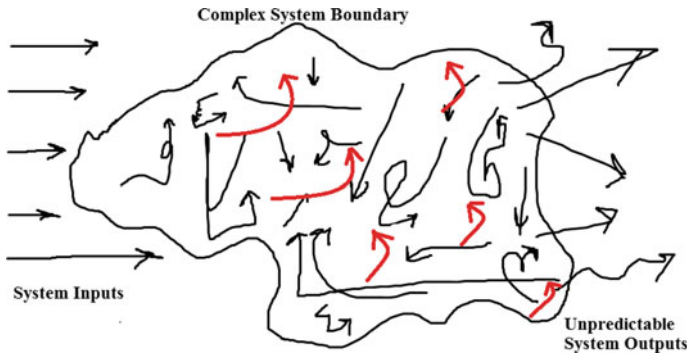
*Recursions*  $\Leftrightarrow$  *Fractalization*.

*Circularity* is “being or involving reasoning that uses in the argument or proof a conclusion to be proved or one of its unproved consequences” (On-line [29]). Hence, we fall in an inescapable vicious circle, since chaos generates chaos and our cognition once fell within such an enduring pitfall could not escape forever unless we find a way to escape the circularity of chaos; and the key is finding recursions in the data sets (Figs. 3, 4 and 5). By escaping the *circularity* we would fall within a potential virtuous circle, i.e. “a chain of events in which one desirable occurrence leads to another which further promotes the first occurrence and so on resulting in a continuous process of improvement” (On-line [30]).

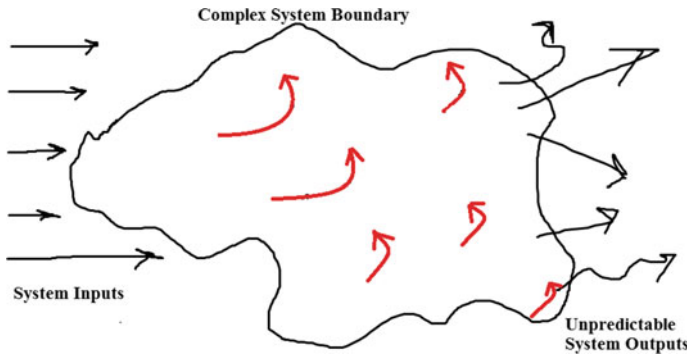
**Warrant**

*P<sub>4</sub>: Mathematical approach could define/formulate the remaining recursions in complex systems.*

The sporadic behaviors in the complex systems (black arrows in Fig. 4) are the same as the noises which block our true understanding of the complex systems. Once



**Fig. 4** Derivation of recursions (the recurring structures/data/shapes/formula/trends, etc.) from the complex systems *Source* Authors' own work



**Fig. 5** Omission of sporadic behaviors (irregular fluctuations): Recursions left as the recurring traits of the complex system *Source* Authors' own work

we have diagnosed the recurring behaviors within the complex systems (red arrows in Figs. 4 and 5) we can proceed and devise accurate mathematical formula to be able to define them. This is exactly what we try to do in the disciplines such as physics or economics, i.e. definition by mathematics. In other words, we quantify what at first seemed as a complex bafflement and once it is defined through the dominant feature of the system by mathematics it could be perceptible.

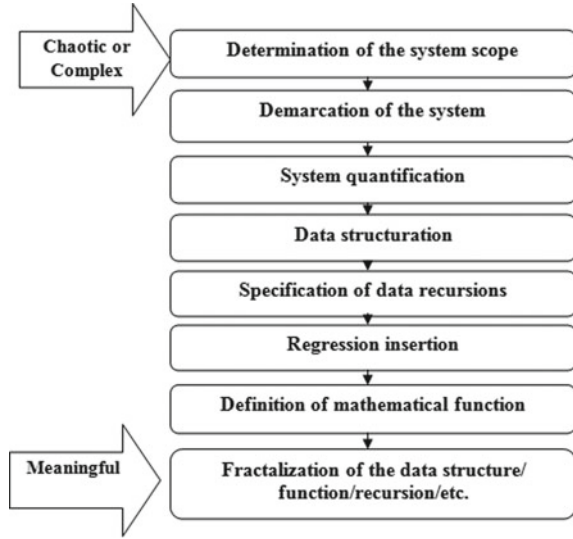
However for mathematical quantification of the dominant traits of the complex system (recursions) we should follow the steps presented in Fig. 6.

The steps in Fig. 6 are as follows:

1. *Defining the systems* finity versus infinity (i.e. system's limitation/scope definition).
2. *Demarcating* the system boundary (i.e. setting the system's boundary).
3. Searching for the availability of schematic or numerical data (i.e. data study).



**Fig. 6** Proposed methodological flowchart: Changing chaos and complexity to its dominant prevailing recursions *Source* Authors' own work



4. Searching for meaningful shapes/numbers/set of numbers, etc. in the data (i.e. data mining).
5. Defining a warranted *regression* for the *recursive* data (i.e. inserting a meaning structure/graph/meaning, that is defining a self-repetitive data-driven attribution).
6. Extracting logically/mathematically justifiable and provable repetitions (i.e. data repetitions auditing<sup>5</sup>).
7. Defining an epistemologically justifiable *recursion function* for the most recursive shapes/sets/etc. (i.e. presenting a quantifiable correspondence in recursive data) and introducing the function as the prevailing/dominate trait of the studied complex system.
8. *Fractalization* (i.e. generalization) of the recursive shapes/sets, etc. as the dominant spirit of the system.

**An example for the clarification of discussions (the methodology in practice)**

In the example provided in the following we assume power as one of the most complex phenomena within organizations (i.e. power as a complex organizational system). Power tends towards a triangular recursion. That is the constituents of power: 1. *Need*, 2. *Interest*, and 3. *Relationship*, make a reciprocal connectivity within a triangular recurring fractal (Fig. 7).

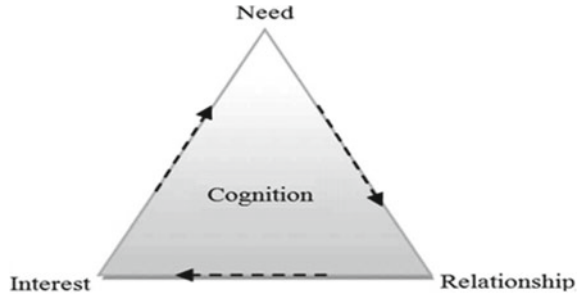
According to Forouharfar [20; p. 9]:

The ontological concept of power is built upon a triangular necessity that embraces the three fundamental constructing components of power: (1) interest, (2) need, (3)

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<sup>5</sup> This phrase is coined by the authors and it indicates any endeavor on the side of the researchers for finding meaningful repetitive – i.e. recursive - sets of numbers within the available data.

**Fig. 7** Constituting elements of power [20]  
 Source Forouharfar



relationship. Initially, power shapes in a cognitive context. In other words, power is among animate creatures with the faculty of cognition, otherwise it is a force, which is a subject in physics. That is without the cognitive element (human) or its omission there is no such a power. Moreover, an isolated and separate entity does not form power. There must be at least a “relationship”. Power is a structure-bound phenomenon, i.e. it emerges within specific relationship structures. These structures could be economic, political, social, cultural, professional, etc. The structurality of power is deeply rooted in the prerequisite of a fundamental constituting component of any power, which is relationship or interdependence. The relationships within any framing structure superimpose special characteristics on the essence of power. In other words, power metaphorically is a liquid in a structural container; it takes the shape of the structure (container). Moreover, relationship has a tendency toward directionality. What determines the dimensionality of this relationship is the existence of “need”. Without “need” there will be no “interest”. Furthermore, the two elements of “need” and “interest” do not show inferiority or superiority, i.e. “need” is not only in the inferior but also in the superior. For example, if an inferior finds his interest in subjectivity to fulfill his social needs such as welfare, security, etc., the superior finds his interest in supremacy on the subjects to fulfill his need for the expansion and maintenance of his power.

Thus, if we assume each organizational chart/coalition as the equilateral triangles constituting the power structure (searching for meaningfulness step), then the fractal formation of formal organizational power in an organization or a governmental body (demarcation step) should be the result of innumerable simultaneously major-minor organizational charts/coalitions (fractalization step) (Fig. 8).

To clarify more, we present a mathematical perspective of the fractal *structuration* of power within organizations. By this approach a researcher could quantify the dominant characteristics of a complex entity after the diagnosis of its fundamental recursions and reveal the dynamics of chaos or complexity by mathematical approach (See, [1, 18] for more on the application of mathematics in the study of chaos and complexity):

First, we provide the theoretical mathematical model.

The solutions  $\varphi$  of the following system of iterative functional equations have fractal structure, as proved in Buescu and Serpa [13],



**Fig. 8** The fractalization of formal power within organizations (Recurring fractals of organizational charts) [20] Source Forouharfar

$$\varphi\left(\frac{x + j}{p}\right) = a_j\varphi(x) + b_jx + c_j,$$

where  $|a_j| < 1$ ,  $x \in [0, 1)$  and  $0 \leq j \leq p - 1$ . Here there are  $p$  equations where  $\varphi$  is the unknown function with domain  $[0, 1)$  and  $p$  is the fractal period. This function has an unlimited number of fractal levels  $L$ . The properties and constructive formulas for this function are given in [39, 40]. The explicit analytical formulae for such fractal functions is

$$\sum_{n=1}^{+\infty} \left( \prod_{k=1}^{n-1} a_{\xi_k} \right) \left( b_{\xi_k} \sum_{m=1}^{+\infty} \frac{\xi_{m+n}}{p^m} + c_{\xi_n} \right).$$

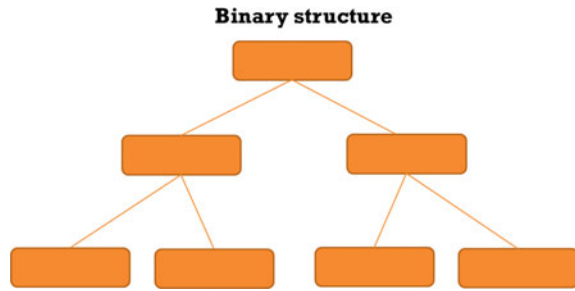
For practical purposes, when working with a limited number of domain points, we use a  $L$ -finite  $p$ -expansion of such as:

$$\begin{aligned} \varphi(0) &= \frac{c_0}{1-a_0} \\ \varphi\left(\frac{\xi_1}{p}\right) &= a_{\xi_1} \frac{c_0}{1-a_0} + c_{\xi_1}, \xi_1 \neq 0 \\ \varphi\left(\frac{\xi_1}{p} + \frac{\xi_2}{p^2}\right) &= a_{\xi_1} a_{\xi_2} \frac{c_0}{1-a_0} + a_{\xi_1} c_{\xi_2} + b_{\xi_1} \frac{\xi_2}{p} + c_{\xi_1}, \xi_2 \neq 0 \\ &\vdots \end{aligned}$$

Note that  $\varphi\left(\frac{\xi_1}{p}\right)$  is in the first fractal level of the function and  $\varphi\left(\frac{\xi_1}{p} + \frac{\xi_2}{p^2}\right)$  is in the second fractal level.

For statistical modeling of data, regression analysis is a process for estimating the relationship between a dependent variable (here  $y_{\xi_1\xi_2}$  stands for two fractal levels,  $y_{\xi_1\xi_2\xi_3}$  stands for three fractal levels, and so on...) and an independent variable (here  $x$ ). The suitable form of regression for these functions is called affine fractal regression, in which one finds the curve that most closely fits the data according to this mathematical model of function  $\varphi$ . This process implies an optimization algorithm

**Fig. 9** Fractal binary structure



that finds numerically an approximation solution. In fact, reaching the analytic solutions seems to be impractical. For this purpose, user-friendly software is available online.<sup>6</sup>

The process of identifying and computing the fractal characteristics is the following:

- Identification of the key indicators to analyze
- Data collection
- Identification of the structure of the organization
- Preliminary qualitative analysis
- Application of an optimization algorithm
- Test the optimization results
- Analyze the results
- Estimate the intensity of fractal behavior (by Hausdorff/fractal dimension estimation)
- Resize/shift sample data, redo and compare.

Any organization has fundamental indicators that form the basis of its management and power endeavors. Some indicators are commonly used for the general of organizations, such as number of employees, sales volume, counting/measurement of resources/products/establishments and indexes. For each particular case, the analyst will find specific indicators, depending on the area of business, location, logistics, constrains on politics, environment, laws and culture.

The step of collecting data should be done carefully to have accuracy and without gaps from a reliable source.

The hierarchical structure of an organization is, in general, of a pyramid shape. We use this usual shape to identify the fractal behavior of the organization. The simplest one is the binary structure, as depicted in Fig. 9.

The fractal hierarchical shape may have also ternary or, generally,  $p$ -ary structure (see Figs. 9 and 10).

Organize your data according to the fractal shape identified (see Fig. 11 and 12).

The number of hierarchical levels is the same of fractal levels (parameter  $L$ ).

<sup>6</sup> The software Fractal Real Finder is available online. See [www.researchgate.net/profile/Cristina\\_Serpa](http://www.researchgate.net/profile/Cristina_Serpa), for information on how to download it and for support materials.

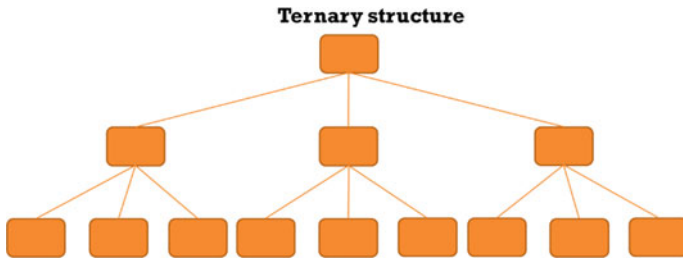


Fig. 10 Fractal ternary structure

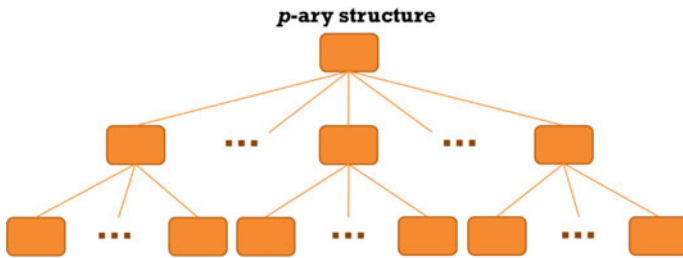


Fig. 11 Fractal p-ary structure

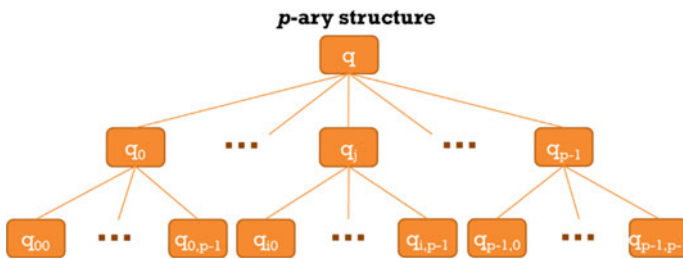


Fig. 12 Fractal p-ary structure and corresponding data

For simulations purpose, construct a set of ordered data, such that  $\{y_{ij} : i, j = 0, 1, \dots, p - 1\}$  for binary structure, or  $\{y_{ijk} : i, j, k = 0, 1, \dots, p - 1\}$  for ternary structure, and so on. The construction of this set is done according to a suitable rule, depending on the type of data. We give some suggestions, for binary case:

- A sum:  $y_{ij} = q + q_i + q_{ij}$ ;
- An average:  $y_{ij} = \text{average}\{q + q_i + q_{ij}\}$ ;
- Last row information:  $y_{ij} = q_{ij}$ ,
- And ternary case:
- A sum:  $y_{ijk} = q + q_i + q_{ij} + q_{ijk}$ ;

- An average:  $y_{ijk} = \text{average}\{q + q_i + q_{ij} + q_{ijk}\}$ ;
- Last row information:  $y_{ijk} = q_{ijk}$ ,

At this time, the data collected is number  $p$  (number of sub-divisions that each fractal cell divides from one fractal level to the next), number  $L$  (number of fractal levels in the hierarchy/structure) and the set of  $y$ 's (for example,  $\{y_{ij} : i, j = 0, 1, \dots, p - 1\}$  for binary structure, or  $\{y_{ijk} : i, j, k = 0, 1, \dots, p - 1\}$  for ternary structure).

For performing the optimization algorithm, execute the program Fractal Real Finder,<sup>7</sup> inserting previously organized data and a delta (a delta of 0.00001 means that the program will work with 5 decimal digits). The output is a file FractalResults.txt.

In the output, you may find the fractal function that fits the data, the total error (sum of squared residuals) and the original and estimated data.

After obtaining a result it is wise to perform a statistical test to evaluate the goodness of the fit. The statistical confirmation of this test validates the fractal function as good enough to model data. The recommendation is on the two-sample Kolmogorov–Smirnov Test.<sup>8</sup>

After a confirmation statistical test, the next step is to analyze the fractal behavior of the function. The fractal function is characterized by its parameters ( $a_j$  are the fractal coefficients,  $b_j$  are the directional coefficients). Bigger  $a_j$ 's means bigger fractal oscillations, and near zero means straighter data behavior.

The intensity of the fractal behavior may be measurable by an indicator, called fractal dimension, or Hausdorff dimension. With the estimations of parameters  $a_j$ , this indicator is upper estimated by the following theoretical result (see [13]).

Theorem: The Hausdorff dimension of the function defined above is upper estimated by the solution  $s$  of equation  $\sum_{j=0}^{p-1} \beta_j^s = 1$ , where  $\beta_j = \max\{\frac{1}{p}, a_j\}$ , for  $j = 0, 1, \dots, p - 1$ .<sup>9</sup>

It is good to perform multiple simulations, with variations on data. You may resize the set (adding or excluding fractal levels  $L$ ), compare different structures (with different  $p$  and  $L$ ) and variables. For this, redo the algorithm and compare. Plot the results to visualize the estimates.

## Conclusion

Since any endeavor for understanding complexity and chaos within systems could not escape the simultaneous *representationist* (i.e. mental imaging of the objects) and *reductionist* (i.e. defining a larger entity by smaller entities denoting the partial

<sup>7</sup> The software Fractal Real Finder is available online. See [www.researchgate.net/profile/Cristina\\_Serpa](http://www.researchgate.net/profile/Cristina_Serpa), for information on how to download it and for support materials.

<sup>8</sup> There is a simple and easy tutorial about this test on page: <https://www.real-statistics.com/non-parametric-tests/goodness-of-fit-tests/two-sample-kolmogorov-smirnov-test/>.

<sup>9</sup> The computation of such an equation may be done in the page <https://www.wolframalpha.com/>.

or complete identical features of the first entity) approaches, any understanding of “complexity” and “chaos” could not escape from human simultaneous perceptive representationism (i.e. mental imaging) and reductionism (i.e. reducing the entity to its main features) tendencies. Therefore, all the approaches to the study of the complex systems and chaos try not only to be representationist but also reductionist in their endeavors toward pattern formation in complex/chaotic systems. One of these representationist-reductionist approaches is the fractalization of chaos/complexity proposed as a generic methodology in this research. This approach formed a reductionist image of the complex systems through pattern formation and evolution; hence fractal formation and development. This approach had the potential to answer the *epistemic modes* of complexity (e.g. *descriptive complexity*, or the minimum length of the account that is accurate and sufficient to provide an adequate description of the system; *generative complexity*, or the minimum length of the set of characteristics and instructions necessary to generate a complex system and *computational complexity*, or the capacity to quantify, simulate and present models/mathematical formula). Additionally, the research developed the epistemological *Belief* ( $P_1$ ) that *chaos and complexity in the systems could be fractalized*, and then proceeded with the epistemological *Justification*,  $P_2$ : *If we could find identical recursions in chaotic/complex system then we could define a possible structure in the system which could lead to system structuration and hence fractalization of the system*. In the next step a logical proposition presented for the justification which denoted that in order to escape *chaos circularity* we have to find a non-circular approach to be able to escape chaotic interpretations and hence defining order. Logically we deduced that one of the potential ways of escaping chaos circularity is finding the dominant recursions in the chaotic/complex systems to be able to fractalize the recursions and define the result as the dominant spirit/trait of the system. For the third entity of the epistemological discussion, *Warrant*,  $P_4$  was proposed as: *Mathematical approach could define/formulate the remaining recursions in complex systems*. Additionally for implementing the fractalization of chaos/complexity, discussed above, a seven-step procedure was defined. Later in order to add more clarification to the discussions (especially  $P_4$ ), the case of organizational power as one of the complex organizational phenomena unfolded through the steps. Finally, it is noteworthy to accentuate that the proposed methodology for the study of complex/chaotic systems in this research was generic and researchers could expand, define or re-define the procedures based on their expertise and field of research in the future.

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## References

1. Akhmet, M., Fen, M. O., & Alejaily, E. M. (2020). Dynamics with Chaos and Fractals. *Springer*. <https://doi.org/10.1007/978-3-030-35854-9>
2. Arévalo, L. E. B., & Espinosa, A. (2015). Theoretical approaches to managing complexity in organizations: A comparative analysis. *Estudios Gerenciales*, 31(134), 20–29. <https://doi.org/10.1016/j.estger.2014.10.001>
3. Arthur, W. B. (1999). Complexity and the economy. *Science*, 284(April), 107–110. <https://doi.org/10.1126/science.284.5411.107>
4. Arthur, W. B. (1999). Complexity and the economy. *Science*, 284(5411), 107–109.
5. Asllani, M., Challenger, J. D., Pavone, F. S., Sacconi, L., & Fanelli, D. (2014). The theory of pattern formation on directed networks. *Nature Communications*, 5(1), 1–9. <https://doi.org/10.1038/ncomms5517>
6. Audouin, M., Preiser, R., Nienaber, S., Downsborough, L., Lanz, J., & Mavengahama, S. (2013). Exploring the implications of critical complexity for the study of social ecological systems. *Ecology and Society*, 18(3). <https://doi.org/10.5751/ES-05434-180312>.
7. Bar-Yam, Y. (2002). General features of complex systems. *Encyclopedia of life support systems (EOLSS)*. Oxford, UK: UNESCO, EOLSS Publishers.
8. Bedau, M. A., McCaskill, J. S., Packard, N. H., & Rasmussen, S. (2010). Living technology: Exploiting life's principles in technology. *Artificial Life*, 16(1), 89–97.
9. Boers, N., Kurths, J., & Marwan, N. (2021). Complex systems approaches for Earth system data analysis. *Journal of Physics: Complexity*.
10. Boulton, J., Allen, P., & Bowman, C. (2015). *Embracing complexity: Strategic perspectives for an age of turbulence*. Oxford: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199565252.001.0001>
11. Britannica, T. (2020). Editors of encyclopaedia (2020, February 28). Reductionism. *Encyclopedia Britannica*. <https://www.britannica.com/topic/reductionism>.
12. Britannica, T. (2016). Editors of encyclopaedia (2016, April 8). Representationism. *Encyclopedia Britannica*. <https://www.britannica.com/topic/representationism>.
13. Buescu, J., & Serpa, C. (2019). Fractal and Hausdorff dimensions for systems of iterative functional equations. *Journal of Mathematical Analysis and Applications*, 480(2), 123429.
14. Chu, D., Strand, R., & Fjelland, R. (2003). Theories of complexity: Common denominators of complex systems. *Complexity*, 8(3), 19–30. <https://doi.org/10.1002/cplx.10059>
15. Cilliers, P. (2016). In R. Preiser (Ed.), *Critical complexity, collected essays*. Berlin, Boston: De Gruyter. <https://doi.org/10.1515/9781501502590>
16. Cramer, F. (1993). *Chaos and order: The complex structure of living systems*. Cambridge: VCH.
17. Drożdż, S., Kwapień, J., & Oświęcimka, P. (2021). Complexity in economic and social systems. *Entropy*, 23(2), 133. <https://doi.org/10.3390/e23020133>
18. Falconer, K. (2004). *Fractal geometry: Mathematical foundations and applications*. Wiley.
19. Foote, R. (2007). Mathematics and complex systems. *Science*, 318(5849), 410–412.
20. Forouharfar, A. (2020). The anatomy and ontology of organizational power as a fractal metaphor: A philosophical approach. *Cogent Business & Management*, 7(1), 1728072. <https://doi.org/10.1080/23311975.2020.1728072>
21. Gerrits, L., & Marks, P. K. (Eds.). (2012). *Compact I: Public administration in complexity*. ISCE Publishing.
22. Goldenfeld, N., & Kadanoff, L. P. (1999). Simple lessons from complexity. *Science*, 284(5411), 87–89.
23. Guidara, A. (2021). Complex systems and public policy. In *Policy decision modeling with fuzzy logic. Studies in fuzziness and soft computing* (Vol. 405). Cham: Springer. [https://doi.org/10.1007/978-3-030-62628-0\\_3](https://doi.org/10.1007/978-3-030-62628-0_3).
24. Holland, J. H. (2000). *Emergence: From chaos to order*. OUP Oxford.
25. Ladyman, J., Lambert, J., & Wiesner, K. (2013). What is a complex system? *European Journal for Philosophy of Science*, 3, 33–67. <https://doi.org/10.1007/s13194-012-0056-8>



26. Markie, P. (2010). The power of perception. In J. Dancy, E. Sosa, & M. Steup (Eds.), *A companion to epistemology*, (2nd Ed., p. 72). New York: Wiley-Blackwell.
27. Mazzocchi, F. (2016). Complexity, network theory, and the epistemological issue. *Kybernetes*, 45(7), 1158–1170. <https://doi.org/10.1108/K-05-2015-0125>
28. McGrath, M. & Frank, D. (2020). Propositions. In E. N. Zalta (Ed.), *The stanford encyclopedia of philosophy* (Winter, 2020 Edn.). <https://plato.stanford.edu/archives/win2020/entries/propositions>.
29. Merriam-Webster's collegiate dictionary. (2021a). <https://www.merriam-webster.com/dictionary/circularity>.
30. Merriam-Webster's collegiate dictionary. (2021b). <https://www.merriam-webster.com/dictionary/virtuous%20circle>.
31. Merriam-Webster's collegiate dictionary. (2002). (10th). Massachusetts, USA: Springfield.
32. Parrish, J. K., & Edelstein-Keshet, L. (1999). Complexity, pattern, and evolutionary trade-offs in animal aggregation. *Science*, 284(5411), 99–101.
33. Preiser, R. (2019). Identifying general trends and patterns in complex systems research: An overview of theoretical and practical implications. *Systems Research and Behavioral Science*, 36(5), 706–714. <https://doi.org/10.1002/sres.2619>
34. Preiser, R., Biggs, R., de Vos, A., & Folke, C. (2018). Social-ecological systems as complex adaptive systems: Organizing principles for advancing research methods and approaches. *Ecology and Society*, 23(4), 46.
35. Rescher, N. (1998). *Complexity: A philosophical overview*. New Brunswick, NJ: Transaction Publishers.
36. Rind, D. (1999). Complexity and climate. *Science*, 284(5411), 105–107.
37. Schindwein, S. L., & Ison, R. (2004). Human knowing and perceived complexity: Implications for systems practice. *Emergence: Complexity and Organization*, 6(3), 27–32.
38. Schwitzgebel, E. (2019). Belief. In E. N. Zalta (Ed.), *The stanford encyclopedia of philosophy* (Fall 2019 Edn.). <https://plato.stanford.edu/archives/fall2019/entries/belief>.
39. Serpa, C., & Buescu, J. (2015). Explicitly defined fractal interpolation functions with variable parameters. *Chaos, Solitons & Fractals*, 75, 76–83.
40. Serpa, C., & Buescu, J. (2017). Constructive solutions for systems of iterative functional equations. *Constructive Approximation*, 45(2), 273–299.
41. Stace, W. T., & Goldstein, J. A. (2006). Novelty, indeterminism and emergence. *Complexity & Organization*, 8(2), 77–95.
42. Steup, M. (2016). Epistemology. In E. N. Zalta (Ed.), *The stanford encyclopedia of philosophy* (Fall 2016 Edn.). <https://plato.stanford.edu/archives/fall2016/entries/epistemology/>.
43. Thurner, S., Hanel, R., & Klimek, P. (2018). *Introduction to the theory of complex systems*. Oxford: Oxford University Press.
44. Werner, B. T. (1999). Complexity in natural landform patterns. *Science*, 284(5411), 102–104.
45. Whitesides, G. M., & Ismagilov, R. F. (1999). Complexity in chemistry. *Science*, 284(5411), 89–92.
46. Wintermantel, T. M., Buchhold, M., Shevate, S., Morgado, M., Wang, Y., Lochead, G., et al. (2021). Epidemic growth and griffiths effects on an emergent network of excited atoms. *Nature Communications*, 12(1), 1–6. <https://doi.org/10.1038/s41467-020-20333-7>.
47. Zheng, Z. (2021). An introduction to emergence dynamics in complex systems. In X. Y. Liu, (Ed.), *Frontiers and Progress of Current Soft Matter Research. Soft and Biological Matter*. Singapore: Springer. [https://doi.org/10.1007/978-981-15-9297-3\\_4](https://doi.org/10.1007/978-981-15-9297-3_4)

# International System, Transformation of Terrorism and Chaos Theory



Selim Kanat

**Abstract** Although chaos theory first appeared in the field of mathematics, it is increasingly accepted in the field of social sciences every day. In the field of international relations, the predictions of chaos theory have recently been increasingly used to interpret the international system and relations. Especially, the complexity of the international system after the Cold War resulted in traditionalist theories not fully explaining the emergence and functioning of the new era. The increase in the number and variety of actors in the international system every day after the Cold War, the increase in the interdependence of these actors and the mutual interaction between the actors, the international system becoming a more open system has made the chaos theory contribute to the making of more accurate evaluations in explaining the new international system. Chaos theory has contributed to some understanding of the nonlinear, unpredictable nature of the new international system. Perhaps the most important phenomenon that was affected by the transformation of the international system after the Cold War and also affected this transformation is terrorism. Terrorism's importance for the international system and the policies of states is increasing day by day. Terrorism is spreading every day and becoming a more serious threat, feeding the chaotic structure of the system. Similarly, the chaotic structure of the system also feeds terrorism. Based on these predictions, this study has tried to interpret the transformation of international terrorism with chaos theory and the structure of this international system.

**Keywords** Chaos theory · International system · International terrorism · New terrorism · International relations

## Introduction

Understanding the international system is the main aim of international relations (IR) theories and approaches. In this context, every theory tries to understand the

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system to answer the question of “how can we avoid wars and security, stability can be sustained”. IR experts started to ask this question after World War I. That war brings out a need to understand the dynamics of the international system [3]. The first answer to this need is named liberalism. The liberal theory of international relations tries to describe why World War I and the other wars emerged? And how we can prevent wars. The answers of the Liberal Theory were criticized by the Realist Theory and with the start of World War II foresight of the Liberal theory was evaluated as wrong. This is can be seen as the first debate in theories in international relations. After World War II, the Realist theory of international relations seen as a grand theory for about fifteen years. After that second theoretical debate of IR was experienced. Critical approaches criticized the foresight of classical theories Liberalism and Realism. Critical and structural approaches of IR tries to explain state policies in the bipolar world’s détente period.

With the collapse of the Soviet Union, the international system has been transformed rapidly. Bipolar World has ended and new security threats and challenges emerged. The absence of stability, provided by the bipolar world order, caused an unstable security environment and the international system to become more and more dangerous than the period of the Cold War. The first (Liberalism, Realism) and second (structuralism, behaviouralism, etc.) generation has difficulty in explaining the sudden change and the new status of the international system. Newer theories/approaches as the chaos and complexity approach have valuable insights to explain the change in the international system.

The new world order is much more complex and difficult to understand than before. For instance, in the period of the Cold War, states generally protect themselves from the threats of enemy armies or states. And security means defending national borders and the sovereignty of the state from enemy or opponent states which are generally in the opposite block, but the definition of security post-Cold War has evolved in a revolutionary way. Today, as security threats vary, the subject of security is gradually changing. So the security policies become more and more complex. Another example is terrorism. Terrorist violence is imaginable as a dirty tool of international politics and power struggle in the Cold War period. But with the end of this period explaining the nature, aims, types of terrorism, has become more difficult, and the fight against terrorism is more complicated than ever before.

In this context the main aim of this paper to analyze the international system and terrorism, as an important threat to world order and stability, in the post-Cold War period. As the new era is much more complex and chaotic than ever, it was appropriate to act in the foresight of chaos and opposition approaches to analyze this period. For this main aim, firstly new international system will be discussed under the foresight of chaos theory. Under this title, how chaos theory explains the international system will be questioned especially in the post-Cold War period. Secondly, the transformation of international terrorism, widely accepted as a major threat to international peace, order, and wealth, will be examined from the Cold War period to nowadays with the perspective of chaos and complexity approach.

## Chaos Theory and International Relations

### *Chaos Theory*

The meaning of the term chaos is, “*a state of total confusion with no order*” (Cambridge Dictionary). The word chaos was used in Ancient Greek to mean “*absolute anarchy, chaos, and disorder*”. At that time, the word was interpreted as the exact opposite of the word “cosmos”, which means “absolute universal order”. Consequently, the term “chaos theory” refers to “a scientific theory about situations that obey particular laws but appear to have little or no order” (Cambridge Dictionary). In this manner, the term shortly refers to disorder.

Chaos theory is an anti-thinking understanding of the classic mechanical paradigm of science. Mechanical systems can be considered predictable, predictable structures in the short and long term that function like machines and these structures form a small part of the physical universe and are closed systems. These systems are referred to as Newtonian systems because the certainty of the cause and conclusion relationship in Newton’s dynamic laws has found the foundations of modern deterministic linear science. Newton formulates this, in his “dynamics laws”, for instance, he said in 3rd dynamic law “*every action there is always opposed an equal reaction: or the mutual actions of two bodies upon each other are always equal, and directed to contrary parts*” [24]. This statement is valid for all occasions, the cause creates the same result each time linearly. In the direction of Newtonian thought, determinism is the understanding that claims that everything that happens in the universe takes place in a causal relationship, that all facts and events in the physical universe and hence in the history of humanity are dependent on their causes and are conditioned by their causes. This linear relationship and machine paradigm is still the “reference point” for physics and the core model of science in general [49].

Chaos theory can be accepted as the end of this “deterministic linear science” which named cause-result relations in all matters [9]. For chaos theory “a small change in the system can cause a very large change after a while” [41]. For this reason, while it is possible to make consistent and accurate predictions in the short term in chaotic systems, it is not possible to make such predictions in the medium and long term. Uncertainty in a forecast increases with time. Doubling the time in a prediction mathematically increases the uncertainty more than the square. For this reason, it is impossible to make long-term accurate predictions. Since meaningful predictions cannot be made, the system appears complex and chaotic. This point, called Lyapunov time, indicates a different time for each chaotic system. The consistent relationship between cause and effect becomes chaotic from this point on, unstable and complex. So Lyapunov time roughly reflects the limits of a system’s predictability. For example, while there is an accuracy rate of 90% in a five-day forecast, this rate drops to 50% for 10 days or more [48]. Based on this, it is argued that it is impossible to make long-term predictions. In the future estimates, the longer the period, the less likely the forecast will come true. This situation is defined as chaos about an unpredictable future.

The intellectual roots of the chaos theory go back to ancient times but, it has been modernized in the 20th century with mathematical formulations. Henry Poincare and Edward Lorenz are important names that can be counted for this period [44]. Henri Poincaré is the first person that uses chaos term for an unpredictable condition in the early 1890s during his work about the solar system whether stable or unstable [27, 40]. Furthermore, chaos theory rises with Edward Lorenz in 1960–70s. Lorenz was a mathematician and meteorologist, and be named the father of chaos theory (Nature 2008).

Edward Lorenz asked the following question in a speech in 1972: “Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?” This question can be said as the best-known quote of the theory known as the “butterfly effect” and indirectly of the chaos theory. Because of entering the data used by Lorenz in the weather forecast into the computer, the graphic took a shape like butterfly wings. Statements derived from this question have virtually become the labels of the chaos theory arising from the uncertainty about digital weather forecasts. Furthermore, initially, Lorenz bases his “chaos theory” by putting forward two basic properties of chaotic systems that appear to be disordered from the outside but have an internal order: Sensitive dependence to the initial conditions and not randomness [22]. Nowadays it is possible to talk about five basic features of chaos theory today.

The first is the *sensitive dependence on initial conditions*. The butterfly effect emphasizes the importance of “sensitive dependence on starting conditions” in chaotic systems [2]. Because the butterfly effect emphasizes that an event that is small or underestimated and overlooked can have big consequences in the medium and long term [17]. In other words, events in chaotic systems can cause several unexpected outputs that are larger than their capacity in a nonlinear manner [1]. This results in the dependence of chaotic systems on initial conditions. The fact that the initial conditions of the system can never be determined and formulated with all clarity reveals the uncertainty in chaos theory [21]. It had a place in folklore: “*For want of a nail, the shoe was lost; for want of a shoe, the horse was lost; for want of a horse, the rider was lost; for want of a rider, the battle was lost; for want of a battle, the kingdom was lost!*” [22].

The second is *non-linearity*. Linearity is a feature of Newtonian scientific thought. For centuries, science has focused on examining repetitive, that is, periodic, events that occur in a causal relationship under certain conditions. This behavior is somehow a result of the classical approach of science. Because a linear system maintains the ratio between inputs and outputs, it can be predicted and controlled. Nonlinear systems are systems that are in a fluctuating course between consistency and inconsistency, far from balance. For these reasons linear systems are stable, predictable, precise, and therefore do not allow chaos [23]. Nonlinear systems change in uncertainty, so their process of movement is unpredictable. Chaotic systems are nonlinear. The usual cause and effect relationship, that is, the same reason causing the same results every time, is out of the question in nonlinear systems.

The third is *incalculability/unpredictability*. Radical changes in chaotic systems can be caused by very small and unpredictable reasons. The consequences of a small effect can be very large or very small. The same effect may not always produce the

same result. This feature points out that a small difference in initial conditions will create unpredictable differences. Unpredictability is the most common interpretation of sensitive dependence on initial conditions. According to the chaos theory, long-term behavior is random, uncertain and cannot be predicted reliably [52].

The fourth is *fractal structures and self-similarity*. Where everywhere chaos arises, dimensions become fractal. In other words, fractal structures emerge as systems move from order to chaos. The term fractal is derived from the Latin word “Fractus”. It means shattered, broken. The concept was introduced by a mathematician, Mandelbrot, in 1975. The concept was the first step in the emergence of a new geometry system not only in mathematics but also in physics, chemistry, physiology, fluid mechanics, aerodynamics. Fractals are structures that can also be observed in nature. The shape of the turbulence left behind by the wings of an airplane, the curved shape as the smoke rises, the fractal structure such as a snowflake, tree bark can be observed. Fractal shapes are generally like themselves [39]. Irregular details or patterns are repeated at ever smaller scales and can last indefinitely in completely abstract objects. When each part of each part is magnified in fractal shapes, it again resembles the whole body. In a way, fractal structures can be regarded as images of chaotic systems.

The fifth is *self-organization*. It is one of the most basic features of complex systems [47]. Self-organization is when a group that comes together to fulfill a task decides what to do, how to do it, when to do it, without being subjected to any external intervention and regulation, and does it spontaneously [37]. Although self-organizing structures are not the result of a preprogrammed design; it is not determined by external conditions [11]. Self-organization is a feature of complex systems that develops by spontaneously changing their internal structure (internal mechanism) [11]. Spontaneity is the most important feature of self-organization. Spontaneousness means “not coming out intentionally”, “not deliberately designed” and “spontaneously occurring” [35].

The sixth is *connectivity, interdependence, and mutual interaction*. Chaos is important as it is a means of dealing with these systems by improving the ability to describe, understand and predict inconsistent balances [42]. A chaotic system is not deterministic. In such a system, it is impossible to accurately predict the behavior of the actors in the long run. On the one hand, difference and different behaviors produce disorder, on the other hand, the interrelatedness of these units puts the system in order and disorder and order are intertwined [32].

For chaos theory, there is some form of an order under the state of irregularity [28]. This order is formed by interaction. Every event and everything affects the others and effected by the others. This interaction creates the orders in irregularity. So, we can say that every system has an order even if looks chaotic. From this point, it can be said that chaos theory is a universal theory that applies to both natural and political sciences, and also to International Relations [7].

## *Chaos Theory and International System*

Some parts of the universe can function like machines, but these are closed systems. Social systems are open [42]. Trying to understand social systems mechanically will fail [49]. Many human systems can be best explained within the framework of chaos theory, the nature of the human body, weather forecasting, and education are the first examples that come to mind as areas where chaos theory can be applied [43]. Since chaos theory includes possibilities other than regularity, it provides important opportunities that did not exist before for social sciences and international relations as social science [53].

In a world where everything is constantly connected, complexity increases proportionately. Interdependence increases the sensitive dependence on initial conditions [50]. This situation brings along unpredictability. The fact that the international relations environment gradually becomes open systems due to the diversification of actors negatively affects the comprehensibility of the system with traditional theories. If we describe chaos as “a complex thing, made up of many interrelated parts, not easy to analyze and understand” it can be said that as the number of interrelated parts in a system increases, the complexity increases [2]. As the interactions between the parts (actors) of the system increase, it becomes increasingly difficult to predict the full effects of any action [32]. After the Cold War, the number and diversity of actors in the international system increased. Beyond that, with the end of the bipolar system that keeps the behaviors of these actors under control, the diversity in behavior has increased.

If we look dynamics of the international system we realize that international system is essentially chaotic. Kissane argues that “the assumption of chaos can assist in explaining the variety of international behavior exhibited by international actors”. Kissane [29, 30] draws attention to three points in explaining the international system and chaos theory. These are the chaotic nature of the international system, the security pursuit of the actors in the international system, and the interaction between the actors in this search for security.

The chaotic nature of the international system idea firstly refers “anarchical nature” of the international system. Classical international relations theories like Liberalism and Realism explain the international system with human nature. For Realism, a state should be selfish, sordid, and opportunist in an anarchic international system, like a man which lives in an anarchic state of nature. We can say that the concept of anarchy has been at the core of theorizing about international system/relations since the time Thucydides, 4th century B.C. After him, political thinkers N. Machiavelli, T. Hobbes, E.H. Carr, H. Morgenthau, K. Waltz, H. Bull, J.J. Mearsheimer like-minded with Thucydides. Anarchy is the core element of the international system. To being secure, every state should gain power and not trust anyone about its survivability, and this choice has the same logic as Hobbes’s famous quote “*homo homini lupus*”. When we say the Realist description of the international system is anarchic, we say at the same time it is chaotic. Because there is no safety, no rule, no authority in this situation, and every man has to survive in some way.



A man in this anarchic state can be allied with another one day, another day when the circumstances changed, they can become enemies. Like Realism, Neo-Realism, English School, Neo-Classical Realism international system is anarchic and chaotic in some manner [26].

In this manner, if one accepts that the international system is almost or sometimes anarchic, chaos theory can help in explaining the assumption of the anarchic nature of the international system. Because explaining the origin and the results of the anarchic international system with only human nature can see as inadequate. When one explains the basis of the international system with only human nature, neither measurement nor evaluation can possible. But by applying chaos theory to explaining the anarchic international system, it could be possible to express the conditions and nature of the anarchic system numerically.

Furthermore, the concept of anarchy in the international system does not characterize chaos, but situations in which there is no state, rules, and hierarchy. The concept of "order", which evaluates to the opposite of anarchy, is thought to express situations in which there is no chaos. However, the concept of chaos should not be considered as a state of complete disorder and anarchy. Traditional theories of international relations; The complex and dynamic structure of the international system is very limited to explain the conditions of the order, anarchy, and disorder, and the terms are often used interchangeably, but with different meanings [6]. But when we think anarchical nature of the international system with interdependence and multipolarity, the chaotic nature of international relations can be more clearly understood.

Secondly, the chaotic nature of the international system refers to "interdependence". In 1970s Keohane and Nye criticized the anarchic nature of the international system. This new approach focused on the reality of "interdependence" in international relations. This new approach does not deny the anarchic nature but with focusing on only anarchy the explanations about the international system will insufficient. Because for this assumption "anarchy" could not explain the richness and variety of international interactions, particularly in a globalized world, alone. Describing the international system with interdependence is more common after the collapse of the Soviet Union and the end of bipolarity. With the reduction of the importance of national borders, especially in international trade, mutual interdependence increased in the world. Capital market and domestic, international politics have been interconnected together much more than ever. This reality makes the globalized world more chaotic. For instance, the global economic crisis of 2008 has emerged with the collapse of the mortgage system in the United States, and it influences the whole world after. After the crisis, the European Union exports decreased about %19 [13]. Samples can be reproduced but, this reality can be seen in daily life, the world more interrelated and connected. A little effect or policy caused bigger troubles and crisis easily, maybe World War II can be given as an example for this assumption [5]. The reason for the 1929 World Economic crisis emerges in the USA due to the collapse of the New York Stock Exchange [10]. This crisis is a domestic economic crisis, and it is a matter of internal affairs. But 1929 crisis affect the rise of Hitler and Nazis first in Germany, after the whole of Europe. This process takes the world-to-World War Second [4, 46].



Thirdly we should emphasize under the chaotic structure of the international system is “multipolarity”. Apart from interdependence, with the end of bipolarity, the world becomes more dangerous and chaotic. If unipolarity is defined as the situation where, within a system, one actor is preponderant and controls more than half of the resources within that system, it should be rare under a chaotic system like an international system [29, 30]. We can say that multipolarity is an element of chaotic systems, like the international system. The assumption in this point is that “multipolarity” is a more common status than unipolarity or bipolarity in a system with a significant number and variety of actors, as the international system as described must be. For instance, if one accepts that there are 10 actors in a system and there are only 10 different alternatives to talk about unipolarity. But when we mention bipolarity in that system there are about 45 different pairing alternatives and in 968 ways system can be multipolar.

If we accept that there is a connection between multipolarity and chaos, we can argue that the international system is chaotic, or at least it tends to be chaotic. When we look to political history, we see rarely unipolarity (e.g. Roman Empire), sometimes bipolarity (Cold War) but generally see multipolarity. In multipolar international systems and chaos, randomness is common meaning, and everything possible in random systems. For instance, Walt mentions this possibility, with his “balance of threat” idea. For him, states ally to balance against threats rather than against power alone, he surveys the diplomatic history of the Middle East between 1955 and 1979 and discovers that balancing is far more common than bandwagoning [51]. If we look at this assumption with chaos glasses, we can say that; bandwagoning creates a unipolar international system, but balancing behavior supports arising of multipolarity in the international system and chaos also.

As another point, the security pursuit of the actors in the international system idea refers “security dilemma” in the international system. Security dilemma in essence, what states do for their security is rather insecure rather than providing them with security. This situation is the emergence of an unpredictable outcome. While waiting for security, what is achieved is insecurity. This process is a non-linear, the reasons do not produce the same result every time. One of the reasons for the emergence of unpredictable nonlinear results in the safety dilemma system is the sensitive adherence to initial conditions. The armament of a state to ensure its security, for example, causes other states to feel threatened and consequently arming, and consequently, the first armed state feels under threat and continues to take up arms. This security dilemma system is the result of mutual interaction and interdependence. In this sense, the security dilemma situation, which is often identified with realism, can be explained by the chaos theory predictions.

Interaction between the actors in the search for security idea refers to the “armament race” between states. This idea is based on the idea that states seeking security in an anarchic international system will simply compete with each other. This idea can be criticized in the traditionalist school of international relations as a prediction of realist understanding as an old idea valid during the Cold War period. However, in the post-Cold War period, it is difficult to see a meaningful decrease in the budgets spent by states for armament compared to the previous period. Even in armaments to Turkey

possible to say that the constant increase [45]. The reason for this is the general understanding that states should not rely on anyone but themselves to provide security. This understanding is the result of the understanding that is described as “self-help” in neorealist thought and argues that states should hope to benefit from their power in the solution of international problems. Therefore, the arms race continues today as it was in the past. The arms race, which makes the international system more chaotic, is in harmony with the idea that the system is anarchic and the security dilemma. The armament of a state, even for its security, creates a butterfly effect in the system and initiates an armament process that affects each other. However, this arms race is not linear. On the one hand, while armament continues, on the other hand, the disarmament process may be experienced. START treaties in the post-Cold War era can be cited as an example. Beyond these, it seems impossible to predict how the arms race will work in the long run. The Covid-19 global pandemic, for example, brought about questioning the meaning of the weapon stock owned.

We can easily claim that chaos theory presents useful assertions in explaining the dimensions of the international system, especially in the period after the Cold War. With the rising multipolarity, new challenges and security threats emerged and this makes the international system more unpredictable and chaotic. The most dangerous to human, state, and international security is terrorism maybe. Apart from other threats, the characteristics of terrorism make the system more complex and chaotic. Classical international theories try to explain the change in the international system, and they have some explanations about it, but it will be much easier to explain the current system with the help of the assertions of chaos and complexity approach. Chaos approach is not an international relations theory originally but using the basic assertions of it, will help us to understand the new world order and help to make an accurate evaluation about it. In this manner, we think that the chaos and complexity approach is useful to identify the evolution of terrorism.

## **Chaos Theory and Transformation of Terrorism**

Throughout the historical ages, there is a relationship based on mutual interaction and interdependence between the transformation of the international system and the transformation of international terrorism. As the international system transformed, this turn affected and changed terrorism, and as international terrorism transformed, this transformation affected and transformed the international system. For this reason, one of the requirements of those who make sense of today’s international system with the predictions of chaos theory and make short-term predictions is to understand the transformation of terrorism.

International terrorism is a concept that should not be ignored in the analysis of today’s international system and international relations. As a global threat, terrorism plays a decisive role in the policies of states on the one hand, and on the other hand, affects the international system in various ways. However, terrorism is not a threat specific to our age. Terrorism, a concept that can be started with the history of

humanity, has changed and transformed in various ways throughout the ages. It experienced its last major transformation with the end of the Cold War. The September 11 attacks, on the other hand, have been an example of this latest transformation. With the effect of globalization experienced with the end of the Cold War, terrorism has become a common problem of humanity today. Global terrorism threatens all states in one way or another [34].

In this context, terrorism experienced its last major transformation with the end of the Cold War. This transformation is based on the transformation in the international system. With the collapse of the USSR, the ideology element has lost its importance in terrorism. Throughout the Cold War, terrorist organizations tried to appear left-leaning and pro-communist to provide financial and logistical support regardless of their real motivations. During the Cold War era terrorism imaginable as a dirty tool of international power struggle. States use, in different ways, terrorist violence to weaken their enemy states, nations which are generally been in opposite polar. In this period almost every terrorist organization has used left and revolutionary discourses in their interests. The socialist ideology, to destabilize the Western Bloc and weaken the Western States, provided some support to such leftist revolutionary movements [38]. Thus, within the bipolar system, terrorist groups have defined their positions in line with the predictions of the ideologies they have supported in one way or another. But the collapse of the Soviet Union changed this situation. Terrorist organizations, which envisage that they can no longer obtain more support in the ideological sense, have chosen to define themselves and their aims in accordance with their basic objectives. This situation makes the new terrorism more unpredictable. Because in Cold War period terrorism was trapped between two blocks and ideology. But after the end of the Cold War terrorism has survived the chains that restrained itself, almost has obtained its freedom. Multipolarity has produced this result. In the period of the Cold War, either Eastern or Western block has control of terrorist organizations. They use terrorist organizations for their political goals in a dirty style. Under that circumstances, terrorism was under the control of the bipolar world system. With the multipolarity, after the Cold War, the importance of ideological ideas has decreased in politics and terrorism [25].

This new state of transformation of terrorism can first be explained by the “butterfly effect”. Terrorism has transformed into a new situation due to the end of the Cold War. However, terrorism, which was shaped by the support and control of the bloc states during the Cold War, was expected to come to an end, or at least to lose its effectiveness, just as in chaotic systems, it has become even more dangerous randomly and unpredictably.

Terrorism has become much more dangerous. Organizations carry out actions that cause much more destruction than before. This is because the motivation for terrorist acts has changed. The purpose of terrorism (former terrorism) during the Cold War was; the least damage with the symbolic actions, and to attract the most attention to the case. This motive was strictly controlled within the command-order system [14]. Hence the number of people who lost their lives due to terror from the cold war period is limited. Because in this period, terrorism wanted the change the existing system for its purposes. In harmony with this purpose, organizations did not intend to

get a reaction by killing too many innocent people. But in the aftermath of the Cold War, the idea of successful action as many dead people began to dominate terrorism. The motivation behind the actions has moved closer to random violence, aiming to move away from symbolism and lose more people [33]. Post-Cold War terrorism (new terrorism) aims to kill as many people as possible, to destroy the international system which they see as the enemy and the states that created it [16].

However, “unpredictability” as a feature of chaotic systems is also valid for the transformation of terrorism. While the new terrorism aims to kill more people on the one hand, on the other hand, acts are carried out without ending the lives of many innocent people with the developing digital terrorism [36]. Especially after the last Covid 19 pandemic, as a result of changing social habits, terrorist acts take the form of digital terrorism.

This new state of transformation of terrorism can be explained secondly by the “chaotic nature of the international system”. The post-Cold War international system is much more chaotic than before. A similar assessment can be made for terrorism, i.e. international terrorism has become a much more chaotic system. It is possible to explain this for three reasons.

First, the reason why the new terrorism is much more chaotic than the former one is the more anarchic nature of the new terrorism. In the new era, terrorism got rid of the regulatory and restrictive effect of the bipolar world. Terrorist organizations that needed the support of the polar states in the old period also fell under the control of the states they supported. However, in the post-Cold War period, this possibility of control has also disappeared. Taking advantage of the development of technology, terrorism has now become much more dangerous and unpredictable. For example, in the past, terrorist organizations were mostly composed of professional terrorists with criminal records [31], while in the new period, terrorists consist of members of difficult to identify organizations without a criminal record [18, 19].

Secondly, international terrorism is being carried out by far more diverse actors than ever before. The increase in the number and diversity of actors supports the chaotic nature of international terrorism. In the post-Cold War period, the world has encountered an increase in the effectiveness of many terrorist organizations that are effective on a global scale. In the new terrorism, organizations carry out actions with a wide range of motivations, from religious radicalism to ethnic separatism, from hostility to the west to destroy the global system altogether [12].

Thirdly, the reason why new terrorism is much more chaotic than before is that terrorist organizations are much more interconnected and interact with each other. Terrorist organizations, which make use of the possibilities of communication technologies more than before, can communicate with each other, even establish alliances and carry out joint actions. Especially as global radical religious organizations, organizations such as Al-Qaeda, Taliban, ISIS, and Boko Haram sometimes act by establishing alliances beyond sharing knowledge and experience [20].

## Conclusion

In social systems like the international system, there is no linear relationship and machine paradigm. If we accept human nature as the core element of social systems, one can argue that human nature is not constant and stable. The uncertainty of human nature makes social systems like the international system unpredictable. And if we accept social relations as the core elements of a social system as well, the result is the same. Because social relations are associated with “the dependence of everything on everything”. All living and non-living beings in nature are not isolated and not independent of themselves. Almost all beings interact with their environment this interaction create uncertainty and unpredictability. Either in theory or practice, we cannot control social systems and relations. So, we cannot guess the possible outcomes and results in social life for long periods correctly.

The international system and international terrorism experienced their last major transformation with the end of the Cold War. In the post-Cold War period, the system has become much more chaotic compared to the bipolar system. Trying to explain this transformation with traditional international relations theories may lead us to partially wrong conclusions. Because all of the traditional theories are based on the assumption that the international system can be opened and the developments in the system can be predicted. However, traditional theories have not been successful in predicting and evaluating the abrupt end of the Cold War and the consequences of this abrupt end. The new era has emerged, unexpectedly, in an unexpected form.

One of the most appropriate theories in explaining and interpreting the new form that the new international system and international terrorism has taken is chaos theory, which is essentially a mathematical theory. The predictions of other traditionalist approaches in explaining the nature of the new system and the new terrorism operating with non-linear contradictions remain, so to speak, old-fashioned. In this respect, there is a need for new predictions in the discipline of international relations in the analysis of the new situation with new features. The closest theory to meeting this need is the chaos theory, which is used first in the positive sciences but can very well be applied to social sciences.

## References

1. Anderson, P. (1999). Complexity theory and organization science. *Organization Science*, 10(3), 216–232.
2. Andiç, U. (2008). *Uluslararası İlişkiler Teorisine Kaos Teorisi Perspektifinde Postmodern Bir Yaklaşım*. İstanbul: Yüksek Lisans Tezi, Kadir Has Üniversitesi.
3. Angell, N. (1910). *Great illusion*. New York: Knickerbocker Press.
4. Armaoğlu, F. (2010). *Yüzyıl Siyasi Tarihi 1914–1995*. İstanbul: Alkım Kitapevi.
5. Açıkalın, Ş. N., & Erçetin, Ş. Ş. (2012). Great illusion in twenty-first century-chaos knocking door, chaos, complexity and leadership. In S. Banerjee-Sefika & S. Erçetin (Ed.). Dordrecht Heidelberg New York: Springer.

6. Açıklım, Ş., N., & Bölücek, C. A. (2014). Understanding of Arab spring with chaos theory—Uprising or revolution. In S. Banerjee-Şefika & Ş. Erçetin-Ali Tekin (Ed.), *Chaos theory in politics*. Dordrecht: Springer.
7. Açıklım, Ş. N. (2015). Leadership. In *Chaos: Angela Merkel and Eurocrisis* (Unpublished Master Thesis). Middle East Technical University, Social Sciences Institute.
8. Cambridge Dictionary. <https://dictionary.cambridge.org/tr/s%C3%B6zl%C3%BCk/ingilizce/chaos>.
9. Çavuş, M. Fet al. (2016). Kaos ve Durumsallık: Bir Değerlendirme. *KSÜ Sosyal Bilimler Dergisi*, C: 13, S: 2. S. 205–224.
10. Ceadel, M. (2009). *Living the great illusion: Sir Norman Angell, 1872–1967*. New York: Oxford University Press.
11. Cilliers, P. (1998). *Complexity and postmodernism: Understanding complex systems*. Routledge, Taylor and Francis Group: London and New York.
12. Cooper, B. (2004). *New political religions, or an analysis of modern terrorism*. Columbia: University of Missouri Press.
13. Curran, L. (2009). The impact of the crisis on EU competitiveness in international trade. *Intereconomic*, 2009, 264–293.
14. Cvrtula, V., & Perešin, A. (2009). The transformation of terrorism and new strategies. *Politička misao*, 46(5)
15. Edward, N. L. (1917–2008). *Nature*, 453, 300. <http://eds.a.ebscohost.com/eds/pdfviewer/pdfviewer?vid=0&sid=64bc304a-a386-4732-b9a2-966941eb69dc%40sessionmgr4006>.
16. Edwards, F., & Steinhäusler, F. (2006). *NATO and terrorism*. Dordrecht: Springer.
17. Ertürk, A. (2012). Kaos Kuramı: Yönetim ve Eğitimdeki Yansımaları, *Kastamonu Eğitim Dergisi*, C: 20, No:, Eylül 2012, s.855. S849–868.
18. Fellman, P. (2015). Modeling terrorist networks: The second decade, conflict and complexity. In P. Vos Fellman-Yaneer & B.-Y.-A. A. Minai (Ed.). New York, Springer.
19. Fellman, P. (2015). Modeling terrorist networks: The second decade, conflict and complexity. In P. Vos Fellman-Yaneer & B.-Y.-A. A. Minai (Ed.). New York: Springer.
20. Fishman, B., & Forest. (2009). WMD and the four dimensions of al-Qaeda, unconventional weapons and international terrorism. In M. Ranstorp & M. Normark (Ed.). London: Routledge.
21. Font, J. P., & Regis, D. (2006). Chaos theory and its application in political science. In IPSA World Congress [https://www.researchgate.net/publication/238788385\\_Chaos\\_The\\_ory\\_and\\_its\\_Application\\_in\\_Political\\_Science/link/5e4eea1592851c7f7f48fa51/download](https://www.researchgate.net/publication/238788385_Chaos_The_ory_and_its_Application_in_Political_Science/link/5e4eea1592851c7f7f48fa51/download) (02.01.2021).
22. Gleick, J. (1987). *Chaos making a new science*. New York: Viking Penguin Inc.
23. Gleick, J. (1995). *Kaos Yeni Bir Bilim Teorisi*. Ankara: TÜBİTAK Popüler Bilim Kitapları.
24. Hellingman, C. (1992). Newton's third law revisited. *Physics Education*, 27(2), 112–115. <https://doi.org/10.1088/0031-9120/27/2/011>.
25. Hoffman, B. (1998). Terrorism trends and prospects, countering the new terrorism. I. O. Lesser et al. (Ed.). New York: RAND.
26. Kantemnidis, D. (2016). Chaos theory and international relations, (Unpublished Master Thesis) Naval Postgraduate School, Monterey, California.
27. Karaçay, T. (2005). Determinizm ve Kaos. Kaos, Mantık, Matematik ve Felsefe II. Ulusal Sempozyumu, Yay. haz., Şafak Ural, Yücel Yüksel v.d., İstanbul, İKÜ Yayınları, 2005, Yayın No: 49.
28. Kendirli, S. (2006). Portföy Yönetiminde Kaos Teoremi. *Journal of İstanbul Kültür University* (2), 171–180.
29. Kissane, D. (2007). A chaotic theory of international relations? Te possibility for theoretical revolution in international politics. *Pro Polis*, No. 2.
30. Kissane, D., (2007). A chaotic theory of international relations? Te possibility for theoretical revolution in international politics. *ProPolis* (2), 85–103.
31. Krueger, A. (2007). *What makes a terrorist*. New Jersey: Princeton University Press.
32. Lale, A. (2018). Kaos Teorisi ve Uluslararası İlişkiler: Arap Baharı Örneği, (Yayımlanmamış Yüksek Lisans Tezi) Gazi Üniversitesi Sosyal Bilimler Enstitüsü.

33. Laqueur, W. (1999). *The new terrorism*. New York: Oxford University Press.
34. Luntz, B., & Luntz, J. (2017). *Globalization and the economic consequences of terrorism*. New York: Palgrave Macmillan.
35. McMillan, E. (2004). *Complexity organizations and change*. London and New York: Routledge, Taylor and Francis Group.
36. Mesjasz, C. (2015). Complex systems studies and terrorism, conflict and complexity. In P. Vos Fellman-Yaneer & B.-Y.-A. A. Minai (Ed.). New York: Springer.
37. Mitleton-Kelly, E. (2003). Ten principles of complexity and enabling infrastructures. Mitleton-Kelly, E. (Eds.), *Complex systems and evolutionary perspectives on organizations: The application of complexity theory to organisations*. Netherlands: Pergamon.
38. Mockaitis, T. (2007). *The "New" terrorism myths and reality*. London: Praeger Security International Publishing.
39. Oestreicher, C. (2021). A history of chaos theory. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3202497/pdf/DialoguesClinNeurosci-9-279.pdf> (02.01.2021).
40. Öge, S. (2005). Düzen mi Düzensizlik (kaos) mi? Örgütsel Varlığın Sürdürülebilirliği Açısından Bir Değerlendirme. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 1, 285–303.
41. Prigogine, I. (1987). Exploring complexity. *European Journal of Operational Research*, 30, 97–107.
42. Prigogine, I., & Stenger, I. (1984). *Order out of chaos*. New York: I. Bantam Books.
43. Rockler, M. (1991). Thinking about Chaos: Non-quantitative approaches to teacher education. *Action in Teacher Education*, 12(4), 60.
44. Romya, K., Çelik, Ö., Gerdanlı, B., Arabacı, S. N., Ergen, S., & Karasakal, D. (2002). Uzun Zamandır Piyasada Olan Ancak Yeni Ünlene Kaos". *Pivolka*, Yıl: 1, Sayı: 1.
45. SIPRI. (2021). SIPRI military expenditure database, data for all countries from 1988–2019 in constant (2018) USD, <https://www.sipri.org/sites/default/files/Data%20for%20all%20countries%20from%201988%E2%80%932019%20in%20constant%20%282018%29%20USD.pdf> (02.01.2021).
46. Sander, O. (2020). *Siyasi Tarih 1918–1994*, 10. Baskı, İmge Kitabevi, Ankara.
47. Sayğan, S. (2014). Örgüt Biliminde Karmaşıklık Teorisi, *Ege Akademik Bakış*, Cilt: 14, Sayı: 3, ss. 413–423.
48. SciJinks. (2021). How reliable are weather forecast. <https://scijinks.gov/forecast-reliability/> (01.02.2021).
49. Toffler, A. (1984). Foreword: Science and change. In I. Prigogine & I. Stenger (Eds.), *Order out of chaos*. New York: I. Bantam Books.
50. Tome, L., & Açıkalın, Ş. N. (2017). Complexity theory as a new lens in IR: System and change, chaos, complexity and leadership. In Ş. Şule Erçetin-Nihan Potas (Ed.). Switzerland: Springer.
51. Walt, S. (1987). *The origins of the alliances*. London: Cornell University Press.
52. Williams, G. (1997). *Chaos theory tamed*. Washington: Joseph Henry Press.
53. Yeşilorman, M. (2006). Kelebek Kanadını Kimden Yana Çırpıyor? Birleştirilmiş Bilimin Kıyısında Kaos ve Sosyal Bilimler. *Journal of Istanbul Kültür University*, 4(3).

# How Fractals Contribute to Supply Chain Management? An Initial Bibliometric and Social Network Analysis on Articles Indexed in Web of Science



Nurcan Deniz

**Abstract** Due to the high complexity, fractal based approach was adopted to solve general problems in supply chain management. As a consequence, the research question of this study is “How fractals contribute to supply chain management?” Web of Science database is used to find both “fractal” and “supply chain” related articles to answer the research question. According to the results only seven articles were identified. Bibliometric and social network analysis were employed. The findings of these analysis show that, seven articles were written in high quality journals. There are four clusters in the social network and Ryu and Jung wrote at most three articles in this field. Both of these authors are located in Korea. In terms of the subjects, the predominantly articles are related with fractal-based supply chain management and fractal frameworks for supply chain networks. In addition to these, there are some articles related with agent-based modelling and simulation. According to the results, it can be easily seen that this field is immature and there is a gap. Fractal based approach can be applied for other supply chain management problems.

**Keywords** Fractal · Supply chain · Bibliometric analysis · Social network

## Introduction

Supply chain (SC) is mainly defined as a complex and volatile network [1] comprises several organizations with different objectives such as producers/manufacturers, assemblers, suppliers etc. According to the SC complexity drivers’ study of Pia et al. [10], customer need, competitor action, and government regulation have found the highest dominance. On the other hand drivers such as logistics and transportation, production planning and control, forecasting error, and marketing & sales are found to be the dependent drivers. Number of suppliers, company culture, product variety, and organisational structure are the other SC complexity drivers fall between these

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two classifications. Also, it should be stressed that in the presence of strategic coordination absence, the complexity increases. It is advised to stakeholders to be flexible, adaptive, and coherent to reduce complexity [10].

Recent trends emphasize collaborative and agile supply chain management to manage the uncertainties and dynamics of the global marketplace [8]. Supply chain management approaches can be classified in two main areas. The first one is analytical approaches which are criticized with being too simplistic for complex supply chains. On the other hand, the simulation models can be more realistic to deal with the dynamic, stochastic and uncertain supply chain characteristics [1]. Although the literature on supply chain collaboration develops, complexity issue is still a research gap [5]. Zhou and Chen [16] are one of the authors studied on channel integration and service cooperation in this chaotic environment with game theoretical approach.

A fractal which was coined by Mandelbrot (1975) can be defined as “*a rough or fragmented geometric shape that can be split into parts, each of which is a reduced-size copy of the whole, a property called self-similarity*” [12]. As “fractal” used to describe complex organisms and structures in nature that exhibit self-similar characteristics, Ryu et al. [12] adopted it to solve general problems in supply chain management. Each member in the supply chain is modelled with a self-similar structure referred to as a “fractal” in fractal-based supply chain management. Fractals can be considered as a new perspective in perceiving and modelling of the inherent complexity in supply chain systems because supply chain has a form of approximate self-similarity in both structure and function. This self-similarity exists in both macro and micro levels [1]. Self-similarity, self-optimisation, self-organisation, goal orientation and adapt to the dynamic environment changing by themselves are the capabilities of fractals [13].

Ryu et al. [11] juxtaposes the advantageous features of the fractal concept. First of all, it is shown that to understand a complicated system becomes easier. Additionally, some fractal-specific characteristics like self-similarity and self-organization can be added to the system. The other advantageous feature is computational time reduction with local local optimization instead of global optimization. This can be occurs with dividing the large SCM problem into smaller ones. This advantage also helps to give fast responses for fluctuations in customer demand. Last but not least, flexible inventory management can be possible. Simulation at different scales and levels is another advantage stated in Dai et al. [1]’s study. In this study the extensibility in modelling is also highlighted.

This paper is structured as follows. In Sect. 2, there is a traditional literature review on fractal based supply chain management. Materials and methods of the study are presented in Sect. 3 while in Sect. 4 the results of the analyses are shown. Conclusions part is the fifth and the last part of the study.

## Literature Review on Fractal Based Supply Chain Management

Ryu et al. [12] proposed a fractal-based framework for e-Biz company supply chains. These companies connects with customers, a single transportation system and multiple external manufacturers through the Web interface. They modeled a basic collaborative fractal-based supply chain management fractal unit, which consists of five functional modules (observer, analyzer, resolver, organizer, and reporter) by using unified modeling language (UML). They also used mathematical models for decision-making related modules (analysers and resolvers). At the end of the study the proposed methodology was illustrated with a numerical example.

Ryu et al. [12] modeled a basic collaborative fractal-based supply chain management fractal unit, which consists of five functional modules: Observer, analyzer, resolver, organizer, and reporter, by using unified modeling language (UML). Firstly, observer module can be stated as the input channel. These inputs are commonly status information, incomplete goals, negotiation replies, or restructuring request commands. This input can be any kind of request from customers via websites from the bottom-level fractal. To monitor the state of the unit is the first function of observer. It also receives messages from outer fractals. These messages depend on the the type and the level of a fractal. The other function of the observer is to transmit composite information to correspondent fractals. To perform profit analysis of the fractal with cost information and status is analyser unit's function. Analyser uses a numerical formula to calculate and analyse status of a fractal. After gathering the transaction records from the database, it checks the position within the target area periodically. The last function of the analyser is to integrate the information and to provide it for the resolver. Resolver fractal unit is known as the the most important unit. It is responsible for goal-formation and decision making processes. According to the current status information from the analyser, it uses numerical optimization or heuristic techniques. Different methods can be used by different fractals in this step. The other function of the resolver is to initiate negotiation, coordination and cooperation processes among fractals in case of necessity. Last but not least, to make future strategies, it gives insight for the fractal. The fourth module called "organizer" is responsible for dynamic restructuring processes. To realize this, it manages the fractal status (the number of processed jobs and currently processing jobs) and fractal addresses (e.g. department id, manufacturer id, etc.). Similar with resolver unit, organizer can also use numerical optimization techniques in reconfiguration. Otherwise, bottlenecks can be arise from the poor performance according to the unbalanced workloads between departments. Lastly, reporter which is known as output channel transports results from all processes between fractals. Reporter sends sub-goals, negotiation replies, and task requests messages [12].

An automobile is one of the most complex supply chains with nearly 20,000 components more than 80 companies for only a single model. It is obvious that there are complicated interactions and relationships between partners and the trustworthiness plays an important role. Oh et al. [8] studied automobile supply chain and they

modeled the relationships between the participants of a supply chain as a fractal. In this collaborative fractal-based supply chain management framework, each fractal has a goal model which is developed from an operational perspective. A fuzzy trust evaluation model was embedded in these goal models to evaluate the trust value of partners. Also a production plan is generated according to the goal model. Simulations were conducted to validate the developed framework. According to the results of these analysis, it was proved that precise production plans can be generated with the proposed framework.

In the same year Qu et al. [9] focused on the entropy in supply chain networks. They established an entropy model of fractal supply chain network organization structure. They also used fuzzy AHP in their model. The effectiveness entropy and entropies of information and structure are determines as the main sources of entropy. The results of this study showed that fractal structure played an important role in reducing entropy.

Two years later, Sun et al. [15] presented the concept of fractal integration of the knowledge in supply chains. They built modularization fractal knowledge integration network to realize this concept. This fractal integration process consists of acquisition, transition, application, innovation, and conversion stages. The effect of integration was quantified and evaluated. According to the result of the study, the significant reduction in entropy via fractal knowledge integration was stated.

Coordination of inventory policies is another important issue in supply chain inventory management. A fractal-based vendor-managed inventory (fVMI) model was proposed by Ryu et al. [11]. The traditional echelon concept change places with fractal- echelons. To minimize the inventory costs is the first aim of this model. The other aim of the model was smoothing material flows between supply chain members. Simulation analyses were again used to validate the approach.

Dai et al. [1] proposed a framework based on fractal thinking and multi-agent technology. They also implemented simulation with distributed multi-agent system (DMAS) for supply chain modelling. Supply chain is abstracted as five elements (manufacturing, demand, storage, transportation, and transportation planning) from the fractal perspective in this study. In the concept modelling of Dai et al. [1], there are five core elements called basic fractal elements: manufacturing, demand, storage, transportation and transportation planning elements. This concept modelling encloses the conciseness and inner regularity of supply chain systems.

Last but not least, Saad and Bahadori [13] proposed a new framework for top and bottom level information fractals. This framework was used to optimise the food distribution network sustainability. Greenfield analysis was also used to identify the optimal number and location for setting up the new facilities in this study. The roles of the fractals in different levels are different. The sustainability status of the distribution network is traced, observed and analysed with the fractal in the top level. The optimum configuration solution is also determined and shared with fractals in the bottom level. On the other hand, the roles of bottom level fractals are implementation of the reconfiguration orders, application of green vehicle routing optimization, and transmission of the sustainability performance information to the top-level fractal.

**Table 1** Exclusion criteria

Exclusion criteria	Number of articles
Unrelated fields	14
Inaccessible	1
Different language(Chinese)	1
Total excluded article number	16

## Materials and Methods

The purpose of this article is to answer the question: “How fractals contribute to supply chain management?” In this context, Web of Science database is used to find articles related with both “fractal” and “supply chain management”. 23 articles published up to 5<sup>th</sup> October 2020 are reviewed according to the exclusion criteria stated in Table 1. The articles written in unrelated fields and have unrelated summaries are excluded. Also, there was a Chinese article excluded. The seven articles, related with fractal supply chains are analyzed in detail.

Authors, publication years, journal names, keywords, are the data generated as bibliographic records from WoS database. Before the bibliometric and social network analysis, bibliometric records cleaned. Different spelling of the same author, big/small letters were corrected to make accurate analysis.

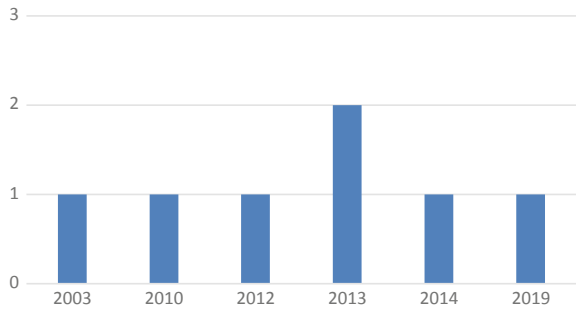
The methods used in this review are both bibliometric and social network analysis as up-to-date methods. They have been both used successfully in literature [2, 4, 6, 14]. It can be possible to see the number of articles according to their published years, journals, and cited times with bibliometric analysis. BibExcel software is used to make easy and accurate of this analysis. On the other hand, it is possible to draw the social networks of the authors with Pajek software. The clusters consists of the authors work together and the authors who wrote more articles can be detected visually by this analysis.

Social network analysis (SNA) is used [7] to detect and interpret patterns of social ties among that is involved in a social relation. Pajek (vlado.fmf.uni-lj.si/pub/networks/pajek/) and BibExcel (<http://homepage.univie.ac.at/juan.gorraiz/bibexcel/>) noncommercial software packages were employed to build networks. BibExcel is used both for bibliometric analysis and prepare input file for Pajek.

## Results

According to the bibliometric analysis results, as it can be from Fig. 1, two articles were published only in 2013. The other articles were published once in years 2003, 2010, 2012, 2014 and 2019. These results show not only scarcity, but also monotonic nature.

**Fig. 1** Article numbers according to years



**Table 2** Journal list of articles

Journal	Article number
Production Planning & Control	1
International Journal of Production Research	1
International Journal of Production Economics	1
Flexible Services Manufacturing Journal	1
International Journal of Food Engineering	1
Journal of Computers	2

The findings of the journal analysis show that (Table 2), seven articles were written till 2020 in high quality journals such as International Journal of Production Research, International Journal of Production Economics, Flexible Services and Manufacturing Journal, and International Journal of Food Engineering. There are two articles only in Journal of Computers.

In terms of authors, Ryu K and Jung M wrote at most three articles in this field (Table 3). Both of these authors are located in Korea. Oh S, Moon I and Qu X follow them with two articles. The other authors wrote only one article in this area.

Figure 2 shows the SNA result. The bigger circles means, the author wrote more articles like Jung M and Ryu K.

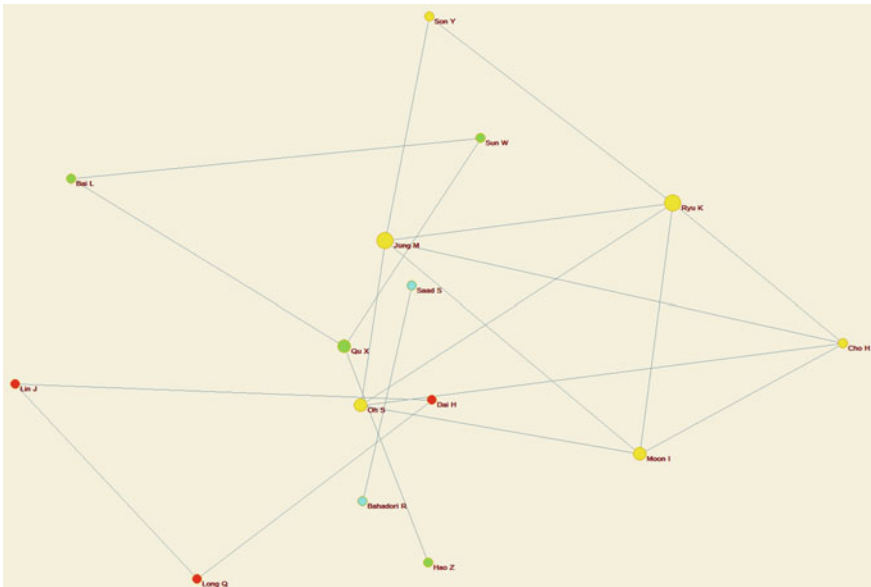
Figure 2 can be simplified using “Kamada Kawai Separate Components”. The results of this step can be seen in Fig. 3. There are four clusters in the social network.

The biggest component in network is shown in Fig. 4. This cluster consists of six authors: Ryu K, Moon I, Oh S, Jung M, Cho H and Son Y.

In terms of the subjects, the predominantly articles are related with fractal-based supply chain management and fractal frameworks for supply chain networks. In addition to these, there are some articles related with agent-based modelling and simulation. There is also an article in which a fractal echelon approach is proposed for inventory management one of the main issues in supply chain management.

**Table 3** Authors list of articles with numbers

Author	Article number
Ryu K	3
Jung M	3
Oh S	2
Moon I	2
Qu X	2
Saad S	1
Son Y	1
Sun W	1
Cho H	1
Bai L	1
Bahadori R	1
Dai H	1
Long Q	1
Lin J	1
Hao Z	1



**Fig. 2** Social network analysis result

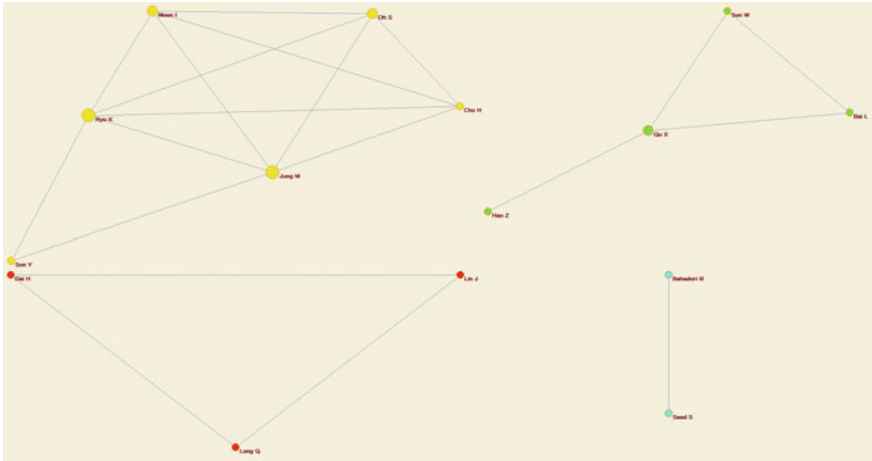


Fig. 3 Kamada Kawai separate components

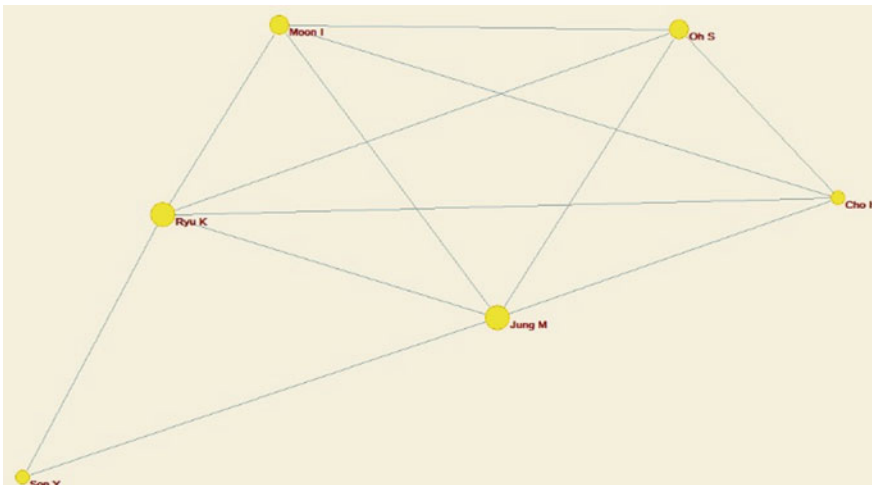


Fig. 4 The biggest component in network

### Conclusions

Due to the high complexity, fractal based approach was adopted to solve general problems in supply chain management. As a consequence, the research question of this study is “How fractals contribute to supply chain management?” Web of Science database is used to find both “fractal” and “supply chain” related articles to answer the research question. According to the results only seven articles were identified. Biblioemetric and social network analysis were employed. The findings

of these analysis show that, seven articles were written in high quality journals. There are four clusters in the social network and Ryu K and Jung M wrote at most three articles in this field. Both of these authors are located in Korea. In terms of the subjects, the predominantly articles are related with fractal-based supply chain management and fractal frameworks for supply chain networks. In addition to these, there are some articles related with agent-based modelling and simulation.

According to the scarce literature analysis, it can be concluded that fractal based supply chain management is an immature field. Only seven papers can be determined in Web of Science (WoS) database. Although fractal concept is combined with supply chain networks largely, there are other supply chain problems still waiting. There is a gap here to answer the question for which supply chain related problem fractal based models are useful or not. Due to the pandemic, one of the actual problem is identifying risk types and proposing risk mitigation strategies [3].

Some of the articles are written in a special (automotive and food) supply chain context not general. These researches can be extended to other special supply chains. This first attempt can be extended with 34 proceedings found in WoS as a future direction. This paper contributes to the fractal based supply chain management literature by being the first systematic literature review with bibliometric and social network analysis.

## References

1. Dai, H., Lin, J., & Long, Q. (2014). A fractal perspective-based methodological framework for supply chain modelling and distributed simulation with multi-agent system. *International Journal of Production Research*, 52(22), 6819–6840.
2. Deniz, N., & Özçelik, F. (2019). An extended review on disassembly line balancing with bibliometric & social network and future study realization analysis. *Journal of Cleaner Production*, 225, 697–715.
3. Fan, Y., & Stevenson, M. (2018). A review of supply chain risk management: definition, theory, and research agenda. *International Journal of Physical Distribution & Logistics Management*, 48(3), 205–230.
4. Fahimnia, B., Sarkis, J., & Davarzani, H. (2015). Green supply chain management: a review and bibliometric analysis. *International Journal of Production Economics*, 162, 101–114.
5. Huang, Y., Han, W., & Macbeth, D. K. (2020). The complexity of collaboration in supply chain networks. *Supply Chain Management: An International Journal*, 25(3), 393–410.
6. Madani, F. (2015). Technology Mining' bibliometrics analysis: applying network analysis and cluster analysis. *Scientometrics*, 105, 323–335.
7. Nooy, W., Mrvar, A., & Batagelj, V. (2011). *Exploratory social network analysis with Pajek* (2nd ed.). New York: Cambridge University Press.
8. Oh, S., Ryu, K., Moon, I., Cho, H., & Jung, M. (2010). Collaborative fractal-based supply chain management based on a trust model for the automotive industry. *Flexible Service Manufacturing*, 22, 183–213.
9. Qu, X., & Hao, Z. (2010). The entropy model of fractal supply chain network system based on fuzzy AHP. *Journal of Computers*, 5(8), 1213–1218.
10. Piya, S., Shamsuzzoha, A., & Khadem, M. (2020). An approach for analysing supply chain complexity drivers through interpretive structural modelling. *International Journal of Logistics Research and Applications*, 23(4), 311–336.



11. Ryu, K., Moon, I., Oh, S., & Jung, M. (2013). A fractal echelon approach for inventory management in supply chain networks. *International Journal of Production Economics*, 143, 316–326.
12. Ryu, K., Son, Y. J., & Jung, M. (2003). Framework for fractal-based supply chain management of e-Biz companies. *Production Planning & Control*, 14(8), 720–733.
13. Saad, S. M., & Bahadori, R. (2019). Development of a dynamic information fractal framework to monitor and optimise sustainability in food distribution network. *International Journal of Food Engineering*, 20180061, 1–19.
14. Strozzi, F., Colicchia, C., Creazza, A., & Noe, C. (2017). Literature review on the ‘Smart Factory’ concept using bibliometric tools. *International Journal of Production Economics*, 1–20.
15. Sun, W., Bai, L., & Qu, X. (2012). Entropy evaluation model of fractal integration of the knowledge of supply chain. *Journal of Computers*, 7(4), 819–826.
16. Zhou, J., & Chen, X. (2020). The impact of service and channel integration on the stability and complexity of the supply chain. *Complexity*, 8178947, 1–27.

# Chaos and Complexity of Understanding Online Shopping Behaviour from Marketing Perspective



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**Abstract** Online shopping is an emerging area of corporate dialogue in terms of survival and getting more market coverage. The methods of purchasing product is changing from traditional methods to online purchase facilitating shopping anytime with all benefits under one roof. Technological inventions all over the world have changed the perception of consumer behavior. Consumers are playing a significant function in online shopping. With the increase of digital engagement, the complexity of taking purchase decision and chaotic behaviour are also portrayed by the consumer. The present study empirically assesses the chaotic factors which sketches out the unpredictable consumer purchase behaviour through various shopping platforms. The study is based on Cross cultural survey and Primary data. Stratified sampling method is used to collect the sample. The respondent numbers to 120 for the analysis. The data collected is analyzed by the statistical tools SPSS21 using the KMO and Barnett's Test, to identify the major factors which are effective among the other factors that are influenced by the complexity; of the online shopping behaviour. This study identifies the different pattern of online purchase, chaotic behaviour, online Purchase frequency complexities, age wise purchase pattern of the online shopping behaviour in market perspective. KMO and Barnett's Test indicates four major influenced factors that are affected by the chaotic and complex behaviour i.e. Technical factor, Online customer service factor, convenience factor and Trust worthy factor. The study showed that each of these factors are differently affected among which the trustworthy factor and technical factor have showed a dynamic behaviour as the people who are tech savvy tend to get vibrant online shopping behavior. Practical implication: This study yields a very important implication of the chaotic behavioral implication on the factors of online shopping behaviour as today's market has shifted to digital platforms. It helps to understand the various aspects that create a chaos culture in the shopping behaviour and helps marketers develop a counter chaos marketing

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strategy to mitigate this factor and transforms this chaotic factor into new market opportunities.

**Keywords** Chaos in online shopping · Chaotic consumer behaviour · Online shopping issues and prospects · Online shopping behavior

## Introduction

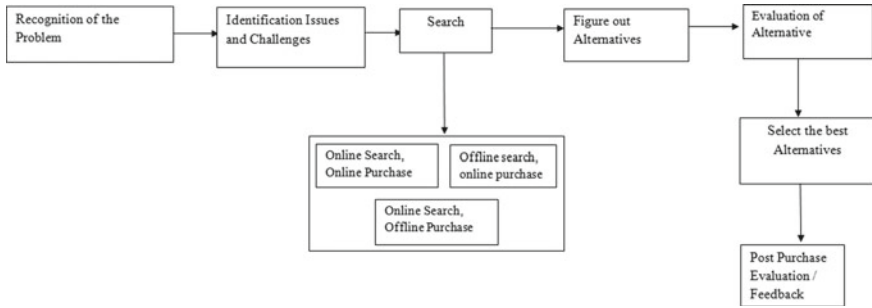
Online shopping behavior refers to the process of purchasing intention of products or services via the Internet or web. Due to the wide range of internet usage, the buying behavior patterns have been changed. Online shopping has changed the way goods are purchased and sold, resulting to the exponential growth in the number of online consumers. Approach toward online shopping and goal to purchase through web are not only affected by ease of use, usefulness, and enjoyment, but also by other factors like consumer individuality, situational factors, product pattern, previous online shopping experience, trustworthiness in online shopping.

Advanced computer literacy makes online shopping smarter. Consumer awareness about the internet also makes them to create interest which influence to take decision for purchase of products and services. By the internet, consumers find that they no longer have to accept fixed prices for the products and services and through the click of a few buttons the lowest priced, highest quality product can be found.

## Theoretical Framework: Chaotic Behaviour of Online Shopping Behaviour

The word “chaos” is used to imply the deviation from the Standards that a consumer usually follows in decision making or in the repetitive situation like whether to buy or not to buy a particular product, to travel or not to travel in certain situation etc. In generic terms it refers to the complexity in the operation and decision-Making System. This highlights that human behaviour have *order, stability, irregularity and disorder*.

In the digital era, information is shared at a rapid speed with the help of various medium of communication network, the purchasing behaviour have gone a drastic change with the rhythms of the marketing perspectives. With reference to McLuhan, human emotions and perception have cause the mutation of the new technologies and evolved new customers. With change being invertible part of humans, the technology, human perception, society, market changes every second of life. With these changes the shopping behaviour of the consumer has taken a drastic change from traditional platform to online shopping platforms.



**Fig. 1** Basic customer decision making process

Alike, the consumer also displays such chaotic behaviour while online purchase. We know the basic consumer purchase decision making includes the following stages (Fig. 1).

The generic model of chaotic consumer purchase decision starts with the identification of necessity, which drives the consumer to reach out for information about the products leading to the second step, After the information are gathered about the various products, consumer tends to evaluate the best alternative creating the third stage, with selection the product as per the requirement of the consumer, they finalize a product in the fourth stage and the fifth stage commence when the consumer uses (consumes) the product or service that is bought. This Cycle repeats each time a customer’s urge to satisfy this need arises. These stages are influenced by many internal and external factors or stimulus influencing the decision.

With the increase of technological involvement in the consumer purchasing process, these influencing chaotic factors have become more unpredictable in nature and the consumer of the present era displays a more chaotic purchase behaviour.

According to Shim, Shin & Nottingham [25]. The Internet/World Wide Web (Web) is a critical medium for the sharing of business information between retail firms and their customers (business-to-customer or B2C).

The chaotic behaviour of the consumer are generally showed under several factor, most important among them are the convenience factor, technical factor, online customer service factor and trustworthy factor. Each of this factor that influence the consumer online shopping behaviour are influenced by chaos and complexity increasing in the cause and effect relation of the marketing, where once need to adopt mass customization of the products. Boughton [6] observed two main objectives of online advertising campaigns as brand development and direct response. People tend to associate Internet marketing with direct marketing because companies participating in online marketing usually shortened the supply chain Edwards et al. [10]. According to Jarvenpaa and Tractinsky [11] consequently, the role of trust casts some doubts on Internet consumer merchandising. Consumers are unlikely to patronize Internet stores that fail to create a sense of trust. Trust can only exist if the consumer believes that the seller has both the ability and the motivation to deliver goods and services of the quality expected by the consumer.

## **Complexity on Convenience Factor**

The convenience factor specifies the ease of purchasing, at the ease of our home environment but it is also known that when consumer is given too many of a good option it tends to create a confusion while making a purchase which may result in tension in the consumer resulting in delayed purchase or impulse and confused purchase deviating them from the actual sessility. with the help of digital platform, one is provided the ease of shopping from anywhere but it is also influenced the factor like the income of the customer, cost of the product; often many people tend to purchase various products in physical stores as they are in often presented the option of bargaining which is not available in digital platform. One of the major chaotic and complex factors that create complexity is the time, not all have the time to surf the internet to go through the products and also the delivery time taken by the organizations, which often make the customer confused while online shopping, often show a tend to buy show chaos in purchase behaviour.

## **Technical Chaos**

In the context of the technical factor, which is the base of online shopping often face various chaos and complexity. With rapid changing technology the consumer often is tend to lag behind and fails to cope with the digital shopping platforms. Even though the technology has become the part and parcel of life not all have the access to that, the consumers who belong to the generation x often prefers to follow traditional purchase. Many consumers are reluctant to make online purchase being concern about the safety about their personal information and monetary safety. With the help of technology now one can communicate infraction of section, this also increase the chaos in shopping behaviour as one often is influenced by the peer review, comments and information available about various products which influence consumer either to buy or not to buy the product.

One of the major factors upon which the reliability of the consumer upon a brand or products presides is the online customer service factor. Various Services that a customer avails tends to build the loyalty factor toward s that platform while online shopping, as we know that a sale doesn't end with the transfer of possession, an effective marketer should take care of the customer through the post-sale service. One of the important chaotic behavioral patterns often showed cased by the customer is the shifting from one brand or platform to seize the offers, low price, seasonal demand. Not all the platforms are able to provide with services that are customized to a particular customer demand which often tend them hinder their purchase online. This factor is also influenced positive factors which increase the customer shopping rate online.

## Complexity in Trust Factor

Trustworthiness factor is the most fragile factor that tends to get distorted with slightest chaos leading to behavioral change in online shopping. It basically deals with safety and security of consumer's personal information. With the technological advancement this information often tends to become vulnerable in the Web. The case of online line bank account fraud with fake calls for personal information's demines the trustworthiness hindering the buying behaviour. Often the consumer personal information tends to go in wrong hands through the shopping sites like the card number, personal information, bank details etc. some other factors like often customers don't get product delivered as the quality mentioned in the shopping sites all this factor hinder the online shopping behaviour of consumer.

The chaotic nature is more in the products which are not regular in nature and often tends to be moderate in case of day to day products. i.e. the consumer online buying behaviour more organized in case of daily or pattern purchase and tends to greatly complex in case of luxury products in online platform.

## Objectives of the Study

1. To identify the present status of online shopping in Chaotic and complexity perspective
2. To identify the chaotic pattern of consumer purchasing behavior
3. To study the parameters that are influencing factors of online shopping.

## Research Methodology

Data for the study undertaken has been collected from the primary source, which is again collected through pre-structured questionnaire. The questionnaires include information on their name, sex, age, country and occupation. Through convenience sampling method 120 respondents has been considered for this present study. Primary data were collected using a predetermined personally administered questionnaire. The questionnaire was designed to capture sample characteristics and the objectives. It has a mix of quantitative and qualitative feedbacks. For quantitative analysis, a five-point Likert scale from 1 to 5 was used, where 1 was for the lowest satisfaction level and 5 was for the highest satisfaction level. Collected data has been analyzed by SPSS 21 using KMO and Bartlett's Test to identify effective factors of online shopping. On the basis of factor analysis, researchers identified 3 Dimensions of service quality.

**Table 1** Reliability statistics

Kaiser-Meyer-Olkin measure of sampling adequacy		0.800
Bartlett's test of Sphericity	Approx. Chi-Square	1063.306
	df	136
	Sig.	0.000

## Online Shopping in India

In recent times with the advent of Industry 4.0, INDIA has experienced an immense growth in online shopping sectors. Indian Chamber of commerce has numbered the growth of online retail industrial growth to 7000 crores in 2018 from 2000 crores in 2015 at an annual growth rate of 35%.

India have more than 100 million Internet users, out of which around half opt for online purchases and the number is growing every year. With such a large market size, companies, right from retail shops to consumer goods, are entering the Web space to attract potential customers. Even traditional retailers like Shoppers Stop, Westside and Pantaloons are looking at the online shopping space for growth as the Indian population is now keener towards online shopping platforms.

## Data Analysis

### *Factor Analysis*

#### **KMO and Bartlett's Test**

To test the internal consistency and reliability, researchers applied Cronbach Alfa. Here, Cronbach Alfa is 0.975 (See Table 1). This value is above the recommended 0.70. Therefore, the items on the measurement scale are considered to possess high-internal consistency and reliability. Exploratory Factor Analysis followed by Principal Component Analysis and Varimax with Kaiser Normalization processes were performed to reduce data and to observe whether the different items were properly loaded under several components or not. Close observation did take place on Rotated Component Matrix where factor loading has taken place in order to take a decision about whether regrouping of several items was possible or not. The eigenvalues, the percentage of variance, cumulative percentages, Cronbach's test, Kaiser-Meyer-Olkin (KMO) measure for sampling adequacy and Bartlett's test of sphericity were also conducted for the purpose of this study. According to Kaiser and Cerny [13], the high shared variance and relatively low uniqueness in variance are indicated by the KMO measure for sampling adequacy (0.800). The Bartlett's Sphericity Test where

**Table 2** KMO and Bartlett’s Test

Cronbach’s Alpha	Cronbach’s Alpha based on standardized items	No of items
0.975	0.975	17

Chi-square value is 1063.306 ( $p < 0.0001$ ) established that distribution is ellipsoid and amenable to data reduction (See Table 2).

The Rotated Component Matrix shows that the values of all the 17 items are greater than 0.5 which strongly support the recommendation of Nunnally and Bernstein (1994) about the factor loading and cross-loading (See Table 4). So, Table 4 established that all the factors are properly loaded under three components (Tables 3 and 5).

**Table 3** Component Matrix<sup>a</sup>

	Component			
	1	2	3	4
VAR00001	0.570	0.235	-0.162	0.569
VAR00002	0.582	0.354	0.176	0.149
VAR00003	0.661	0.327	0.339	-0.131
VAR00004	0.268	0.618	0.164	0.353
VAR00005	0.162	0.512	-0.199	-0.121
VAR00006	0.233	0.655	0.573	0.127
VAR00007	0.337	0.588	-0.329	-0.006
VAR00008	0.410	0.577	0.338	-0.412
VAR00009	0.389	0.211	0.518	-0.086
VAR00010	0.422	0.461	0.665	0.236
VAR00011	0.166	0.243	50.165	-0.373
VAR00012	0.208	0.051	0.600	0.094
VAR00013	0.337	0.148	0.524	-0.197
VAR00014	0.473	0.099	0.638	0.420
VAR00015	0.360	-0.166	0.058	0.577
VAR00016	0.365	-0.409	0.021	0.523
VAR00017	0.498	0.038	-0.479	0.535

Extraction Method: Principal Component Analysis.

a. 4 components extracted



**Table 4** Total variance explained

Component	Initial Eigenvalues			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	6.639	39.052	39.052	6.639	39.052	39.052
2	1.758	10.342	49.395	1.758	10.342	49.395
3	1.387	8.157	57.551	1.387	8.157	57.551
4	1.213	7.136	64.688	1.213	7.136	64.688
5	0.959	5.640	70.327			
6	0.896	5.272	75.600			
7	0.759	4.467	80.066			
8	0.669	3.934	84.001			
9	0.556	3.271	87.271			
10	0.434	2.553	89.825			
11	0.377	2.216	92.041			
12	0.324	1.904	93.944			
13	0.277	1.627	95.572			
14	0.246	1.449	97.021			
15	0.199	1.170	98.191			
16	0.180	1.056	99.247			
17	0.128	0.753	100.000			

Extraction Method: Principal Component Analysis

## Discussions and Findings

Figure 2 depicts that type of product purchase through online. It has been found that clothing purchase is highest (12%) followed by books (9%), Consumer electronics (9%), Event ticket (9%), Medicine (5%) etc. In case of most frequent product online purchase data reveals that ticket booking (41%) is highest followed by Books/Journal purchase (24%), Electronic Goods (18%), Medicine (17%). (See Fig. 3). Figure 4 In case of online shopping using websites Fig. 3 depicts that Flipkart is highest (19%) followed by Myntra (18%), Amazon (14%), Jabong (11%), Snapdeal (10%), homeshop18 (9%), ebay stands at (8%), where yebhi.com stands lowest at (4%). According to Fig. 5 age wise online shopping involvement it has been found that youngsters are more involved in online shopping (47%) rather than elders(40%).

The results of the study revealed that amongst the four factors extracted, to first factor comprises of nine items which are related to the website. Hence, it is named as **Convenience Factor** of internet shopping. It was analyzed that the consumers were satisfied from these services in terms of smooth functioning of the website, site's speed, quick confirmation of the payments, instant replies, round the year online support, etc.

**Table 5** Particulars

Sl. No	Particulars	Factors
1	I get on-time delivery by shopping on-line	Convenience Factor
2	Detail information is available while shopping online	
3	I can buy the products anytime 24 h a day while shopping online	
4	It is easy to choose and make comparison with other products while shopping online	
5	The website design helps me in searching the products easily	Technical Factor
6	While shopping online, I prefer to purchase from a website that provides safety and ease of navigation and order	
7	The website layout helps me in searching and selecting the right product while shopping online	
8	Functioning of 24X7X365 basis service, Online assistance	
9	Continuous improvement on online systems	Online Shopping services Factor
10	I believe that familiarity with the website before making actual purchase reduce the risk of shopping online	
11	Clear information, Degree of customer’s belief that the organization’s site is safe	
12	Online shopping takes less time to purchase	
13	Online shopping doesn’t waste time	
14	I feel that it takes less time in evaluating and selecting a product while shopping online	
15	I feel safe and secure while shopping online	
16	Online Shopping protects my security	
17	I like to shop online from a trustworthy website	

The study also showed that the ease of shopping from home plays a major role as the age group mostly belong from the young group their choices turns to be influenced by their peers, reviews acting as a complexity factor as the buyer of Apparel are mostly female, their choices often tends to be influenced on the disposable income and the large availability of choice were they often tend to end up not buying portraying a chaotic behaviour. Many respondent said that they face complexity in the time dimension of the delivery system and often the need tends to cease until the product arrive and they end up buying it offline showing a chaotic nature. The middle-aged respondent pointed out the fact that they often prefer the retail store as they don’t get the option of bargaining in the online platforms which is also a complexity that is

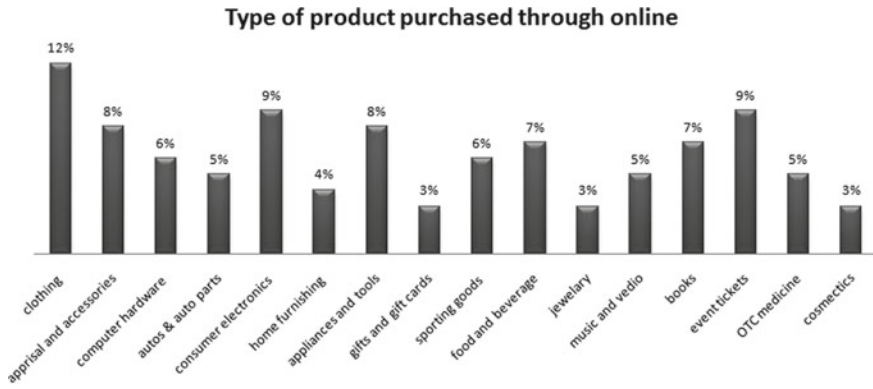


Fig. 2 Type of product purchased through online

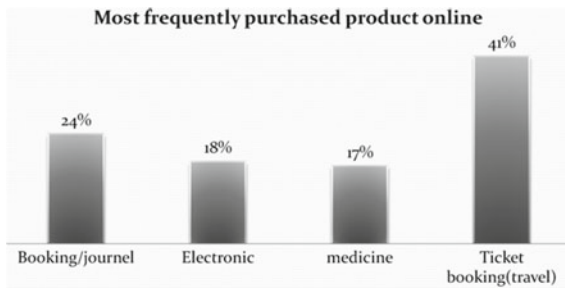
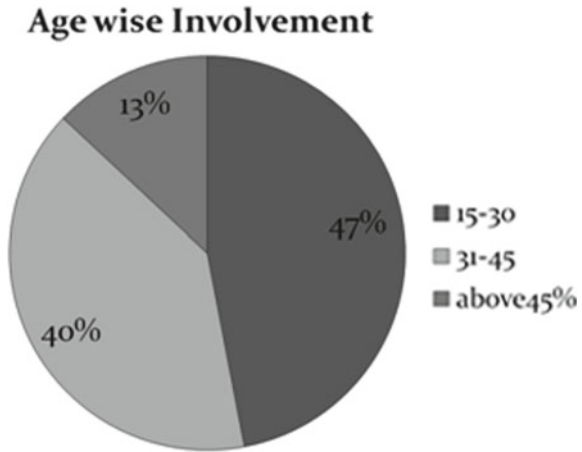


Fig. 3 Most frequent product purchased online



Fig. 4 Online shopping using sites

**Fig. 5** Age wise involvement in online shopping



being pointed out. Chaotic behaviour is often created by the fact that on internet it's difficult to form an impression as the product that are pertinent or not.

The second Factor that included the five major items related to safety and privacy element of the online buying platform, referring to the Technical Factor. the analysis showed that most the people often tend to face a safety issue while purchasing the e tickets online where they face that the same seat is often offered to two person or the names of tend to mismatch, were the site often tend to lose their credibility creating a chaotic behaviour on the consumer side with the rapid changing of technology, and less digital literacy, they often tend to go on back foot from purchasing online via their credit and debit card and often end up taking the option of cash on delivery. One more factor that adversely affect the buying behaviour of the generation Z as they tend to be very freckle minded and their decision are often influenced by their peers, reviews etc., which create chaos and they often end up either buying or not buying the products. They low cyber security in many social media shopping platforms makes it chaotic to complete a purchase with constant fear of being robbed from their personal information.

The study indicates the organization in the today's world need to pay personalized attention to its customers, as the current trend is now moving towards the customization and co creation shift with regards to product and service. This often tends to create complexity as the consumer often tend to portray dis- loyalty to the site when not provided the same and also are bogged up with wide variety of chooses in sites.

The customer now a days are not just concern about the purchase, but also the after-sale services that they are provided which they tend to lack in online shopping platforms. The study points out that an empathetic Attitude is that make the real difference. the respondent pointed out the factors that if the sites are too complicated they often tend to move to other site or shopping platforms when they have a sense of uncertainty towards the after-sale services provided by the platforms. Specially, during the purchase of electronic they have this ambiguity as in the online platform they tend to miss the touch and buy factors and also the reliability factor which shows

a chaotic and complex behaviour in the consumer. This factor also has a positive side, the platforms that cater to the need of the customers tend to get a huge traffic on their platforms. The complexity in returning the online purchase product also affects the buying behaviour of the consumer.

Often the sites tend to promise many services free of charge but end up having hidden costs which hinder the repeat purchase and thus lose customer credibility which is the major cause of complex behaviour that affects the online purchase which points towards an important factor i.e. trustworthy factor. It basically states about the customer's online safety and security (i.e. their personal information) are well protected or not. This factor is the most fragile that can create chaotic behaviour in online shopping of a person. The fake calls that consumers often get asking their bank details often diminishes the trustworthiness of the customers. We know that with the advancement of technology information on the web is the most misused which is the major factor creating complexity in the buying behaviour affecting their online purchase. The study also pointed out this factor in a very rigid manner where the respondent pointed to the lack of awareness of this fact. The trustworthy factor also deals with the customer loyalty towards a particular site i.e. the how frequently and number of times a person makes a purchase from a particular site. The complexity that consumers face on this fact is that with the large number of similar online shopping platforms there is a competition among them and the consumer often tends to shift from one platform to another where they are getting the most suitable pricing factors, discounts, purchase coupons etc. The younger generation have showed a frequent shift among across the site than the elder generation and portrayed a lack of loyalty behaviour. According to Ray [21] the relation between Service quality and client satisfaction are very important in business especially in service industry.

The second factor included five items that were related to safety and privacy elements of the service. Hence, the second factor was renamed as **Technical Factor**. The study indicates that in organizations need to pay personalized attention to its customers. Problem solving attitude should also prevail in online shopping, as this factor has an impact on assured service dimension. Again, should support service recovery process if any service failure occurs on the part of the organization itself. Empathetic attitude will bring the real difference. Customer satisfaction and trustworthy relationship, according to the study, suggests high customer satisfaction in online shopping and higher loyalty of the customers. The third factor extracted from the factor analysis comprises of six items related to overall strategy. Hence the factor is renamed as '**Online Customer Service Factor**'. **Trustworthy Factor** is the most crucial factor any online shopping site. This factor states about the customer's online safety and security i.e. (their personal information is well protected) when used in online shopping portals. It also portrays the customer loyalty i.e. how frequently and number of times a person buys from a particular site.

## Concluding Comments

The online shopping behaviour varies from person to person and the pattern of shopping behaviour have similarities and difference based on how the chaos and complexity affects the personal uniqueness. The perception of the consumers towards online shopping is restricted to the availability of correct connectivity and publicity. The Indian shoppers tend to display a brand savvy nature even when they are shopping online. various socio-economic factors affect their buying behaviour be it the technical factors or the trustworthiness factor. The above study revealed that four important factors viz. perceived risk, perceived enjoyment, Perceived Usefulness and Perceived User friendliness to be affecting the online buying behavior. It also reveals that the respondent tends to show a chaotic buying behaviour in case of daily essentials like the cosmetics, household items, clothing etc. they don't follow a similar ornamented routine, they tend to make use of the opportunities of continence pricing, which varies from product to product and brand to brand.

Customer satisfaction is a serious issue for the success of any organization. Service quality is the main indicator to measure the client satisfaction. The relation between expectations and perceptions are very important in business especially in service industry to identify the service quality [22].

Many studies on buying behaviour have stated that the consumer generally tends to show a structured pattern in case of luxury goods or high price product, but with the change in traditional shopping pattern, the study shows that, the buying behaviour of the consumer have drastically changed an have displayed a chaotic and complex buying behaviour defying the structured pattern of purchase. The mobile brands have seen a drastic increase in sales through the online platforms with discounts and penetration pricing strategy.

Only a low percentage of consumer have shown a structured pattern of online buying behaviour i.e. they buy from few particular brands. This shows us that customers fidelity to companies and brands are affected by the chaotic buying behaviour and is getting scares. The study shows that the generation Y and Z tends to have amore complex online buying behaviour than the gen x. it also portrays that the consumer show a positive online buying behaviour with the convenience and trustworthy factors.

Thus, the marketers should look for the factors that are influencing the positive aspects of the online shopping behaviour of the consumer and try an mitigate the negative aspect or come up with new strategies to convert this negative influencing factors false calling, data safeguard, complex technicality etc. into positive ones.

## References

1. Alreck, P., & Settle, R. B. (2002). Gender effects on Internet, catalogue and store shopping. *The Journal of Database Marketing*, 9(2), 150–162.

2. Bauer, H. H., Grether, M., & Leach, M. (2002). Building customer relations over the Internet. *Industrial Marketing Management*, 31(2), 155–163.
3. Bellman, S., Lohse, G. L., & Johnson, E. J. (1999). Predictors of online buying behavior. *Communications of the ACM*, 42(12), 32–38.
4. Bhatnagar, A., Misra, S., & Rao, H. R. (2000). On risk, convenience, and Internet shopping behavior. *Communications of the ACM*, 43(11), 98–105.
5. Bobbitt, L. M., & Dabholkar, P. A. (2001). Integrating attitudinal theories to understand and predict use of technology based self-service: the internet as an illustration. *International Journal of Service Industry Management*, 12(5), 423–450.
6. Boughton S. B. (2005). Search engine marketing. *Perspective in Business*, 2(1), 29–33; Brunner, C., & Bennett, D. (1997). Technology and gender: Differences in masculine and feminine views. *NAASP Bull.* 81(592), 46–52.
7. Changchit, C. (2006). Consumer perceptions of online shopping. *Issues in Information Systems*, 7(2), 177–181.
8. Chen, Q., Clifford, S. J., & Wells, W. (2000). Attitude toward the site: New information. *Journal of Advertising Research*, 42(2), 33–45.
9. Eastlick, M. A., & Feinberg, R. A. (1994). Gender differences in mail catalog patronage motives. *Journal of Direct Marketing*, 8(2), 37–44.
10. Edwards, N. S., Handcock, S., & Mullen, J. (1997). Electronic commerce: Reality bytes. *Supply Management*, 3(8), 32–34.
11. Jarvenpaa, S. L., & Tractinsky, N. (1999). Consumer trust in an Internet store: A cross-cultural validation. *Journal of Computer-Mediated Communication*, 5(2).
12. Jun, G., & Jaafar, N. I. (2011). A study on consumers Attitude towards Online Shopping in China. *International Journal of Business and Social Science*, 2(22), 122–123.
13. Kaiser, H. F., & Cerym, B. A. (1979). Factor analysis of the image correlation matrix. *Education and Psychological Measurement*, 39(4), 711–714.
14. Kim, D., & Benbasat, I. (2003). Trust-related arguments in internet stores: A framework for evaluations. *Journal of Electronic Commerce Research*, 4(2), 49–64.
15. Kotler, P. (2002). *Winning on the Web*. Richard Gay, Allen: Web Metrics paper.
16. Lamoureux, T. (1997). IS goes shopping on the web. *Computerworld*, 31(46), 106.
17. Nunnally, J. C., & Bernstein, I. H. (1994). The assessment of reliability. *Psychometric Theory*, 3, 248–292.
18. Peterson, R. A., Balasubramanian, S., & Bronnenberg, B. J. (1997). Exploring the implications of the Internet for consumer marketing. *Journal of the Academy of Marketing Science*, 25(4), 329–346.
19. Ray, N., & Ghosh, D. (2014). Internet Service Quality (I-SQ) dimensions and their impact on consumer satisfaction: Case from banking industry. *Asian Journal of Research in Banking and Finance*, 4(8), 212–221.
20. Ray, N., Sen, K., & Ghosh, T. N. (2016). Examination of internet banking customer perception of service quality: Evidence from banking industry. In N. Ray (Ed.), *Business infrastructure for sustainability in developing economies*. USA: IGI-Global.
21. Ray, N. (2016). Impact of internet service quality (IS-QUAL) on client satisfaction: Case from indian banking services. In U. Singh, R. Kumar, & N. Ray (Eds.), *Hand book of research on promotional strategies and consumer influence in the service sector* (pp. 371–388). USA: IGI-Global.
22. Ray, N. (2017). Expectation and perception of internet banking service quality of select indian private and public sector banks. *Online Banking Security Measures and Data Protection*, 58–68.
23. Rodgers, S., & Harris, M. A. (2003). Gender and e-commerce: An exploratory study. *Journal of Advertising Research*, 43(03), 322–329.
24. Shergill, G. S., & Chen, Z. (2005). Web based Shopping: Consumers' Attitudes towards online shopping in New Zealand. *Journal of Electronic Commerce Research*, 6(2), 80.
25. Shim, J. P., Shin., Yong, B., & Nottingham, L. (2002). Retailer web site influence on customer shopping: exploratory study on key factors of customer satisfaction. *Journal of the Association of Information Systems*, 31(3), 53–76.

26. Szymanski, D. M., & Hise, R. T. (2000). E—satisfaction: An initial examination. *Journal of Retailing*, 76(3), 309–322.
27. Teo, Thompson S. H. (2002). Attitude toward online shopping and the Internet. *Behavior and Information Technology*, 21(4), 259–271.
28. Vaitheeswaran, K., Teltzrow, M., Meyer, B., & Lenz, H.-J. (2007). Multi channel consumer perceptions. *Journal of Electronic Commerce Research*, 8(1), 19.



# Institutional Reputation of Private Schools



Nigar Nevra Karakaş and Elife Doğan Kılıç

**Abstract** In this study, how the reputation of private primary schools is evaluated within the framework of the views of administrators, teachers, and parents is examined. The data of the study were collected with the “Institutional Reputation Scale”. This scale consists of the sub-dimensions of *management and leadership, emotional attraction, employees and work environment, products and services, financial performance, social responsibility, and institutional ethics*. The research was carried out with eight administrators, 54 teachers, and 96 parents working in 5 private schools. As a result of the analysis, the order of how institutions reputation was perceived ranked from high to low as administrators, teachers, and parents, respectively. When the group differences were examined in terms of demographic variables, there was a significant difference among parents in terms of the educational status and age variable while there was a significant difference between the managers and the teachers in terms of the employment period. It was determined that demographic variables are not an essential factor in determining institutional reputation. When the data were analyzed in terms of total reputation levels, perceptions of administrators and teachers were higher than the perceptions of parents. In each dimension of the scale, the reputation levels of the administrators and teachers were higher than the level of the parents. While the dimension of “emotional attraction” had the highest reputation level, the dimensions of “employees and work environment” and the “financial performance” had the lowest reputation level by administrators and teachers, and the parents, respectively.

**Keywords** Private schools · Institutional reputation · Teacher · Parent · Administrators

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## Introduction

Due to circumstances that became widespread such as the disappearance of national borders with globalization, the dissemination and availability of information resources, the similarity of products and services, and the management of stakeholder perceptions in the 21st century, the most crucial feature that distinguishes and differentiates the institutions from their competitors is the reputation [24]. Reputation is an asset that evaluates all the works and movements of the institutions from the past, that reflects the internal identity of the institution and builds strategic value for the institution by giving implicit information about the institution [22]. Reputation enables institutions to demand high prices for their products and services, to lower purchase costs, to attract the best employees and investors, to increase the loyalty of customers and investors, and to reduce risk situations and gain competitive advantage [23].

Reputation is also of great importance for educational institutions. Educational institutions, which are social structures, are always in contact with their environment. Therefore, managing stakeholder perceptions towards these institutions is a necessity for establishing, developing, and protecting institutional reputation [33]. Another situation is the standardization and increasing number of chain schooling structures in education, which causes the originality to disappear, the quality to decrease, and the differences to diminish [20]. Private schools are profit-oriented institutions and have to provide a competitive advantage for their development and improvement. Reputation, which is an essential abstract value in providing a competitive advantage, enables institutions to differentiate and become unique [23]. To attract qualified students and employees to the institution, to be different from other institutions, and to be approved by the public opinion, private schools should put emphasis on earning reputation and managing their existing reputation.

## The Concepts Related to Reputation and Institutional Reputation

Turkish Language Association (TDK) defined the term, “reputation” by the words of dignity, respect, trustworthiness, and being precious and honorable (tdk.gov.tr). Institutional reputation is the total judgment of the institution that the stakeholders attribute to the organization over time based on the financial, social, and environmental impact [5]. Reference [26] defined institutional reputation as the general assessment of the institution developed over time as a result of the direct experience of the stakeholders, any communication and symbols that provide information about the institution’s actions, or the comparisons to the actions of other leading competitors. Reference [41] defined the institutional reputation as the institutional asset that is valuable, abstract, sustainable, and difficult to imitate. In another definition, institutional reputation is the collective idea of institution stakeholders towards the

institution [38]. Based on the above definitions, institutional reputation can be associated with many concepts. The concepts related to reputation are as follows: institutional identity, institutional image, institutional culture, institutional communication, institutional ethics, institutional social responsibility.

Institutional identity is the institution's self-expression with visual elements and behaviors to the internal and external stakeholders of the institution about who they are, what they do, and how they do [45]. The institutional identity that consists of the ideas about the institution itself is how the institution sees itself and how it is perceived by its internal stakeholders [35].

The image is related to how the institutions are perceived by ' external stakeholders, especially by their customers. For this reason, it is formed by the stakeholders of the institution [44]. The institutional image is the picture of the target audience in their mind about the institution, and the ones that come to mind when the name or logo of the institution is encountered [27]. The image can be easier and faster than creating a valuable reputation. A strong image can be established through image creation campaigns that include an official communication system such as name, logo, signature, advertisement, public relations. A positive reputation requires more effort than an effective communication effort and often requires a respectable identity shaped with a consistent performance that lasts for years [27].

The corporate image expresses the stakeholders' thoughts, impressions, and perceptions of the institution. Conditions such as the appearance of a school, the usefulness of its garden, the number of classes it has, the clothes and uniforms of the employees, and performing social responsibility activities by integrating with the city are the elements that create the image of the school [39]. The positive image that the educational institutions possess raises the institution to a more advantageous position than its competitors. The intangible outcomes of educational institutions cause them to be more affected by perceptions and subjective evaluations. Research shows that stakeholders' perceptions about school affect their behavior on choosing a school, recommending a school, helping the school [39].

The concepts of identity, image, and reputation can be summarized as follows: image is the views of external stakeholders, especially customers, about the institution. Identity is the opinions of internal stakeholders and employees about the organization. Reputation is the opinion of all stakeholders of the institution about the institution [15].

## **Management of Institutional Reputation and Its Components**

In institutions, reputation is managed for two purposes. The first one is to create the desired image in mind. This image is generally formed by the recognition of the business field, products, and name of the institution. The second aim is to create a positive reputation in the minds of relevant stakeholders for the organization [27].

It has been stated that nothing other than the reputation of the institution is more important for the institution. While a good reputation brings success to the institution, the reputation lost is more costly than losing economic value to the institution. In order for institutions to strengthen their reputation and make them permanent, it is necessary to determine who their stakeholders are and how they evaluate the institution, what their strengths and weaknesses are compared to their competitors—in short, to manage their reputation [32]. In addition, it has been stated that the greatest danger to the reputation of the institutions may be insufficient, biased, and incorrect information. It has also emphasized that reputation should be managed to prevent these situations. In the management process of reputation, institutions are expected to identify and prevent avoidable threats and to minimize the effects by controlling unavoidable threats [28].

Situations such as how the institutions are perceived by their stakeholders, what the factors that create and affect their reputation are, the determination of their strengths and weaknesses, and considering the position they stand in comparison with their competitors occur following the measurement of institutional reputation [29]. As a result of the review of the literature, the reputation of educational institutions was handled in seven dimensions, and the institutional reputation was measured based on these dimensions. The dimensions of institutional reputation are as follows: Management and Leadership, Emotional Attractiveness, Employees and Working Environment, Products and Services, Financial Performance, Social Responsibility, Institutional Ethics.

1. **Management and Leadership:** Management is defined as the science and art of effectively using the resources that institutions possess in order to reach their goals [21]. The role of management is to ensure that the institution lives according to these goals [7]. The manager, who performs the management duty in educational institutions, is defined as the person who is responsible for the productive and efficient functioning of the school [1]. The training manager should be effective in solving problems, managing the education program, preparing the environment that is suitable for students and employees, and managing the school budget well. Successful execution of the management process in school increases the success of the school and the principal [6]. Another fundamental concept in the field of management is leadership. The leader is the person who accomplishes the institutional goals by the power of influencing and directing extraordinarily using the existing rules [21]. In order to become leaders, school administrators should achieve the aims of the school, provide the necessary resources in achieving these aims, provide more opportunities for education and training, give importance to continuous development, meet the expectations of its stakeholders, create a positive atmosphere for all its stakeholders, establish two-way and effective communication with its stakeholders, support activities that ensure the development of the personnel, provide effective materials and new methods, develop an open vision suitable for school aims, solve problems creatively, and always interact with students and teachers [9].

2. **Emotional Attraction:** Reputation is an abstract value, and the most effective factor in gaining reputation is the emotions of stakeholders. The underlying reason for people's emotional bond can be explained by the basic formula "85/15". 85% of the decisions are made based on emotions, and 15% of them are made within the framework of the facts [25]. Institutions with strong emotional attraction are perceived as valuable by their stakeholders, and it is concluded that these institutions have a robust institutional reputation due to their culture and communication with the environment [8].
3. **Employees and Working Environment:** Reputation is the mutual product of management and employees working together in an institution [13]. The quality and talent of the employees are vital for organizations because the attitudes, actions, and words of the employees, who are accepted as the most crucial social stakeholder for institutions, have an impact on customers. For this reason, the integration of the employees with their institutions makes them an ambassador that introduces their institutions. This situation also strengthens the institutional culture and affects the institutional reputation positively [17]. In schools, it has to be done in an appropriate environment to reach the aim of teaching [6]. As a result of their work, [2] concluded that the physical conditions of educational institutions increase the quality of learning and affect the success of students. It is stated that the suitability of schools for education in terms of space that possesses plays an active role in the formation of the desired students and the increase of academic success.
4. **Products and Services:** The rule of having a good reputation is to meet the needs and satisfaction of the consumers as a result of the quality of the products and the service provided by the institution. The quality of products and services show institutions reputable [8]. The institutions are connected with their stakeholders through their products and services. Ensuring the continuity of this connection is thanks to the quality products and services of the institution. The quality of the product and service can make the institution attractive in the eyes of stakeholders and positively affect the corporate reputation [31].  
According to [23], quality means never regretting. Therefore, the institution must produce quality products in order to be reputable. Quality ensures that the customers recognize the institutions, they are satisfied, and products are professional. The quality of education, on the other hand, is determined by the students having the behavior and equipment appropriate to the expectations of the society. Behavior and equipment that ensure quality are obtained by schools incorporating a number of elements. The first is to have qualified teachers. The second is that schools should have sufficient physical structure and equipment. Other elements that constitute the quality of education are appropriate training programs and methods, ending wrong practices in education and training, life-long education, giving more value to education and training, providing education considering the needs, that is, providing education according to the number of people to be employed and areas, directing individuals to the choice of appropriate profession, providing students with the habit of using their time well,

providing the researcher and innovative spirit that enables individuals to progress continuously and providing the necessary financial support to schools [36].

5. **Financial Performance:** Institutions that are financially strong and that do not have sufficient resources have more reputation than their competitors [34]. This dimension shows that the institution is profitable, the possibility of future growth, and how it looks like as an investment tool. The fact that the institution's earnings are high and seen as a low-risk investment instrument strengthens corporate reputation [8]. The financial performance of institutions can be useful in determining their profitability, competitiveness, risk of losing/winning, situation, and value in the market. Institutions that are high in terms of financial performance can develop more critically than their competitors by following the developments closely and carrying these developments into their structure [43].
6. **Social Responsibility:** Social responsibility means that institutions are responsible for the society and the environment they live in, and they should avoid damaging them. With social responsibility activities, institutions become sensitive to the problems around them and establish positive ties with their stakeholders [40]. According to Darling-Hammond and Ascher [14], there are five types of responsibility in education. Below is the list of these types (as cited in [4]):
  - a. **Political responsibility:** It includes topics such as elections and the election of board members.
  - b. **Legal responsibility:** Schools may be sued in case of violation of laws such as discrimination between students and equal opportunities.
  - c. **Bureaucratic responsibility:** It includes setting the rules and making arrangements for the education to be carried out within the determined standards.
  - d. **Professional responsibility:** It is the situation where teachers, administrators, and other employees are supposed to have a certain standard and be the experts in their work.
  - e. **Market Responsibility:** It includes that parents can choose any schools that they think suitable for their students.
7. **Institutional Ethics:** The aim of teaching should not be to increase students' knowledge alone. Instead, it should aim for people to achieve perfection in academic, individual, and social responsibility areas with a humanistic and ethical purpose. In addition to finding the right answer in teaching, the aim should be for students to distinguish between good and bad situations, gain empathy behavior, be respectful and compassionate, create ethical and personal responsibility, and form a good personality by seeking the answer for the question "why" [37].

Ethics is not a moral list that shows how people should behave, but a system of values that explain dilemmas such as good-bad, and right-wrong in human behavior. Institutions that apply the truths and that have strong values increase their institutional

reputation by leaving positive impressions on their stakeholders [34]. Ethical practices and behaviors strengthen institutional reputation by increasing stakeholders' trust and respect for the organization [19]. It is concluded that the ethical environment in schools increases the assurance that teachers have in their students and students in their teachers [16].

Institutional reputation consists of the perceptions of stakeholders. The variety of expectations and diversity of stakeholders make it difficult to establish and maintain institutional reputation. A school with a good reputation is also highly respected by society, and this school is a preferred and praised institution. With this study, the views of stakeholders about the institutional reputation of private schools were revealed, and the importance of reputation over the institution was stated.

This study aims to reveal the current situation as a result of the evaluation of the institutional reputation of the private schools in Malatya by internal and external stakeholders.

## Method

This study utilized the descriptive method of research. In this study, no sampling method was performed. Since it is intended to reach the entire population, it is planned to collect data over the population. The target population of this research is the stakeholders of private primary schools providing education within the boundaries of Malatya province. In the 2016–2017 academic year, administrators (principals and deputy principals) and teachers that are the internal stakeholders and working in private elementary schools and parents who have children studying in fourth grade and who are the external stakeholders within the provincial borders of Malatya are the participants of the study. The scale form was distributed to 8 administrators, 54 teachers, and 96 parents working in 5 private schools in Malatya province. The scale form of a manager and a parent who did not fill out the scale form adequately was not evaluated and was excluded from the scope of the research. Seven administrators, 54 teachers, and 95 parents (156 individuals in total) participated in the study.

In the research, the “Institutional Reputation Scale” was used to determine stakeholder views towards educational institutions. The Institutional Reputation Scale consists of two parts: the demographic information part and the scale items. There are four questions regarding demographic information and seven dimensions that include 32 items in total. Each dimension consists of items ranging from 3 to 6. In the research, a 5-point Likert type scale was used. The scale is as follows; absolutely agree, agree, neutral, disagree, absolutely disagree.

Confirmatory factor analysis was conducted to provide evidence about the construct validity of the “Corporate Reputation Scale”, which consists of seven sub-dimensions. It was concluded that model-fit indices obtained from the LISREL 8.80 program for the confirmatory factor analysis showed that the research data fitted the model. The path diagram and standardized factor loadings for the “Institutional

Reputation Scale” were examined. When the t-values for these loadings were examined, it was determined that all of the factor loadings were significant. According to this result, it was concluded that the items on the scale predicted the latent factor. Path coefficients ranged between 0.39 and 0.94. Since these standardized values are over 0.30, the items measure the property that is desired to be measured. In addition, when the errors of the items are examined, it can be said that the errors are lower than 0,90, and therefore they are at an acceptable level. For the reliability, McDonald’s  $\omega$  coefficient was used because the factor loadings of the scale varied [46, 47]. It was observed that the reliability coefficients of McDonald’s  $\omega$  ranged between  $\omega = 0,75$  and  $\omega = 0,93$ . In line with these results, it can be said that the scores obtained from the scale items are reliable.

## Findings

When the values obtained from the responses given by the administrators, teachers, and parents to the *Institutional Reputation Scale* are examined, it is seen that the total minimum and maximum scores of the institutional reputation of the administrators range from 141 to 157, the total scores of the teachers range from 116 to 160, and the total scores of the parents range from 95 to 160. Besides, when the mean values for administrators, teachers, and parents in terms of institutional reputation level are examined, it is seen that the highest value belongs to the administrators (151,29). The second group with the highest value in terms of institutional reputation level is teachers (146.62), and the third group is parents (134.72). According to these values, it can be said that administrators have higher mean scores than teachers and parents in terms of institutional reputation levels (Table 1).

As a result of the results of analyses, it is concluded that institutional reputation scores of the teachers-administrators did not differ significantly in terms of the variables of gender, age, and marital status. There is a statistically significant difference in the institutional reputation of teachers- administrators in terms of the employment period. As a result of the multiple comparison test, there is a significant difference between the teachers-administrators with an employment period of 6 years or more and the teachers-administrators with an employment period less than one year, and

**Table 1** Descriptive statistics on the total level of institutional reputation of managers, teachers, and parents

	Administrators	Teachers	Parents
Number	7	54	95
Mean	151,29	146,62	134,72
Standard deviation	6,37	10,57	17,82
Minimum	141,00	116,00	95,00
Maximum	157,00	160,00	160,00



**Table 2** Kruskal Wallis test results for the employment period

Employment period	n	Mean Rank	Df	$\chi^2$	p*	Group comparison**
Less than one year	8	43,13	2	6,511	,039	C-A
1–5 year	30	32,33				
Six years and more	23	25,04				

\*p < 0.05

\*\*A (Less than one year), B (1–5 years), C (Six years and more)

**Table 3** Mann Whitney U test results for educational status

Educational status	n	Mean rank	Sum of ranks	U	p*
Graduate	28	61,34	1717,50	564,50	0.002
Non-university graduate	67	42,43	2842,50		

\*p < 0.05

this difference is in favor of the teachers-administrators working for less than one year (Table 2).

There is no statistically significant difference between the groups of parents formed according to demographic variables such as gender, marital status, and level of institutional reputation. The scores of the reputation of the institution differ significantly in terms of the educational status of the parents. It is possible to say that the reputation levels of the institutions vary in terms of parents’ graduation status. According to the mean ranks, it can be said that parents who are university graduates score lower than the institutional reputation scale (Table 3).

There is no statistically significant difference between groups that are created in terms of gender, marital status, and level of institutional reputation. The scores of the reputation of the institution differ significantly in terms of the educational status of the parents. It is possible to say that the reputation levels of the institutions differ in terms of whether the parents are university graduates or not. According to the mean ranks, it can be said that parents who are university graduates have lower scores from the institutional reputation scale (Table 3).

It has been determined that the scores obtained from the institutional reputation scale show a statistically significant difference between groups created according to the ages of the parents. As a result of the multiple comparison test, there is a significant difference in terms of institutional reputation scores between parents aged 32 and under and parents aged 33–42, and the scores are in favor of parents aged 32 and below. Similarly, there is a significant difference in terms of institutional reputation scores between parents aged 32 and below and parents aged 43 and above, and the scores are in favor of parents aged 32 and below (Table 4).

In each sub-dimension of institutional reputation, “management and leadership (ML), emotional attraction (EA), employees and working environment (EWE), products and services (PS), financial performance (FP), social responsibility (SR), and institutional ethics (IE) teachers and administrators have higher scores than parents.

**Table 4** Kruskal Wallis test results for Parent's age

Age	n	Mean rank	Df	$\chi^2$	p*	Group comparison**
32 years and below	14	76,18	2	17,928	0.000	A-B A-C
33–42 years	48	40,94				
43 years and above	33	46,32				

\* $p < 0.05$ 

\*\*A (32 years and below), B (33–42 years), C (43 years and above)

**Table 5** The Mean Scores Related to the Sub-Dimensions of Institutional Reputation Scale

	ML	EA	EWE	PS	FP	SR	IE
Teachers-administrators	4,59	4,83	4,37	4,69	4,47	4,66	4,64
Parents	4,29	4,35	4,07	4,24	4,00	4,24	4,24

It is seen that the perception of institutional reputation is higher among teachers and administrators (Table 5).

The mean scores of institutional reputation that was obtained from the institutional reputation for teachers-administrators and parents were examined. When the means of the sub-dimensions are analyzed, it is seen that the highest mean score is in the “emotional attraction” sub-dimension, while the lowest mean score is in the “employees and working environment” sub-dimension, for the teachers-administrators. It is also seen that the parents have the highest mean score in the “emotional attraction” sub-dimension and the lowest mean score in the sub-dimension of “financial performance” (Table 5).

## Conclusion and Discussion

Reputation, which is the most valuable abstract assets of institutions, consists of the views of stakeholders about the institution and is shaped within the framework of these views. Reputation has many benefits such as differentiating the institution from other institutions, providing a competitive advantage to institutions, providing customer loyalty, and increasing stakeholder satisfaction. These positive attributes of reputation result in the fact that it is a value that needs efforts to be earned by the institutions and increases the interest in reputation. Well-respected schools play a crucial role in recruiting quality students. A decrease in the reputation of a school causes it to lose qualified students, to have difficulties in the employment of its students after graduation, and to find it difficult to get funds in implementing new programs. The stated situations further decrease school ranking and reputation [12].

Perceptions of reputation differ in line with the opinions of the administrators, teachers, and parents. Especially when this difference is examined in terms of internal

and external stakeholders, it becomes more evident. Administrators and teachers, who are the internal stakeholders of the school, regard their institutions as more reputable. The reputation level of institutions perceived by administrators, teachers, and parents ranges from highest to lowest as administrators, teachers, and parents. The researches carried out by Altıntaş [3], Dulger (2017), [30], and [33] support this study. The result of high perceptions of administrators and employees towards institutional reputation in the research can be based on their high sense of belonging, spending more time in the institution, and unwillingness to express a negative opinion against the institution they are a member of. When the literature is examined, there are also research results that do not support the findings of this study. In the study of [10], external stakeholders found Anadolu University more reputable than internal stakeholders. The reason for the contrasting result may be because the educational institution where the scale is applied is a university, and the number of participants is high.

According to the demographic characteristics of the administrators, teachers, and parents, some variables differed significantly. In the analysis of the scores obtained from the institutional reputation scale, there was no significant difference between teachers and administrators in terms of gender, marital status, and age while there was a significant difference in terms of employment period in the institution. Teachers and administrators who have less than a year of employment in the institution find their institutions more reputable.

When the opinions of parents on reputation were examined according to demographic variables, there was no significant difference between groups created according to gender and marital status variables, whereas there was a significant difference in educational status and age variables. The reputation of the institutions was perceived to be lower by non-university graduates. From this point of view, it can be thought that increasing the education level of parents also increases their critical thinking tendencies. For the age variable, parents aged 32 years and below think that their institutions have a high reputation compared to parents in other age groups. In some studies, it was concluded that the groups of gender did not differ significantly [31, 33, 42].

In this study, there is a negative relationship between the employment period in the institution and reputation perceptions of administrators and teachers. In other words, according to the results of the research, it can be said that the increase in the employment period of the administrators and teachers in the institution causes a decrease in the perception of the reputation towards the institution. When the reputation levels of parents in terms of educational status are examined, the study of [10] supports the result that university graduates perceive the institution's reputation lower than the others. It was concluded that individuals who received an undergraduate education approached the institution more critically. In general, it has also been found in different studies that the reputation perceptions of the groups created in terms of demographic variables differ. It is concluded that gender and age variables are not important in perceiving corporate reputation, there is a negative relationship between the educational status and reputation perception, and the relationship between the

employment period in the institution and reputation perception varies in different research.

There is a significant difference between the total reputation levels of administrators, teachers, and parents. Administrators and teachers perceive the institutions they work for as more reputable than parents. When the sub-dimensions with the highest and lowest level of institutional reputation are examined, administrators and teachers perceive the “emotional attraction” dimension of the institution higher than the other dimensions while they have the lowest scores in the “employees and working environment” dimension. Parents, on the other hand, perceive the “emotional attraction” dimension as the highest, while they see the “financial performance” dimension as the lowest.

Based on the findings obtained, the high level of “emotional attraction” makes the institutions think that they create positive impressions on their stakeholders and gain their appreciation and trust. It can be said that, in order for the institutions to be perceived better by their internal and external stakeholders, they must meet the expectations of their employees, improve their education and training environments, meet their physical deficiencies or expectations. It can be commented that meeting the expectations of the participants regarding the working environment will positively affect the opinions about the institution and increase the reputation of the institution.

## Suggestions

The criteria that determine the academic understanding of quality are specified as follows: school reputation studies and rankings, awards won, student achievements, attracting successful students, academic resources of the school, library resources. The ranking of the schools helps students determine which school they will enroll in and provides information about school management and educational policies [11]. In order for the schools to have the desired quality and reputation level, the studies towards the dimensions of the reputation will increase their perceived reputation.

It can be said that school management should give priority to parents and teachers because they have low perceptions of institutional reputation compared to administrators. Reputation is a product of management, leadership, and collaboration of employees in the institution, not a result of orders and commands [13]. From this point of view, it can be said that managers should act with all their stakeholders, especially with their employees, and be an effective leader in doing so to increase their institutional reputation. Based on the findings, it can be said that administrators should meet the needs of teachers, create suitable environments for education and training, be fair and sensitive to teachers. It can be thought that increasing teachers’ satisfaction will ensure better education and training activities, so that parents’ satisfaction will also be increased.

As there is a negative relationship between the educational status of the parents and the institutional reputation, administrators can determine what the expectations of the parents with high education levels are. It is thought that the perceptions of

these parents towards school reputation may change if the determined expectations are met.

In all dimensions of institutional reputation, perceptions of managers and teachers were higher than the perceptions of parents. Starting from this point of view, the school administration should get into the act to change the perceptions of the parents in all dimensions or to strengthen weak perceptions of them. In addition, the criteria that parents, students, and teachers determine while establishing their school reputation can be examined. Similar and different criteria can be determined, and school arrangements can be made on these criteria.

Competitive achievements of competitors in the Olympics consist of their unique combination of different styles and techniques [23]. In order for private schools where service is bought to be ahead of their other competitors, they should have unique teamwork, products, services, etc. School administrators' efforts to ensure the uniqueness of the school and the recognition of schools with this uniqueness in public suggest that it will increase their reputation. Because, as Fombrun mentioned, uniqueness plays a crucial role in creating competitive advantage and building a reputation among institutions (1996).

When the low scores in the dimensions of "employees and work environment" and "financial performance," are considered, it can be said that schools should improve their climate, physical structure, working and education conditions. It has been stated that maintaining to be an actively good workplace, producing strong financial outcomes, selling good products, acting as good citizens enable institutions to build a strong reputation [23].

## Suggestions for Researchers

1. The dimensions of school reputation can be explored and structured in more detail.
2. With the qualitative research method, the principles accepted while defining a school's reputation or defining schools as good schools can be determined.
3. By expanding the research, institutional reputation levels of private primary schools in Turkey can be determined. After the study, the ranking of these schools can be announced to the public.
4. The effect of regional or economic level differences on the reputation of the institutions can be investigated.
5. N-gram technique can be used in the ranking of schools in Turkey.
6. To ensure the participation of schools to be investigated, school administrators and MEB (Ministry of National Education) officials should get into contact with each other to support similar research.
7. Research on determining institutional reputation can be carried out at all levels of public and private institutions (primary schools, high schools, vocational high schools, etc.). The opinions of the parents can be obtained at all levels of education in research that aims at determining institutional reputation.

8. The opinions of inspectors, public, media, other school administrators, and teachers, who constitute different stakeholders of educational institutions, can also be included in reputation studies.

## References

1. Ada, S., & Akan, D. (2007). Değişim sürecinde etkili okullar [Effective schools in the change progress]. *Kazım Karabekir Eğitim Fakültesi Dergisi*, 16, 343–373.
2. Al Sensoy, S., & Sagoz, A. (2015). Öğrenci başarısının sınıfların fiziksel koşulları ile ilişkisi [Relation between pupils academic achievement and physical conditions of classrooms]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, 16(3), 87–104.
3. Altıntaş, E. (2005). *Kurumsal itibar ve Anadolu Üniversitesi İ.B.F. örneği* [Corporate reputation and the case of Anadolu University]. [Master's thesis, Anadolu Üniversitesi]. <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSonucYeni.jsp>.
4. Bakioglu, A., & Baltacı, R. (2017). *Akreditasyon eğitimde kalite* [Accreditation quality in education]. Nobel Akademik Yayıncılık.
5. Barnett, M., Jermier, J., & Lafferty, B. (2005). Corporate reputation: The definitional landscape. *Corporate Reputation Review*, 9(1), 26–38. <https://doi.org/10.1057/palgrave.crr.1550012>.
6. Basaran, İ., & Cinkir, S. (2013). *Türk eğitim sistemi ve okul yönetimi* [Turkish education system and school management]. Siyasal Kitapevi.
7. Bursalioğlu, Z. (2015). *Okul yönetiminde yeni yapı ve davranış* [New structure and behavior in school management]. Pegem Akademi.
8. Cekmecelioglu, H. G., & Dincel, G. (2013). Çalışanların iş tutum ve davranışlarının kurumsal itibar üzerindeki etkisi [The effects of job attitude and behavior of employees on corporate reputation]. *Elektronik Sosyal Bilimler Dergisi*, 12(47), 125–139.
9. Celik, V. (2015). *Eğitimsel Liderlik* [Educational Leadership]. Pegem Akademi.
10. Cillioğlu, A. (2010). *İç ve dış paydaşların değerlendirmelerine göre Anadolu Üniversitesi'nin Kurumsal İtibarı* [Anadolu University's corporate reputation according to the views of internal and external stakeholders]. [Master's thesis, Anadolu Üniversitesi]. <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSonucYeni.jsp>.
11. Clarke, M. (2002). Some guidelines for academic quality rankings. *Higher Education in Europe*, 27(4), 443–459. <https://doi.org/10.1080/0379772022000071922>.
12. Corley, K., & Gioia, D. (2000). The rankings game: Managing business school reputation. *Corporate Reputation Review*, 3(4), 319–333. <https://doi.org/10.1057/palgrave.crr.1540123>.
13. Cravens, K., & Oliver, E. G. (2006). Employees: The key link to corporate reputation management. *Business Horizons*, 49(4), 293–302. <https://doi.org/10.1016/j.bushor.2005.10.006>.
14. Darling-Hammond, L., & Ascher, C. (1991). Creating accountability in big city school systems. *Urban Diversity Series No. 102*. <https://files.eric.ed.gov/fulltext/ED334339.pdf>.
15. Davies, G., Chun, R., da Silva, R., & Roper, S. (2001). The Personification metaphor as a measurement approach for corporate reputation. *Corporate Reputation Review*, 4(2), 113–127. <https://doi.org/10.1057/palgrave.crr.1540137>.
16. Demir, S., & Karakus, M. (2015). Etik iklim ile öğretmen ve öğrencilerin güven ve motivasyon düzeyleri arasındaki ilişki [The relationship between ethical climate and trust and motivation levels of teachers and students]. *Kuram ve Uygulamada Eğitim Yönetimi*, 21(2), 183–212.
17. Dortok, A. (2004). *Kurumsal itibarınızdan kaç sıfır atabilirsiniz?* [How many zeros can you throw from your corporate reputation?]. Rota Yayınları.
18. Dülger, G. (2017). *Özel Okullarda Kurumsal İtibar Algısı: Antalya Özel Envar Okulları Paydaşları Üzerine Bir Araştırma, Yüksek Lisans Tezi*. Erişim tarihi: 5 Mart 2019, <https://tez.yok.gov.tr/>.

19. Er, G. (2008). *Sanal ortamlarda itibar yönetimi* [Reputation management in virtual environments]. Cinius Yayınları.
20. Erdogan, I. (2014). Eğitimdeki değişimlere dair eleştirel irdelemeler [Evaluations on changes in education]. *Hasan Ali Yucel Eğitim Fakültesi Dergisi*, 11(21), 129–140.
21. Erdogan, I. (2010). *Eğitim ve okul yönetimi* [Education and school management.]. Alfa Yayınları.
22. Fombrun, C., & Van Riel, C. (1997). The reputational landscape. *Corporate Reputation Review*, 1(1), 5–13. <https://doi.org/10.1057/palgrave.crr.1540008>.
23. Fombrun, C. (1996). *Reputation realizing value from the corporate image*. Harvard Business School Press.
24. Fombrun, C., & Van Riel, C. (2004). *Fame & Fortune: How successful companies build winning reputations*. Prentice Hall Financial Times.
25. Gee, B. (1996). *Creating a million dollar image for your business*. Council Oak Books.
26. Gotsi, M., & Wilson, A. (2001). Corporate reputation: Seeking a definition. *Corporate Communications: An Internal Journal*, 6(1), 24–30. <https://doi.org/10.1108/13563280110381189>.
27. Gray, E., & Balmer, J. (1998). Managing corporate image and corporate reputation. *Long Range Planning*, 31(5), 695–702. [https://doi.org/10.1016/S0024-6301\(98\)00074-0](https://doi.org/10.1016/S0024-6301(98)00074-0).
28. Green, P. S. (1996). *Sirket Ununu Korumanin Yollari* [Reputation Risk Management]. (A. Ersoy, Trans.). AD Yayıncılık.
29. Guzelcik Ural, E. (2012). Kurumsal itibari olcme yontemi olarak Turkiye Itibar Endeksi ve endeks sonuclarindan hareketle Turkiye’de elektronik sektorunun itibari uzerine bir degerlendirme [Turkey’s Reputation Index as a method to measure the corporate reputation and evaluation of the Turkish electronic sector’s reputation, based on the Turkey’s Reputation Index and its outcomes]. *Online Academic Journal of Information Tecnology*, 3(7), 7–20.
30. Helm, S. (2007). One reputation or many? Comparing stakeholders’ perceptions of corporate reputation. *Corporate Communications: An International Journal*, 12(3), 238–254. <https://doi.org/10.1108/13563280710776842>.
31. Icil, A. (2008). *Akademik orgutlerde kurumsal itibar ve iletisim iliskisi Akdeniz Universitesi uzerine bir arastirma* [Corporate reputation and communication relation: Research on Akdeniz University]. [Master’s thesis, Akdeniz Universitesi]. <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSonucYeni.jsp>.
32. Karakose, T. (2007). Orgutlerde itibar yönetimi [Reputation managements in organizations]. *Uluslararası Hakemli Sosyal Bilimler E-Dergisi*, 11, 1–12.
33. Karakose, T. (2006). *Eğitim orgutlerinde ic ve dis paydaslarin kurumsal itibara iliskin algilamaları* [The internal and external shareholders perceptions regarding corporate reputation in educational organizations]. [Doctoral dissertation, Firat Universitesi]. <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSonucYeni.jsp>.
34. Karakose, T. (2007a). *Kurumların DNA’si itibar ve yönetimi*. Nobel Akademi Yayıncılık.
35. Karatepe, S. (2008). İtibar Yönetimi: Halkla İlişkilerde Güven Yaratma. *Elektronik Sosyal Bilimler Dergisi*, 7 (23), 77–97. Erişim tarihi: 10 Haziran 2017, <https://dergipark.org.tr/>.
36. Kayadibi, F. (2001). Eğitim kalitesine etki eden faktörler ve kaliteli eğitimin üretimi katkısı [Factors affecting the education quality and the contribution of quality education to production]. *İstanbul Üniversitesi İlahiyat Fakültesi Dergisi*, 3, 71–94.
37. Lunenburg, F., & Ornstein, A. (2013). *Eğitim Yönetimi* [Educational Administration]. (G. Arastamam, Trans.). Nobel Akademi Yayıncılık.
38. Nakra, P. (2001). Kurumsal itibar yönetimi: “Kiy” stratejik bir donusum mu? [Corporate reputation management: “CRM” with a strategic twist?]. (F. Otay, Trans.) *Kurgu Dergisi*, (18), 401–416.
39. Polat, S., & Arslan, Y. (2015). *Orgutsel yasamda imaj* [Image in organizational life]. Nobel Akademi Yayıncılık.
40. Sabuncuoglu, Z. (2004). *İsletmelerde halkla iliskiler* [Public relations in business]. Alfa Aktuel.
41. Schwaiger, M. (2004). Components and parameters of corporate reputation-An empirical study. *Schmalenbach Business Review*, 56(1), 46–71. <https://doi.org/10.1007/BF03396685>.

42. Sipahioglu, M. (2018). *Erciyes Üniversitesi paydaslarının kurumsal itibara ilişkin algılarının incelenmesi* [Examining the stakeholder perceptions of Erciyes University regarding corporate reputation]. [Doctoral dissertation, Bolu Abant İzzet Baysal Üniversitesi].
43. Temel Eginli, A. (2008). Kurumların en önemli değeri: İtibar [The most value of corporations: Reputation]. In N.B. (Ed.), *Farklılaşma çağında kurumsal başarıyı yakalamak* [Achieving corporate success in the age of differentiation] (pp. 51–84). Nobel Akademi Yayıncılık.
44. Tengilimoglu, D., & Öztürk, Y. (2011). *İşletmelerde Halkla İlişkiler* [Public relations in business]. Seckin.
45. Uzoglu, S. (2001). Kurumsal Kimlik, Kurumsal Kultur ve Kurumsal İmaj [Corporate identity, corporate culture and corporate image]. *Kurgu Dergisi*, 18, 337–353.
46. Yurdugul, H. (2006). Paralel, eşdeğer ve konjenetik ölçmelerde güvenilirlik katsayılarının karşılaştırılması [The comparison of reliability coefficients in parallel, tau-equivalent, and congeneric measurements]. *Ankara Üniversitesi Eğitim Bilimleri Dergisi*, 39(1), 15–37.
47. Zinbarg, R. E., Revelle, W. R., Yovel, İ., & Li, W. (2005). Cronbach's A, Revelle's B, and McDonald's  $\Omega$ : Their relations with each other and two alternative conceptualizations of reliability. *Psychometrica*, 70(1), 123–133.



# Kutadgu Bilig from the Point of View of Complexity



Hüseyin Çakır

*I have named the book “Kutadgu Bilig (Wisdom of Royal Glory)” may it bring Fortune (kut) to the reader and guide is way. I have uttered my discourse and composed my book. It will be a true guide, that you may grasp both the worlds and he blessed with Fortune*  
Yusuf Khass Hajip

**Abstract** This study aimed to analyze a literary text from the perspective of complexity, which has been considered an important alternative to the linear-reductionist way of thinking since its emergence. The studied work is the work named Kutadgu Bilig, written in the 11th century, which was a political, military and cultural development period in Turkish history and accepted as the first Turkish-Islamic political treatise. In this context, complexity thought has been based first and the related complexity terminology has been explained. Afterwards, the work was evaluated under different titles in terms of structure and content. The work consists of conversations of four characters, representing four different values on various topics in terms of structure, especially, state administration and political philosophy. Although it is very simple in structure and fiction, the constant interaction of multiple actors—in other words, the increase in complexity—has created an enormous work from this simplicity. As a result, it has been seen that the work has a complex feature in many ways in terms of structure and content. In addition to this, the work also provides a comprehensive intellectual framework on how to behave in some situations that have become more complex today due to developments in information and communication technologies and globalization. As a matter of fact, based on this framework, the work has been studied in many subject areas, especially in history and linguistics, from philosophy to economics, from international relations to psychology and from political sciences to women’s studies.

**Keywords** Complexity · Complexity theory · Kutadgu bilig · Wisdom of royal glory

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## Introduction

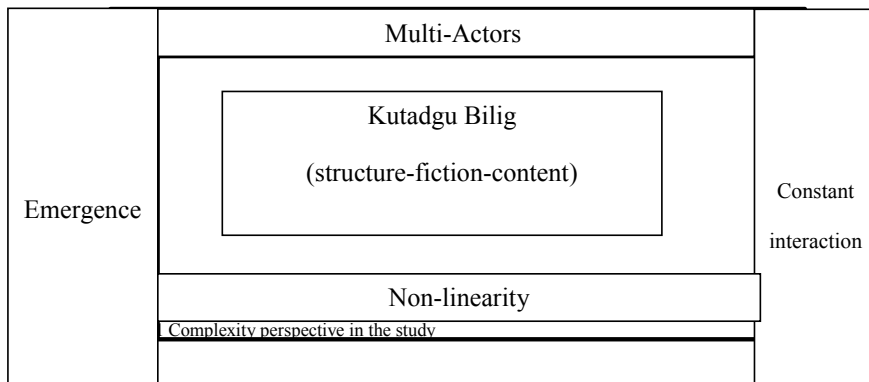
Complexity is, in a scientific sense, a theory of survival, evolution, development and adaptation. It deals with environments, organizations or systems that are connected to each other in different ways and exhibit non-linear interactions with each other [11, 19, 31]. Complexity has developed mostly on the basis of biology and has been seen as a new way of understanding nature since its emergence [13, 30]. In this context, it has been transferred to social sciences as a different perspective and has been the subject of many areas such as; public administration in social sciences [39], educational philosophy [31], international relations [42] and sustainability [14]. This study is about analyzing a literary work from the window of complexity that Kauffman [27] describes as a new science that boldly promises to transform the biological and social sciences in the 21st century.

The studied work is the book named *Kutadgu Bilig* (KB), written in the 11th century, accepted as the first political treatise in Turkish-Islamic history, and one of the most widely studied sources after it appeared in the scientific field. Because it is a theory about biology in particular and natural sciences in general, the association of complexity with a literary work may seem strange at first glance. However, this thought emerged for a number of reasons. First, there are studies [3, 8, 35] in which nonlinear dynamic systems such as chaos and complexity are associated with literary genres such as novel, story and poetry. In addition to this, metaphors of chaos and complexity have recently been used as a post-modern theory in art, cinema, and literary criticism [3]. The second reason is that since the emergence of complexity, many fields of social sciences—including literature—have been studied and have presented realistic analyzes of the fields they are studied. The fact that the period in which the work was written was a very complex period in terms of Turkish-Islamic culture and civilization is another reason for this study. Especially at that time, great Turkish states such as the Karakhanids in Central Asia, the Ghaznavids in India, and the Seljuks in the west emerged and the dominance in the Eastern Islamic world began to pass to the Turks [26]. Therefore, the main character of the period is the enrichment of the steppe Turkish culture with Islamic civilization values. In other words, this period corresponds to a remarkable period of development in Turkish history in terms of military, political and cultural aspects. It seems likely that the work, written by someone who witnessed these developments, reveals an intellectual structure regarding the multidimensional complexity of the period. In this direction, the thought of complexity was first grounded in the study and the related complexity terminology taken into consideration in the study of the work was introduced. Afterwards, the work was evaluated under the headings of general information, structure, fiction, content and related studies.

## The Thinking of Complexity

In order to reveal the idea of complexity in a scientific sense, it is first necessary to look at the etymological meaning of the word “complex”. *Complexus*, which is the Latin origin of the concept, means “intertwined, entangled” [19]. In Turkish, the word complex means “containing many elements of the same kind, consisting of many more or less contradictory things” (<https://sozluk.gov.tr/>). Based on the definitions related to the concept, it can be said that in order for a phenomenon to be complex, it must have two characteristics. The first is that it consists of two or more different parts, and the second is that these parts are interconnected in such a way that it is very difficult to separate. In other words, in complexity, there is a basic duality of parts that are both independent in their own positions and connected to each other in integrity [15, 19]. Complexity strongly emphasizes the existence of a system in this aspect. In this context, we can define complex systems as systems that consist of many parts, elements or components of the same or different types that interact with each other nonlinearly [18, 38, 42]. Although issues such as complexity were discussed by philosophers and scientists in antiquity [9], Nobel Prize-winning biochemist Ilya Prigogine, known for her influential work on chaos and complexity, traces the birth of the science of complexity to the year 1811, when Fourier received the French Academy of Sciences award for the mathematical definition he brought about the diffusion of heat in solid materials. And he expressed this with the words “... *the universal character of Fourier's law is not directly related to the dynamic interactions defined by Newton's laws, and therefore its being proposed can be considered the starting point of a new kind of science*” [36]. The phrase “a new kind of science” is striking here. Because it is frequently emphasized that complexity is a new way of thinking that sharply contrasts with the basic philosophy underlying Newtonian science, based on reductionism, determinism and objective knowledge [32, 20, 12, 33]. The common thought that unites around this idea is that quantum mechanics and chaos theory that strikes determinism, systems sciences that replace reductionism with dignity, and post-modern social sciences and cybernetics, which emphasize the subjectivity of knowledge, are integrated under complexity. In other words, the sciences of complexity themselves are a complex whole that feeds on many scientific ideas belonging to fields such as physics, biology, mathematics, sociology, and ecology [38].

Stating that there are countless examples of complex systems in various disciplines, Haken [18] gives examples of gas molecules in physics, which are 10 to 22 cm<sup>2</sup> and constantly collide with each other. In chemistry, a large number of molecules that react come together to form new molecules; in biology, a cell consists of a complex cell membrane, nucleus and cytoplasm, each containing many different components; the fact that the economy consists of many components such as production, storage, material and money flow, logistics and consumption are also examples of complex systems. Moreover, modern science itself is a complex system as evident from its enormous number of specific branches.



**Fig. 1** Complexity perspective in the study

There are many characteristic features of the complexity, whose etymological origin, scientific meaning, development process and examples have been revealed so far. However, the complexity characteristics considered metaphorically in this study are as follows; (a) multi-actor structure; (b) continuous interaction between these actors; (c) non-linear interactions between actors and (d) emergence [13, 29]. The intellectual complexity window (Fig. 1) used in the study of the work is basically structured on these four characteristics.

The first is a multi-actor structure. In other words, complexity emphasizes a system consisting of a multi-actor structure. These actors, which can be of similar or different nature, have a characteristic that is dependent on each other in terms of the integrity of the system while they are independent in their local positions. Heylingen et al. [20] described the multi-actor structure as the central paradigm of complexity. This multi-actor structure of complex systems is the source of nonlinear dynamic interactions between actors and the global organization that emerges from these interactions. Therefore, it is necessary to have two or more actors to be able to talk about complexity. When we look at our environment with this eye, it is possible to see complex structures in all images of reality, from the cell level to the macro universe.

The second is continuous interactions between multiple actors. Due to these large numbers of interactions, any actor in the system can affect or be affected by others [42]. Thanks to interactions, actors have the potential to change other actors and/or the whole system, even if they are independent in their local location. Because of this feature, unpredictability/uncertainty prevails in complex systems. Interactions also have positive and negative feedback loops on the system [41]. The system strengthens and expands its existing state with positive feedback. It prevents the system from drifting into chaos by suppressing deviations with negative feedback and initiates self-adaptive processes to adapt to environmental conditions.

Third, interactions between actors are not linear. Not being linear in any system means that input and output are not proportional to action or response to action. In other words, very small changes that were initially overlooked or ignored in such

a system may have big consequences for the system in the future [17]. Prigogine and Stengers [36] emphasize that nonlinearity is almost a general feature of living systems. The phenomenon expressed as a sensitive adherence to initial conditions and conceptualized as the butterfly effect in the literature emphasizes the nonlinear aspect of complex systems [40].

Finally, complex systems show the ability to emerge. The emergence theoretically is that the behavior of a complex system as a whole cannot be explained as a sum of the behaviors of the actors that make up the system. In other words, the interaction between multiple actors that make up the system reveals a holistic behavior that cannot be understood by observing any single actor. In other words, the whole represents more than the sum of the parts and has a different property that cannot be reduced to the properties of the parts [20, 6, 28, 37]. Metaphorically, we can give a water molecule an example. As is known, a water molecule is formed by the combination of two hydrogen and one oxygen (dihydrogen monoxide) atoms. Oxygen in the composition of water is a burning gas and hydrogen is a flammable gas. However, the water molecule formed by the combination of these two atoms is not a flammable substance and is used as a fire extinguisher. Here, the structure of the water molecule cannot be predicted just by looking at the structure of oxygen or just hydrogen. Because when we accept them as actors, the water molecule exhibits a very different feature from the structure of the actors that make it up. Therefore, in this example, it can be said that the behavior of the water molecule is an occurrence.

## **Kutadgu Bilig**

### ***General Information***

Kutadgu Bilig (KB), one of the founding products of Turkish-Islamic culture and literature, is a poetic political book written in the 11th century during the Karakhanids period [2]. The 11th century is a period in which important developments took place in terms of military-political and cultural aspects of Turkish history. Turkish states and empires such as the Karakhanids, Ghaznavids and Seljuks emerged in this period and the dominance in the Eastern Islamic world began to pass to the Turks. This situation brought about a process in which steppe Turkish culture was enriched with Islamic civilization values [26]. KB was written by Yusuf of Balasagun in such a period of intense military, political and cultural interactions. Yusuf presented this work, which he wrote in 1069–1070, to Tamgaç Buğra Han, the ruler of Karahanli at the time. The ruler also liked the work very much and gave Yusuf the title “Has Hacip” [5]. There is no descriptive information about the title of the work. The author said, “I named the book Kutadgu Bilig, happy to read it may it helps the reader. I spoke my word and wrote the book, this book is a hand that reaches out and holds both worlds (lines, 350–351)” and he just expressed his purpose in writing the work. For this reason, there is no consensus about what the name of the work means. Kafesoğlu [26] stated

that scientists such as Vambéry, Radloff and Thomsen who made founding studies on the work took the word “kut” as bliss. Reşit Rahmeti Arat, who translated the work into Turkey Turkish, said that the name of the book was “a knowledge of being blessed and happy” [26]. On the other hand, Arsal [5] stated that the name means “the science of making happiness and state administration”.

KB is a poetic work consisting of 6645 couplets as the main text. These 6645 couplets are classified as 85 bab in total. In addition, there are three additional episodes that are not included in the original text by the author at the end of the work. Forewords were added to the work, which was handled twice in the historical process, by those who discussed it both times [4]. Until today, three copies of the work have emerged. These are Herat, Fergana and Egyptian copies. The Herat copy is in the Vienna State Library and the Egyptian copy is in the Khedive Library of Cairo. The Russian-born German Turkologist Friedrich Wilhelm Radloff analyzed the Herat and Cairo copies comparatively, and published the text of KB with its German translation in 1891 [5]. In 1947, Reşit Rahmeti Arat made a scientific study based on three copies of the work, and in 1959 he presented the translation of the work into modern Turkish. This development also initiated the modern period of studies related to KB, and this translation was taken as basis in studies about Old-Middle Turkish period and translations into different languages [43]. Robert Dankoff, a professor of Turkish and Islamic studies at the University of Chicago, translated the KB into English using Arat’s translation and published his work as “Wisdom of Royal Glory (Kutadgu Bilig): a Turko-Islamic Mirror for Princes” [34].

### ***Structure in Kutadgu Bilig***

KB has a very plain and simple feature both as a fictional structure and language structure. The work is basically built on four characters. These are the people named Kün-togdı, Ay-toldı, Ögdülmiş and Odgurmış. The author revealed everything he wanted to express through the conversations of these four people [5]. Characters in different tasks represent different values in moral and legal terms.

Küntogdı is the ruler and represents the right law/justice. That is, he is directly the law (couplet, 355). The author named the ruler Küntogdı because he likened the nature of justice to the sun. According to him, the sun does not shrink, it always preserves its integrity, its brightness is always the same. The nature of justice is similar to the sun, filled with righteousness and never diminishes. When the sun rises, this world illuminates, the sun’s brightness reaches the whole people, but nothing lessen from itself. So is the ruling of the ruler, his action and word are the same for all people. No discrimination is made to anyone regarding justice. When the sun rises, warmth comes to the ground, and then thousands of colorful flowers bloom. Whichever country the ruler’s law reaches, it will always be in order (lines 824–831).

Aytoldı is the vizier and represents fortune/happiness, the blessed sacred sun shines with it (line, 354). The author named the vizier Aytoldı because he likened the nature of bliss and happiness to the moon. As the moon rises, it first rises very

**Table 1** Characters and their features in Kutadgu Bilig

Character name	Position	Values represented
Kün-togdı (Rising Sun)	King, Ruler	Justice, Right Law, Custom
Ay-toldı (Full Moon)	Vizier	Fortune, Happiness
Ögdülmiş (Highly Praised)	Sage, Son of the Vizier	Intellect, Wisdom
Odgurmuş (Wide Awake)	Ascetic, Zahid	Fate, Man's Last End

small, then grows and rises day by day. When it grows and becomes a full moon, it shines light to the earth and the people of the world benefit from its brightness. After the moon grows and completes and reaches its highest point, it begins to diminish again, its brightness diminishes and eventually disappears. Then, it rises small again and grows again. The nature of happiness and happiness is just like the states of the moon, sometimes they exist and sometimes disappear (lines 730–735).

Ögdülmiş is the son of the vizier and represents mind, wisdom and knowledge. In the words of the author, “It is the name of the mind and it glorifies man (line, 356)”. Odgurmuş, on the other hand, is an ascetic person who has given up all worldly things and represents the sequel (line, 357). These four characters, which constitute the basic structure of the work, are shown in Table 1 in terms of their positions and the values they represent.

### *Fiction in Kutadgu Bilig*

The story is very plain and simple in the work, which is basically built on the conversation of four characters. The fact that the work is plain and simple in terms of structure and fiction is the source of the richness it presents as content. In other words, plainness and simplicity are not a negative situation for the work and on the contrary, it has been the sole basis of the rich content of the work.

Looking at the story setup, it is seen that the main character is Aytoldı. Aytoldı is a young man of calm nature, smart, wise, intelligent and well-willed, born in a town far from the ruler. His face is beautiful enough to be dazzling when looked at. His word is not harsh, but he always speaks the truth. He is a personality who embraces all kinds of virtues. One day, he looks at himself and says; “Today I am one of the notables in the country with my numerous virtues. Why am I wasting time here, let me go to the monarch and go to his service. May my virtues be of help to the ruler, he bestows on me, and my sorrows end. He was a smart, knowledgeable, gentleman, and he was looking for people of virtue. The wise again knows the value of the mind (lines, 466–470)”. Aytoldı desires to go to the capital and do great deeds in the service of the ruler and thus make his ideals real. With this desire, he completes his

preparations and comes to the capital. In order not to be in need afield, he takes solid gold, silver and items with him. Although days and weeks have passed since he came to foreign lands, he did not find an opportunity to introduce himself to government officials. Finally, one day, he becomes a friend of a person named Kusemiş who takes good care of people and shares his thoughts with him. Due to Aytoldı's intelligence, morals and good treatment towards everyone, Kusemiş decides to help him. Kusemiş knows the great vizier (hajip) of the ruler. One day he goes to him and opens the matter to him. He tells all of Aytoldı's words and what his wish is. The vizier tells him to come to him first to see Aytoldı and that he will present the matter to the ruler depending on the situation. Kusemiş takes Aytoldı and brings him to the presence of the vizier. He speaks at length with Vizier Aytoldı. The Vizier likes Aytoldı's confidence in himself, the nobility and kindness in his actions and attitudes, the intelligence that can be understood from his words, and the signs of honesty in his eyes. The vizier says that he will present the situation to the ruler. Finally, one day, Aytoldı appears before the ruler. The ruler appoints Aytoldı to junior services first, and as his abilities are noticed, he assigns him to major services. And finally, Aytoldı is appointed to replace the deceased vizier. Aytoldı died after performing useful services for the people for a while in line with the desire of the ruler. While dying, he writes advice and advice to the ruler and his son Ögdülmiş. He entrusts his son to the ruler. In his conversations with Ögdülmiş, the ruler sees that his mind is very sharp, his intelligence is sharp and his temperament is good and takes him into his service. Having all the good qualities of his father, Ögdülmiş is superior to his father in mind and science. After he became a vizier, he wanted to assign his childhood friend Odgurmış, who had withdrawn from the world and lived a ascetic life in the mountains, in the state administration. Odgurmış opposes this and does not accept it. Ögdülmiş visits Odgurmış personally and tries to convince him that it is superior to asceticism to serve the people in the civil service. However, he cannot convince him. The ruler thereupon first wrote letters and then gave advice to Odgurmış by inviting him to his presence. These also do not affect Odgurmış's change of his mind, and he continues to live the ascetic life away from the people and eventually falls ill and dies. The Ögdülmiş and the ruler are very sorry for this situation. Odgurmış inherits a bowl and a stick to his friend. Ögdülmiş takes the bowl and the ruler takes the stick as a relic. After that, the ruler and the Ögdülmiş fix the crooked affairs and put the world in order, and they live a happy life with the prayers of the people and their good names remain heirloom to humanity.

The story fiction of this voluminous work, consisting of 85 chapters and 6645 couplets, consists of the narration in the paragraph above. In other words, the whole work consists of conversations between four characters representing different values and unlimited repetition of these conversations. Repetition and interactions are simple but fundamental rules that play a role in the creation of the work. Using these rules, Yusuf Khass Hajip skillfully created a work that is diverse in content and rich in knowledge. As Arsal [5] said, the importance of the work is not in its story, but in the conversations and discussions between the people in the story. These conversations and debates generally include political, moral, social and legal issues.



## ***Content in Kutadgu Bilig***

KB is essentially an advice, ethics and law book that explains how to act in the state administration in order to guide the ruler [45]. This feature was clearly expressed in the first preface, which was added to the book later, and it was emphasized that this aspect of the book would benefit everyone, but it would be more beneficial for the administrators who govern the countries and cities. The explanation of various issues such as what the survival or destruction of the state depends on, the situations in which the sovereignty will be lost, the mutual rights and responsibilities of the ruler and the people, how the army will be gathered, how to choose the mansion and expedition routes, has also given the work a feature of political treatise [26]. For this reason, the book is sometimes discussed in the same intellectual framework with works such as Xenophon's *Cyropedia*, French Fenelon's *Telemak*, Machiavelli's *Prince in the west*, Firdevsi's *Şehname* and *Kaabusname* in the east [5].

Although the content seems to be related to the administrative affairs of the state as a whole, it contains information on a wide variety of subjects such as social life, morality and ethics, knowledge and reason, the function of intelligence, the theme of death, feeling of homesickness, illness, etc. [16]. In this context, Yusuf starts his words with the praise of Allah, Prophet Muhammad, Four Caliphs and Buğra Khan, whose book he presented. Then, he explains that the value of human comes from knowledge and reason, the benefits and harms of language, the importance of being good, the benefits of knowledge and reason. Then he introduces the book and gives place to the encounters and conversations of the ruler Küntogdı and Aytoldı. The conversations of the ruler, who represents justice and righteous law, and the vizier, who represents the state and happiness, are mostly philosophical conversations. In these conversations, all aspects of justice were discussed and the ethical boundaries of the basic management philosophy regarding how it would be possible to keep the state were tried to be marked off. Accordingly, the person who wants to keep the state and happiness, which has an unreliable and unstable structure, must be humble and soft-spoken. He should never rush into extremes, never be close with bad and ugly deeds. He must spend his property in the right places, organize his life, work, attitude and movement. He should not hurt others with arrogance and pride, should not take himself to drink, should not interfere with play with his hand and tongue, and should not waste his property in vain (lines 703–710).

The conversations of the ruler with Ögdülmiş, who represents the wisdom and knowledge, mostly include the characteristics of the people in charge of the state organization and the rights and responsibilities of the social classes in the public. He tells how the vizier, commander, treasurer, ambassador, clerk should be, starting with the characteristics of a king who will be worthy of the augmented principality. As an example a bey worthy of a principality should be knowledgeable, intelligent, generous and mild-mannered. He should see the deeds of the country and the people through knowledge and wisdom, should be full and rich in heart, should be pure, courageous, hero and strong, should have all kinds of goodness (lines 1948–2180). Following these, Ögdülmiş tells how the relations with people in the public should

be and in this context, he separately evaluates social classes such as scholars, physicians, poets, farmers, traders, animal breeders, craftsmen and the poor. For example, citizens have three rights over the ruler. These are preserving the money setting, which means economic stability, the administration of the people in a fair way, and the elimination of interceptors and bandits by ensuring security and order. The ruler also has three rights over his subjects. These are the people's respect for the orders and the fulfillment of the orders no matter what, the people's observing the treasury rights and paying their taxes on time, the people being the enemy against the enemy of the ruler and being friend of his friend (lines 5574–5582).

The conversation of the ruler and Ögdülmiş with Ođgurmış, who represents the fate and lives in the mountains by turning away from the worldly life, involves more of a debate. According to the ruler and Ögdülmiş, it is better to use his mind and knowledge in the works that will benefit the people by being in a state service than to get away from people and worship alone in the mountains. Ođgurmış argues that it is better for him to live such an ascetic life because of his worries. In the end, the ruler and Ögdülmiş could not persuade Ođgurmış and he died in accordance with his desire by living the zahid life away from the people. At the end of the main text, there are three annexes written by Yusuf Khass Hajip. The first of these is about pity for youth and old age, and the second is about the disorder of time and the suffering of friends. The last one includes the self-advice of Yusuf Khass Hajip, the owner of the book (lines 6521–6645).

KB reflects the Turkish understanding of state and politics along with Turkish culture in terms of content. Because, Yusuf frequently quotes from state administrators such as the Turkish khan, the Turkish order, Ötügen begi, and the Uç Ordu khan. These people, whose names are understood to be Turkish, represent the Turkish understanding and thoughts of the period and show that these are the main sources. In addition, the concepts of köni törü, kut and ukush representing Küntogdı, Aytodı and Ögdmiş are also used in the book. They are also the basic concepts of the Orkhon Inscriptions written in the 8th century [10]. In addition, Arsal [5] stated that the literary ideas and proverbs used in the book were completely taken from Turkish life and stated that the content was a summary of the ideas on morality, politics and law that had been collected for centuries in a civilized Turkish neighborhood.

The second weight in terms of content is the Islamic philosophy and civilization besides Turkish culture. In particular, the enrichment of the dominant political thought in the book with Islamic political philosophy and the writing of the work in accordance with the Islamic writing tradition support this [7]. The author begins the work with the praise of Allah, the prophet and the four caliphs respectively, which is the general writing form of Islamic works. However, the relationship between justice and the state revealed in the KB is exactly the same as the relationship between justice and the state revealed by the religion of Islam. The religion of Islam establishes the state on justice. In the Qur'an on this subject, it is said, "Indeed, Allah commands you to return trusts to their rightful owners;1 and when you judge between people, judge with fairness (Holy Quran, 4/58) [21]". If it is about the impartial application of justice, "O believers! Stand firm for justice as witnesses for Allah even if it is against yourselves, your parents, or close relatives. Be they rich or poor, Allah is

best to ensure their interests. So do not let your desires cause you to deviate ‘from justice’. (Holy Quran, 4/135) [22] and “O believers! Stand firm for Allah and bear true testimony. Do not let the hatred of a people lead you to injustice. Be just!” (Holy Quran, 5/8) [23]”. As it can be understood from the verses, the religion of Islam strictly ordered justice and left no room for favoritism in its implementation. Because the prophet of Islam, Mohammed, was very meticulous as a head of state in the implementation of justice in accordance with this order. He defined the state where the weak can get their rights from the strong as a just state, and the state where the weak cannot get their rights from the strong as a cruel state. He also attributed the destruction of the previous people to forgiving the noble and rich people when they commit crimes, but to punish the weak and poor people when they commit crimes, and he swore that he would apply his punishment without hesitation, even if it was his own daughter Fatima (İslam with Hadiths, 5/443) [25]. As can be seen, the measure of justice that is commanded in the Qur’an and exemplified by the practices of the prophet Muhammad is the same as the measure of justice set forth in the person of the ruler Küntogdı in the KB. Therefore, it can be said that KB is basically a product of Turkish and Islamic culture.

It has also been argued that KB shows some similarities with the Indian, Iranian, Ancient Greek and Chinese civilizations as well as the Turkish-Islamic culture and civilization values in terms of content [2]. In this context, Bombaci [7], who talked about the similarities between the KB and the ancient Greek thought, emphasized the similarities between the ball on which Aytoldı appeared before the ruler (Line 622) and the sphere attributed to Tykhe-the goddess of luck, the knife held by the ruler Küntogdı (lines, 810–811) and the sword of Dike-the goddess of justice, the three-legged throne (lines, 801–809) on which the ruler Küntogdı sat and the three-legged chair of Themis-the goddess of order. However, Kafesoğlu [26] stated that the differences in understanding and practice regarding rights and justice in the ancient Greek and ancient Turkish states made these symbolic similarities invalid. According to him, in ancient Greece, law meant the will of the strong, the virtue of the strong, and justice the interest of the strong. Therefore, no similarity can be drawn between the rule of law, just, equal and universal in the old Turkish states and an understanding of justice that is based on power and in which the strong is right in the ancient Greek. As it is said, if there were some similarities, this would not only be reflected in the figure, but also in understanding and practices. Stating that there are similarities and even sometimes similarities between the issues explained in the KB and Indo-Iranian traditions, İnalçık [24] also pointed out that these similarities should not be exaggerated due to the basic differences in understanding. According to him, the ruler has absolute authority in the Iranian state tradition and this authority is above the law. Therefore, the administration of justice is wholly a right of forgiveness of the ruler. In the understanding of the state expressed in the KB, absolute authority is the law. The ruler is obliged to ensure justice by applying the law correctly and impartially. Therefore, in the Turkish state tradition set forth in the KB, justice is not an act of forgiveness of the ruler, but a correct and impartial application of the law for everyone. In summary, although the content basically covers the Turkish-Islamic culture, it contains thoughts and symbols that are similar to many different cultures

and civilizations thanks to the intellectual background of the author. In other words, it can be easily said that the content is an integrity that emerges from the interaction of many different cultures and civilization values.

### ***Studies on Kutadgu Bilig***

Since 1825, when KB was recognized by the scientific world, it has been one of the first period Turkish-Islamic works on which the most ideas have been conducted and researched [26]. Uçar [44] listed the studies on the work from 1825 to 2016, and included the information of 687 studies in this context. When we look at these studies, which are basically grouped as early period studies (1825–1947), modern period studies (1947–1979) and recent studies (1979 +), it is seen that they form a wide range of different disciplines from political philosophy to administrative law, from pedagogy to sociology. In the study, it was also aimed to reveal the distribution of studies on KB according to subject areas with provable data. In this context, TR Index was scanned as a database containing articles in the fields of science and social sciences. TR Index basically consists of scientific journals that publish on sub-topics of science and social sciences. It has been developed in accordance with international standards within the scope of Scientific and Technological Research Council of Turkey (TUBITAK) to provide access to electronic media for national and scientific content for researchers. In addition to these standards, it is also accepted for appointments and promotions in universities. Within the scope of TR Index, 1397 scientific journals currently publish on 100 subject areas (<https://trdizin.gov.tr/>). In Turkey, in order to reveal which subject areas studies have been done on KB, the name of the work was written in the search section of the directory and the title part was selected and scanned. As a result of the search, it was seen that there were 100 studies related to 52 subject areas in the database. The numerical distributions of these studies with a KB theme are shown in Table 2.

When Table 2, which includes the studies on KB, is examined, it is clearly seen that studies have been conducted in many different subject areas. Since the work was written between the years 1069–1070, it is normal that studies on the subject area of history take the first place. Again, the features such as writing the work in the Hakaniye dialect, which is described as Old Turkish, with the prosody meter in mesnevi style, and the verse unit being a couplet, have been the source of studies on the subject of language and linguistics. In addition to these, it is a basic proof of the rich information content of the work that it is a source for studies on subject areas such as nutrition and dietetics, population statistics science, general and internal medicine. As an example, the subject area of general and internal medicine is seen as a very distant subject area at first sight. However, Acar et al. [1] investigated the Humoral Theory of Pathology, which was a mainstream medical system until the mid-19th century, specifically in KB, and emphasized that the work contains important information related to the relevant theory. Similarly, another study conducted on body language in KB concluded that the work included laconic expressions about

**Table 2** Number of Kutadgu Bilig studies by subject areas

Subject areas	Number of studies	Subject areas	Number of studies
History	18	Public Relations	4
Linguistics	16	Communication	4
Philosophy	14	Job Training	4
Anthropology	11	Financial Studies	4
Literature Studies	9	Women's Studies	4
Science of Religion	6	Psychology	4
Educational Research	6	Art	4
Economy	6	Asian Studies	3
Cultural Studies	6	Nutrition and Dietetics	3
Music	6	Information, Document Management	3
International Relationship	6	Philosophy and History of Science	3
Archaeology	5	Ergonomics	3
Geography	5	Ethnic Studies	3
Literary Theory and Criticism	5	Movie, Radio and Television	3
Education, Private	5	Nursing	3
Folklore	5	Urban Studies	3
Law	5	Crimonology and Criminal Science	3
Business	5	Substance Abuse	3
Public Administration	5	Logic	3
Political Science	5	Population Science	3
Sociology	5	Medieval and Renaissance Studies	3
Family Studies	5	Hotel, Acommodation and Tourism	3
Humanities	4	Health Policies and Services	3
Environmental Studies	4	Social Work	3
Behavioral Sciences	4	Theater	3
Ethic	4	General and Internal Medicine	1

body language elements—head and facial expressions, hand-arm movements, eye and gaze, clothing and appearance, food and table manners [43].

The fact that KB is based on four characters representing four different values and that the communication and interactions between these characters provide a data source for all these subject areas can be expressed as the richness of fictional complexity. Yusuf Khass Hajip revealed his work through repetitions and interactions through a very simple structure and a very simple fiction, but the resulting work has reached a richness that includes much more than the conversations of four characters. Table 2 illustrates this situation clearly.

## Conclusion

In this study, KB, which is one of the first intellectual products of Turkish-Islamic culture and civilization and whose importance has increased due to the historical features of the period in which it was written, has been tried to be examined from the perspective of complexity. In this context, the idea of complexity is first based and the relevant terminology considered in the study is explained. Afterwards, the structural, fictional and contextual status of the work was revealed, and the research areas in which it was subject were described.

KB is structured on four different characters that basically represent four different values. Almost all of the work consists of the conversations of these four characters, in other words, their continuous interaction. The author demonstrated his intellectual versatility by building on these four characters. This situation is identified with multiple actors, one of the basic characteristics of complexity, and the continuous interactions between these actors. As stated before, talking about the complexity of a phenomenon essentially means emphasizing the existence of multiple actors and the numerous interactions of these actors. Therefore, in this context, the work exhibits a structurally and fictionally complex feature.

When the work is considered as its content, two main results emerge. The first is that the content—although there are comments about the limited similarity—carries the intellectual interactions of different civilizations such as Ancient Greek, China, Indian and Iran besides Turkish-Islamic culture and civilization. The second is that the content is rich in a wide range from state administration and international relations to military issues on how to choose the host and expedition routes. Thanks to this rich content, the work has been studied in many subjects ranging from philosophy to psychology, from economics to law, from health policies. In fact, this is an indication of the nonlinear nature of the content. In other words, the content is not limited to the knowledge of state administration, which is its main purpose, and has been the source of studies in many different subject areas outside the public administration nearly a thousand years after it was written. Therefore, the work is identified with the nonlinearity of the complexity in terms of content.

Finally, it is possible to say that the work is a complete example of emergence in terms of structure and content. That is to say, although the work is based on four

characters that represent four different values structurally, the entire work cannot be understood by looking at the characteristics of these characters separately. In other words, the work is not a linear sum of the four characters that reveal itself, but has a feature more than that. The same is true for the content of the work. While each of the babs, which consists of the conversations of the characters, has a subject integrity within itself, the work they create by coming together has a feature that expresses more than the sum of the babs. For example, the topics discussed by the author in the conversations between the ruler Küntogdı and the vizier Aytoldı and the topics between the ruler Küntogdı and Ögdülmiş, who represents the mind, differ greatly. Therefore, it is not possible to make a correct judgment about the whole work by looking only at the conversations with the vizier or with the Prize. This situation, which complexity characterizes as “emergence”, identifies with the work and the work shows a powerful example of emergence.

As a result, the study clearly reveals that the studied work has a complex feature in terms of structure and content. In addition, the work offers useful practices in many complex subject areas such as public administration, international relations, sociology, economics and law. In this respect, the work shows that complexity can be used effectively in literary fields and that it is possible to reach rich content from simple structural interactions. Of course, we cannot claim that complexity is used as a paradigm in the work, given that complexity has been scientifically conceptualized in recent times. However, we do not think it is a simple coincidence that a literary work put forward about a thousand years ago exemplifies complexity effectively. From this point of view, we believe that we can say that the idea of complexity exists with human beings, although it has been named recently. Because, just because something is newly recognized does not mean that something didn't exist before it was recognized.

## References

1. Acar, H. V., Saritas, E., & Buken, N. O. (2019). Humoral Pathology Theory in the Kutadgu Bilig (Wisdom of Royal Glory): A Karakhanid Turkic Work From the 11th Century. *Erciyes Medical Journal*, 41(4), 462–467.
2. Adahoğlu, H. (2016). Bir Siyasetnâme Olarak “Kutadgu Bilig”. Selçuk Üniversitesi Türkiyat Araştırmaları Dergisi, (34), 237–253. Retrieved from <https://dergipark.org.tr/tr/pub/sutad/issue/22200/238433>.
3. Akdeniz K. G. (2019). The Chaotic Awareness Reality and the Complexity in Turkish Novels. In: Erçetin Ş., Potas N. (eds) *Chaos, Complexity and Leadership 2017*. ICCLS 2017. Springer Proceedings in Complexity. Springer, Cham. [https://doi.org/10.1007/978-3-319-89875-9\\_2](https://doi.org/10.1007/978-3-319-89875-9_2).
4. Arat, R. R. (1959). *Kutadgu Bilig II Tercüme*. Ankara: Türk Tarih Kurumu Basımevi.
5. Arsal, S. (2011). KUTADGU BİLİĞ. *Journal of Istanbul University Law Faculty*, 13(2), 657–683. Retrieved from <https://dergipark.org.tr/tr/pub/iuhfm/issue/9147/114632>.
6. Banzhaf, W. (2009). Self-organizing Systems.
7. Bombacı, A. (1953). Kutadgu Bilig hakkında bazı mülâhazalar. 60. *Doğum Yılı Münasebetiyle Fuad Köprülü Armağanı*.
8. Çakır, H. (2020). YÖNETİM VE LİDERLİK BAĞLAMINDA KAOTİK BİR ÇÖZÜMLEME: DEDE KORKUT HİKÂYESİ. *Uluslararası Liderlik Çalışmaları Dergisi: Kuram*

- ve Uygulama, 3(1), 25–44. Retrieved from <https://dergipark.org.tr/tr/pub/ijls/issue/53618/707560>.
9. Çambel, A. B. (1993). *Applied chaos theory: A paradigm for complexity*. Elsevier.
  10. Ercilasun, A. B. (2003). İlk Müslüman Türk Devletlerinde Dil ve Edebiyat. *Türkler*, c. 5, 759–783.
  11. Erçetin, Ş. Ş. (2001). *Yönetimde yeni yaklaşımlar*. Ankara: Nobel Yayın Dağıtım.
  12. Erçetin Ş.Ş., Bisaso S. M., & Saeed, F. (2015). Understanding chaos and complexity in education systems through conceptualization of fractal properties. In: Erçetin Ş., Banerjee S. (eds) *Chaos, Complexity and Leadership 2013*. Springer Proceedings in Complexity. Springer, Cham. [https://doi.org/10.1007/978-3-319-09710-7\\_12](https://doi.org/10.1007/978-3-319-09710-7_12).
  13. Erkoçak E., Açıkalın Ş. N. (2015). Complexity Theory in Public Administration and Metagovernance. In: Erçetin Ş., Banerjee S. (eds) *Chaos, Complexity and Leadership 2013*. Springer Proceedings in Complexity. Springer, Cham. [https://doi.org/10.1007/978-3-319-09710-7\\_6](https://doi.org/10.1007/978-3-319-09710-7_6).
  14. Espinosa, A., & Walker, J. (2011). *A complexity approach to sustainability: Theory and application* (Vol. 1). World Scientific.
  15. Gershenson, C., & Heylighen, F. (2005). How can we think the complex. *Managing Organizational Complexity: Philosophy, Theory and Application*, 3, 47–62.
  16. Gümüş, İ. (2015). KUTADGU BİLİĞ’DE ZEKÂ KAVRAMI. *Electronic Turkish Studies*, 10(16).
  17. Gürsakal, N. (2007). *Sosyal bilimler karmaşıklık ve kaos*. Nobel Yayın Dağıtım.
  18. Haken, H. (2006). *Information and self-organization: A macroscopic approach to complex systems*. Springer Science & Business Media.
  19. Heylighen, F. (1988). Building a science of complexity. In *1988 Annual Conference of the Cybernetic Society. London*.
  20. Heylighen, F., Cilliers, P., & Gershenson, C. (2006). Complexity and philosophy. *arXiv preprint cs/0604072*.
  21. Holy Quran. Surah An-Nisa, 4/58, <https://quran.com/4>.
  22. Holy Quran. Surah An-Nisa, 4/135, <https://quran.com/4>.
  23. Holy Quran. Surah Al-Ma’idah, 5/8, <https://quran.com/5>.
  24. İnalçık, H. (1966). Kutadgu Bilig’de Türk ve İran siyaset nazariye ve gelenekleri. *Reşit Rahmeti Arat İçin*, 259–271.
  25. İslam with Hadiths (in Turkish) Hadislerle İslam, C.5, s. 443. Ankara: DİB Yayınları. (2013).
  26. Kafesoğlu, İ. (1980). *Kutadgu Bilig ve kültür tarihimizdeki yeri* (Vol. 368). Kültür Bakanlığı.
  27. Kauffman, S. A. (1990, January). The Sciences of Complexity and” Origins of Order”. In *PSA: proceedings of the biennial meeting of the philosophy of science association* (Vol. 1990, No. 2, pp. 299–322). Philosophy of Science Association.
  28. Kissane D. (2015) Cleopatra’s Nose and Complex International Politics. In: Erçetin Ş., Banerjee S. (eds) *Chaos, Complexity and Leadership 2013*. Springer Proceedings in Complexity. Springer, Cham. [https://doi.org/10.1007/978-3-319-09710-7\\_5](https://doi.org/10.1007/978-3-319-09710-7_5).
  29. Maguire, S., McKelvey, B., Mirabeau, L., & Öztas, N. (2006). 1.5 complexity science and organization studies. *The Sage handbook of organization studies*, 165–214.
  30. Marion, R. (2006). Complexity in organizations: A paradigm shift. In *Chaos, nonlinearity, complexity* (pp. 247–269). Springer, Berlin, Heidelberg.
  31. Mason, M. (2008). Complexity theory and the philosophy of education. *Educational philosophy and theory*, 40(1), 4–18.
  32. McKelvey, B. (2004). Complexity science as order-creation science: New theory, new method. *Emergence: Complexity & Organization*, 6(4).
  33. Maya İ. (2019) Complexity in Management: Problems and Strategies. In: Erçetin Ş., Potas N. (eds) *Chaos, Complexity and Leadership 2017*. ICCLS 2017. Springer Proceedings in Complexity. Springer, Cham. [https://doi.org/10.1007/978-3-319-89875-9\\_20](https://doi.org/10.1007/978-3-319-89875-9_20).
  34. Ölmez, M. (2004). Çağdaş Türk Dillerinde Kutadgu Bilig Çevirileri. *Türk Dilleri Araştırmaları*, 14, 103–126.
  35. Özemesi R. (2019) Complexity in Abstract Poetry. In: Erçetin Ş., Potas N. (eds) *Chaos, Complexity and Leadership 2017*. ICCLS 2017. Springer Proceedings in Complexity. Springer, Cham. [https://doi.org/10.1007/978-3-319-89875-9\\_14](https://doi.org/10.1007/978-3-319-89875-9_14).



36. Prigogine, İ. & Stengers, I. (1998). *Kaostan düzene*. (S.Demirci, Çev.) İstanbul: İz Yayıncılık.
37. Prokopenko, M. (2009). Guided self-organization. *HFSP Journal*, 3(5), 287–289. <https://doi.org/10.1080/19552068.2009.9635816>.
38. Prokopenko, M., Boschetti, F., & Ryan, A. J. (2009). An information-theoretic primer on complexity, self-organization, and emergence. *Complexity*, 15(1), 11–28.
39. Rhodes, M. L., Murphy, J., Muir, J., & Murray, J. A. (2011). *Publicmanagement and complexity theory: Richer decision-making in public services*. New York: Routledge.
40. Rosenhead, J., Franco, L. A., Grint, K., & Friedland, B. (2019). Complexity theory and leadership practice: A review, a critique, and some recommendations. *The Leadership Quarterly*, 30(5),
41. Stacey, R. D. (1995). The science of complexity: An alternative perspective for strategic change processes. *Strategic Management Journal*, 16(6), 477–495.
42. Tome, L., Açıkalin, Ş. N. (2019). Complexity Theory as a New Lens in IR: System and Change. In: Erçetin Ş., Potas N. (eds) *Chaos, Complexity and Leadership 2017*. ICCLS 2017. Springer Proceedings in Complexity. Springer, Cham. [https://doi.org/10.1007/978-3-319-89875-9\\_1](https://doi.org/10.1007/978-3-319-89875-9_1).
43. Uçar, İ. (2012). Kutadgu Bilig’de beden dili. *Electronic Turkish Studies*, 7(4).
44. Uçar, E. (2015). Kutadgu Bilig’in Kronolojik Kaynakçısı (1825–2016) [Tekmilleştirilmiş Versiyon]. *Uluslararası Uygur Araştırmaları Dergisi*, (6), 6–47.
45. Ünal, M., Uysal, M. (2018). Doğu ve Batı Kültürlerinde Siyâsetnâme Geleneği: Yusuf has Hacib’in Kutadgu Bilig ve Machiavelli’nin II Principe Örneği. *Tarih Okulu Dergisi*, 11(35), 249–280.

# Political Participation, Voting, and Chaos: Electronic Voting and an Assessment of Turkey



Halil Emre Deniř

**Abstract** Political participation stands for the attitudes and behaviours that a citizen assumes towards the political system that they exist in. Held in specific periods in democratic systems, elections are one of the means of political participation. For more than 30 years, electronic voting has been practiced in a number of countries across the globe. The system in question has changed upon the developments in technology and the inclusion of the internet technology in our lives. The systems, named e-voting or i-voting, are being implemented today as well. It is known that a large number of studies have been conducted in Turkey over the recent years, in regards to electronic voting, and electronic voting machines. This study will discuss what the electronic voting system is, along with its use in the countries, and it also involves a discussion on how it could affect the political participation in the event that it is used in Turkey, and on any probability of chaotic situations that it could lead to.

**Keywords** Chaos · Political participation · Electronic voting

## Introduction

When we hear or use the word “chaos”, what is emphasized is actually a complex situation or a state of turmoil. While the Turkish Language Association designates this usage as a secondary meaning for the definition of the word “*chaos*”, it uses the definition “*a discordant and complex situation that is devoid of the form of the universe before it had an order*” as its primary meaning. The word “chaotic”, however, is used to bear the meaning “*that which is in a state of disorder*”.

The term and theory of chaos can be used in a number of fields from physical sciences to social sciences. According to Kiel and Elliot [11], the theory of chaos came to light as a consequence of the discovery made by naturalists in the field of nonlinear dynamics. Nonlinear dynamics stands for the analysis of evolution

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of nonlinear systems in the course of time. Nonlinear systems uncover dynamic behaviours, in which the correlations between variables are unstable. Hence, the changes in such correlations can tear down current structures, while the newly formed structure brings along behavioural variables and unexpected results.

Political science also includes a great number of studies conducted on the theory of chaos. Political issues, and elections held in democratic systems are nonlinear dynamics. Different variables entering into the process are capable of changing and tearing down politics, political structures, as well as the attitudes and behaviours of voters. Newly formed structures, in turn, bring along unexpected results. For instance; the structural changes that took place in Middle Eastern states in the post-Arab Spring period, or similarly, the politics pursued over various states by the states that attempt to run the world politics, or the system-based changes implemented by the states over their current processes, or changes in their election systems can also bring along chaos.

Electronic voting became widely incorporated into election systems as of the 1990s, and many countries started to use it. Electronic voting helps the processes of casting and counting votes in a much faster manner during the elections. Cast through computer systems, electronic votes can be cast by means of devices with internet connection (computers, tablets, smart phones) in some countries, although it is also possible to cast votes through electronic voting machines in certain countries. Nonetheless, it is possible to observe that casting electronic votes could bring along chaotic situations as well. Security, confidentiality, supervision, and speed are the most crucial elements in electronic voting. These elements are also capable of affecting the voter behaviours.

This study will initially discuss the topics of chaos and political participation, then answers will be sought for the question of what electronic voting is, and how and why it is being implemented. Examples to be given in regard to electronic voting practices in countries will help such practices be comprehended.

Ultimately, the discussion will be shifted to the likelihood of occurrence of a chaotic structure upon any possible implementation of electronic voting in Turkey, which has been desired to be implemented and worked on for years. It is predicted that unexpected results would be yielded following the changes to be made in regard to the structure of the elections, which are nonlinear dynamics. Issues, such as trusting the data that the machine or system provides in regards to the results obtained when electronic votes are cast, or the possibility of the system being exposed to external interventions (hacking), or the likelihood of current governments intervening in election boards or machines with the aim of getting re-elected, or the risk of being compromised in respect of which party one votes for, could always be a topic of agenda, and they would be able to lead to chaos. In particular, the fact that which party the voter votes for is known would either drive the voter away from the ballot box or cause them to vote for the ruling party in order to protect their interests, and it would be possible to observe behavioural changes in voters. It is believed that this situation would cause a healthy democratic structure to be deteriorated, congesting the functioning of the system, which eventually would bring along chaos.

## Chaos and Political Participation

Newton was the first scientist to have ever comprehended how the evolution of physical systems could be in the course of time. According to Newton; if one knows about the condition, namely the location and speed, of a physical system at a specific time (this is the time of inception), then it is possible to estimate its condition at any given time. This topic was systematically developed, although these opinions of Newton received various criticisms in time. Henri Poincare, however, stated that coincidence and determinism turn into obscurity in a long period of time. He expressed that the smallest of reasons that we overlook, would lead to an impact of undeniable proportions, and that we would say that this is nothing but coincidental, nonetheless. As a matter of fact, by this, Poincare expressed the state of chaos. Named “chaos” in today’s world, this situation is a temporal evolution that is sensitively based on the initial condition [13].

Chaos means to achieve certain results with the help of the computer technology, in order to obtain a colossal and fragile structure that lies in the foundations of complexity. Some physicists define chaos as the science of a process, not the science of a situation, and as the science of a formation, not the science of existence. The small differences found in the inputs within this system managed to rapidly leave their places to gigantic differences in the form of outputs. Thus, appeared the phenomenon of “fragile dependence on initial conditions” [6].

Chaos occurs when it becomes impossible to make estimations on any given system in the long run. An uncertainty, appearing at the beginning of a system, increases exponentially. Unstable trajectories, or false estimations in regard to the point of origin of the system or to the parameters could turn into major and significant mistakes later on, although they are seemingly small at the beginning. The state of being nonlinear is required, but never enough for the creation of a chaotic situation. Observable chaotic situations depend neither on external factors nor on the degree of freedom in infinite numbers ([2]: 119).

Scientists claim that there has been a great progress in the discoveries made in regard to how the universe functions, and how chaos affects the social phenomena that are considered developments, forming in a predictable, linear manner ([5]: 347–348). It can be assumed that it is impossible to estimate the long-term behaviors of a chaotic situation in political systems. Because the initial conditions of such systems are limited to a restricted accuracy. Any subsequent mistake grows exponentially. This situation naturally means that any measurable political actors, present at the same political setting, will likely develop in a different manner in the long run ([2]: 120).

Crises, sudden and rapid changes, perplexities, and uncontrollable incidents may occur all around the world. This situation, in turn, can characterize modern organizations and complex systems. Hence, in the face of chaotic situations, individuals, executives, or leaders, must be prepared to manage such systems accordingly ([5]: 339–340).

Right at this point, the butterfly effect can be discussed. Found by Edward Lorenz during his studies on meteorology, the butterfly effect theory also involves the fragile dependence on initial conditions. Nevertheless, any small changes likely to occur in a certain chain event can turn into major problems and chaos. Thus, the effect caused by a butterfly flapping its wings at any place on earth, could cause hurricanes and disasters on another end of the earth [6].

When discussed from this standpoint, any political event taking place in any country in the world could manifest itself in different countries as well, causing similar incidents, or much bigger results that would even lead to political, social, cultural, and economic crises. Developing election systems is also a political matter. Various studies were and have been conducted in order to make political participation widespread and to increase it in even larger scales all across the globe. At this point, we need to specify what political participation means.

Political participation stands for the attitudes and behaviours that a citizen assumes towards the current political system ([3]: 203). The political participation made by citizens is directly associated with the concept of “popular sovereignty”. It develops hand in hand with this concept. A regime being democratic is measured by the political participation opportunities of the citizens. In limited democracies, however, political participation is considered an equivalent of elections. If a regime turns a deaf ear to the problems and criticisms of its people, it demands some sort of intelligentsia. A setting, in which the people could elect those who will rule them, even though they cannot have a say in their activities, directly contradicts the logic of modern democracy. In modern democracies, participation reaches vast areas. In fascist or communist regimes, however, political participation has a different function. The ruling class manipulates the people in such regimes, channelling them into a specific direction ([10]: 220–221).

While some people have a high rate of participation in the political system, that is not the case for others. Citizens with a little amount of interest are called “passive citizens”. Some citizens, on the other hand, have nothing to do with the political system. These are called apathetic and parochial (dormant citizens) ([3]: 203).

There are elements that affect political participation and determine the attitudes and behaviours of the citizens, such as age, gender, educational background, level of income, and occupations. Yet at the same time, there are also specific criteria that are required for the realization of the political participation. Elections must have *confidentiality*. The relation between the voter’s identity and the vote they cast should remain confidential. All must be *equal*. There might be unequal situations occurring between individuals, yet such situations must be equalized at the ballot box. Therefore, everyone should have only one right to vote. Elections should be *accessible*. Citizens need to have access to the means of participation and the instruments of voting. A *fair* structure should be established. Candidates and voters should be treated fairly. There should be no doubts in regard to the *reliability* of the elections to be held. It should be essential that the election results can be verified. Therefore, both voters and candidates need to be able to *count on* elections. Once candidates and voters are certain about the accuracy of the election results, they will to count on

them. Furthermore, elections must be protected against external interventions. Elections should be *transparent*, and respective authorities should be held accountable throughout the processes of casting and counting votes.

When we take a look at the elections, one of the most important elements of political participation, it can be seen that efforts are being made to systematically increase political participation. Thus, various countries made attempts to make the electronic voting widespread over the past 30 years, thanks to the computer technology. This situation, however, also caused chaotic situations in several countries. It is predicted that the causes and solutions of the chaotic situation, created by the method used in the elections in question, will also be solved by chaos theoreticians in the upcoming periods. When evaluated from this perspective, this study aimed to assess which countries use electronic voting mechanisms, and any possible chaotic situations to occur in the event that they are used in Turkey.

## Electronic Voting Around the Globe

Electronic voting is a form of voting, exercised by voters through devices produced with the help of computer technologies. It is possible to see two different types when one looks at the practices across the world. The first one of these, is a practice named electronic voting (e-voting). Devices are used in electronic voting. Here, different machines come into play as well. For instance, voting papers to be used by the voters are similar to optical forms. On this specific voting paper, the voter codes the candidate or party of their choice and swipes this voting paper through these machines. The data collected are merged at election centers. In another form, however, the voters proceed to the electronic device, mark the voting paper appearing on the electronic touchscreen of the device, and this procedure is registered by the device. In another version of this one, a receipt-like paper is printed out following the casting of the vote, and this paper is put in a ballot box. Through these two methods, efforts are made to check the results.

The second form of practice is the system called internet voting (i-voting). Having appeared in parallel with the developments in the internet technology, this system aims to ensure the inclusion of more voters in the process. Providing voters with a great convenience, this system enables voters to cast their votes by means of devices, such as computers, telephones, or tables that are connected to the internet, regardless of wherever they might be.

Simple machines that register the votes at voting centers, as well as systems, enabling the registration of the votes through the internet and ensuring the analysis of the votes on electronic media, have been developed within the process. There are quite a lot of companies, based in the United States of America and in Europe, working on these systems ([14]: 3). At this point, it would be appropriate to give some examples over certain countries.

It can be observed that a number of states started to use such systems following their use in the United States of America, which can be considered a complete

“*butterfly effect*”, so to speak. Similarly, electronic voting also rapidly spread among the countries in South America. November 15, 1992 saw the first attempts towards electronic voting in Panama. It was tested in even greater numbers of regions in 1999, although it was initially implemented in pilot regions. Nevertheless, its use was renounced as the political parties failed to reach a consensus over the use of the system ([12]: 1828).

Having started to be used in Colombia in 1992, the system started to be used in Brazil in 1996 on a national scale. The system, used in Brazil, caused its citizens to believe that there were security problems. Even though major investments were made for the system, it was observed that political participation was quite low ([7]: 37). While it started to be used on a regional basis in Peru, the year 1998 saw its use on a national scale in Venezuela. It started to be used on a regional scale in Paraguay in 2001, on a local scale in Costa Rica in 2002, on a regional scale in Argentina in 2003, on a local scale in Ecuador in 2004, and on a local scale in Mexico in 2006. The Dominican Republic initiated the transactions for purchasing these devices in 2006. Of these countries, many adopted literally the same system and devices used by Brazil ([1]: 203).

Because of its population, India is the biggest democracy in the world. In 1989, a legal regulation was made in regards to the use of electronic voting machines. While many states used this system for their elections, the entire country started to use it as of 2004. In Australia, however, the use of electronic voting machines started in 1998 ([12]: 1826–1827).

Electronic voting was permitted in local elections by Japanese laws as of 2002. The rate of use was quite low even though this voting system was encouraged by the Japanese government. One election was nullified as there was a difference between the total number of voters and the total number of votes cast during the electronic voting process. Therefore, the use of this system was renounced in certain regions ([8]: 101).

In Nigeria, electronic voting was considered a requirement and a solution for the security of the elections. From 2011 to this date, Nigeria has used the electronic voting system and decided to proceed with this technology ([7]: 36).

Certain examples specific to Europe include Belgium, which approved the electronic voting through a law passed in 1994 and which started to use it throughout the elections held in 1999 and 2000 ([12]: 1826). Of the voters, 44% were observed to have cast electronic votes during the elections held in June. The fundamental motivation for casting electronic votes in Belgium is said to obtain results in a faster manner ([4]: 77).

While England started to use machines for casting and counting votes in May 2002, Italy did the same in 2004. Being able to carry out the counting process in a much easier and faster manner, and the rapid and safe submission of the results were declared by Italy to be the main advantage of this system. Spain, however, made its first trial on November 16 2003, during the elections held for the Parliament of Catalonia. The general elections held in 2004, however, saw its trial on a larger scale ([12]: 1827–1828).

The situation is different Estonia. Estonia became the first country to ensure voting through internet on a national scale during the local elections in 2005. Voters are able to cast their votes, using their personal devices with internet connection, such as mobile phones, computers, tablets. This system, which started in 2005, continued to be used in national elections and in the European Parliament elections in the upcoming years ([15]: 2–3).

- There are certain fundamental reasons why transition to e-voting or i-voting is demanded all around the world:
- The factor of *speed* in the counting of the votes
- The system being *verifiable*
- Ensuring the *confidentiality* of the votes
- Demands of *reducing election costs* in the long run
- *Ecological effects* (the desire to eliminate the use of papers).

Elections held in democratic systems are nonlinear dynamics. The variables entering into the process are capable of changing politics, political structures, as well as the attitudes and behaviors of voters. It has been observed that any possible alterations in the election system could also bring along chaotic situations. While some countries renounced these systems, the rates of usage of such systems by voters were quite low in some other countries. Considering the rates of voting within the election system in Turkey, the kind of impact that the transition to electronic voting would create is open to a debate in scientific terms.

## **An Assessment on Electronic Voting in Turkey**

Elections have been held in Turkey (certain exceptional cases excluded) as of 1945, where the transition to a multi-party political life took place. Voters cast their votes by going to ballot boxes and by stamping the voting paper. Voters have had a rate of participation of over 80%, particularly in general elections. It is known that some public institutions and certain private companies have been carrying out studies in regard to the transition to electronic voting, in addition to the production of electronic voting devices.

The problems experienced while casting votes during the elections in Turkey, and the reasons for the nullification of the votes cast can be as follows:

- The absence of the balloting committee's seal on the voting paper provided by the balloting committee to the voters (null),
- Sealing multiple boxes (null),
- Torn voting papers (null),
- Leaving marks, writing, or placing signs on voting papers, using pencils or by some other means (null),
- Affixing the seal on the wrong place (problem),
- The seal running over the box of the other party or of the other candidate (problem),



- Any possible differences between the signature report and the number of voting papers (problem),
- Problems and altercations experienced during the counting process (problem),
- Voting papers being falsified by balloting committees (problem).

Considering these situations, through a transition to electronic voting, it can be predicted that it would be possible to minimize the casting of null votes, along with the problems experienced. Upon the transition to this system, it is believed that voting papers will be abolished, that the risk of seeing damaged voting papers and sacks, in addition to the voting papers taken out of dumpsters, will be eliminated, and that it would be possible to prevent the likelihood of voting in place of others (based on the structure of the system to be used).

However, one must predict that this system would bring along chaotic situations as well. Primarily, the probability of the system being hacked seems to be the biggest problem. In addition to the external interventions that the system might be exposed to, it is also possible that the codes of the system are tempered with, causing the risk of the votes entered having present results. There is also a risk that government-run election boards might be forced by the government to manipulate the results in favour of the government.

The risk of being compromised in respect of which party the voter votes for is among the most important elements that could drive the voters away from the ballot box. In such a case, with the risk of getting blacklisted in mind, the voters will change their attitudes, deciding not to vote. It can be thought that voters working in public offices, in particular, could experience the fear of losing their jobs, keeping this risk of getting blacklisted in mind, while it is also possible that they might abstain from voting or tend to vote for the current government. Nevertheless, it is more likely that they abstain from voting, in the event that the current government might change.

Problems may occur while individuals with a little interest in technology cast their votes through these devices. In particular, elderly individuals living in Turkey have quite a low possibility of using such devices.

All these come knocking our doors as predictable probabilities, and it is obvious that they will lead to chaotic situations. Considering the problems experienced in regard to electronic voting all around the world, as well as the low rates of voter participation, it is predicted that similar situations will also be observed in Turkey.

## Conclusion

Electronic voting has been practiced by various states all across the globe for over 30 years. Any alterations imposed over the elections, which are nonlinear dynamics, could lead to different results and problems, and the problems caused by such results grow to create a chaotic structure.

Various countries around the world experienced problems in their election processes caused by e-voting or i-voting practices. It was observed that the system

was renounced in several countries that implemented it, because of the problems it posed, or due to the failure by political parties to reach an agreement on its use, or as the rates of participation were low. At this point, several studies revealed that specific problems were experienced in the American elections as well. A documentary titled “Hacking Democracy”, produced in the United States of America in 2006, made a tremendous impact. The documentary investigated the abnormalities experienced in the elections between 2000 and 2004, and it was shown that electronic voting machines were problematic, and that there were differences between the votes registered in some machines and the results yielded. As is understood, votes can be stolen by tempering with the software of such machines, and it would be enough to temper with the codes of the software in order to ensure that the candidate or party of choice wins.

“Man of the Year”, an American movie released in the same year, is also interesting in that it shows that it is possible to manipulate an election through electronic voting machines. The speeches delivered on political issues during his show by the protagonist of the movie, a famous talk show host, created colossal repercussions in the public, after which he independently ran for the American presidency with the support of the people, and he won the election as the software codes of the electronic voting machines were tempered with. Despite being nothing more than fictional, the movie in question served as a good indicator that electronic voting systems can create chaotic situations when tempered with.

When compared to other countries in terms of the rates of participation in elections, Turkey has a high rate. Different effects will likely to occur in a currently on going process in the event that Turkey implements the electronic voting systems, which approximately 30 countries across the global are already implementing or trying to implement.

The system being hacked, external interventions that the system might be exposed to, the risks of any political party of choice comes to power by tempering with the codes of the system would always affect the attitudes and behaviors of the voters. Moreover, there is a high risk that election boards are dependent, and that the governments that come to power can manipulate the system through such boards.

For instance, Rahul Gandhi, a senior congress member, opposes Prime Minister Norendra Modi during the election campaign held in India in November 2020. During the meetings and rallies he organizes, Gandhi names electronic voting machines “The Modi Voting Machines” [9]. As is seen, it can be claimed that the system can also be manipulated in India, which is shown as the biggest democracy of the world thanks to its population, and that the votes are altered and stolen in favor of the government.

It is predicted that electronic voting would not be initially preferred by the voters in Turkey, and that the rates of participation would be at low levels in the event that it is designated a mandatory voting form, which in turn would bring along a political chaos, unless a system is developed, which can eliminate all these negative factors and which can never be doubted in respect of reliability.

## References

1. Alvarez, R. M., Katz, G., & Pomeres, J. (2011). The impact of new technologies on voter confidence in latin America: Evidence from E-voting experiments in Argentina and Colombia. *Journal of Information Technology & Politics*, 8, 199–217.
2. Brown, T. A. (1997). Nonlinear politics. Chaos theory in the social science foundations and applications, Ed. Kiel, L. D., Elliot, E., USA: The University of Michigan Press.
3. Daver, B. (1993). *Siyaset Bilimine Giriş*. 5. Baskı, İstanbul: Siyasal Kitabevi.
4. De Cook, D., Preneel, B. (2007). Electronic voting in Belgium: Past and future. E-Voting and Identity, First International Conference, VOTE-ID 2007, Eds: Ammar Alkasser, Melanie Volkamer, Germany.
5. Farazmand, A. (2003). Chaos and transformation theories: A theoretical analysis with implications for organisation theory and public management. *Public Organization Review: A Global Journal*, 3, 339–372.
6. Gleick, J. (1995). *Kaos Yeni Bir Bilim Teorisi*. Ankara: TÜBİTAK Popüler Bilim Kitapları.
7. Haspara, M., Imran, A., & Turner, T. (2016). E-voting in developing countries, current landscape and future research Agenda. Electronic Voting First International Joint Conference, E-Vote-ID 2016, Eds: Robert Krimmer, Melanie Volkamer at al, Austria, Switzerland: Springer.
8. Hisamitsu, H., Takeda, K. (2007). The Security Analysis of E-Voting in Japan. E-Voting and Identity, First International Conference, VOTE-ID 2007, Eds: Ammar Alkasser, Melanie Volkamer, Germany.
9. Indianexpress.com, Bihar Polls: Rahul Calls EVMs ‘Modi Voting Machines’, But Says Even MVMs Can’t Stop Grand Alliance from Winning, <https://indianexpress.com/elections/bihar-elections-rahul-gandhi-narendra-modi-nitish-kumar-evm-mvm-grand-alliance6941651/>, Accessed November 10, 2020.
10. Kışlalı, A. T. (2000). *Siyasal Sistemler, Siyasal Çatışma ve Uzlaşma*. 5. Baskı, Ankara: İmge Kitabevi.
11. Kiel, L. D., & Elliot, E. (1997). Introduction. Chaos Theory in The Social Science Foundations and Applications, Ed. Kiel, L. D., Elliot, E., USA: The University of Michigan Press.
12. Kumar, S., & Walia, E. (2011). Analysis of electronic voting system in various countries. *International Journal on Computer Science and Engineering (IJCSE)*, 3(5), 1825–1830.
13. Ruelle, D. (1994). *Rastlantı ve Kaos*. Ankara: TÜBİTAK Popüler Bilim Kitapları.
14. Smith, R. G. (2002). Electronic voting: Benefits and risks. Trends & Issues in Crime and Criminal Justice Series, Australia: Australian Institute of Criminology.
15. Solvak, M., & Vassil, K. (2016). *E-Voting in Estonia: Technological Diffusion and Other Developments Over Ten Years (2005-2015)*. Estonia: Johan Skytte Institute of Political Studies.

# The Use of Life Story Analysis in Selection and Development of Qualified Human Resources



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**Abstract** In today's world dominated by chaos and complexity, behaviors such as change, renewal, transformation, adaptation, development, learning and flexibility are critical reflexes for organizations. In organizations, people who will exhibit such reflexes are qualified and leader managers. Deciding on the selection and development of these people is vital for organizations. Life story analysis can be used as a criterion for organizations in the selection and development of human resources who are qualified and have to leadership characters such as CEO, general manager, coordinator and director. With this method, the life story of the candidate can be examined and an idea can be obtained about the management development and abilities. Life story analysis can reveal managerial skills gained from experience and life events such as critical life events, memories, milestones, struggles, people who affect life, religious-moral-political and social values, principles, activities and habits. This method can also provide a better recognition and understanding of the person whose development is desired. Thus, it can be used for the solution of career problems and career development. This method is applied by having a face-to-face interview with the person whose life story will be analyzed. The data obtained as a result of the interview is analyzed in accordance with qualitative, narrative and life story researches. As a result of the analysis, inferences about the candidate's life story and reflections on management development are obtained. This study aims to provide a framework for using life story analysis as an evaluation criterion in the selection and development of qualified manpower.

**Keywords** Human resources management · Personnel selection · Training and development · Life story analysis · Manager's development · Qualified and leader manager

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## Introduction

Today, it is not possible to handle organizations in a mechanical structure that is closed to their environment, unaffected by their environment, and not interacting with their environment. With the understanding of the importance of the human factor, organizations have begun to be considered as social systems that communicate and interact with their environment.

From now on, organizations must adopt flexible structures that are affected by their environment, affect their environment, adapt to their environment or adapt their environment to them. Especially in times of chaos where everything affects everything, continuous change and transformation is experienced, irregular and unpredictability comes into questions, and in complex conditions where mutual relationship, interaction and commitment gain importance, this has become a necessity.

One of the strategies of organizations to cope with chaos and complexity is to have managers with leadership skills. These managers, who can be expressed as qualified managers, must be fast, intuitive, flexible, analytical, able to manage emotions, have higher communication and persuasion, adaptive, innovational, transformational, assertive, able to see the big picture, think analytically, be learning-oriented, development-oriented and alert.

The abilities of the managers, whose selection or development will be decided, cannot be understood only by talent tests, interviews or exams. To discover critical life events, milestones, struggles, people, experiences in the lives of candidates whose choice or development will be decided, and to reveal what managerial skills they have acquired from their lives may be another option for organizations.

Life story analysis is one of the ways to achieve this. Life story analysis, which is a self-verification method [72], focuses on the lives, experiences and events in their lives by applying to the managers themselves, whose choice or development will be decided. With this aspect, life story analysis can provide an advantage in the selection and development of qualified human resources.

This study proposes that life story analysis can be used for the selection and development of qualified human resources. This issue, especially, is more important in today's conditions where chaos and complexity prevail. For this reason, chaos, complexity and its effects on organizations are emphasized first. Later, the subjects of qualified human resources, life story analysis, manager selection and development were discussed. Finally, a suggestion was made on the use of life story analysis in the selection and development of qualified human resources.

## Chaos, Complexity and Organizations

The word *chaos* means emptiness, abyss, flexibility, opening up, no boundaries and absolute disorder. The *chaotic system*, derived from the word chaos, refers to systems

that are incompatible, disordered and unpredictable. The concept of *complexity* is an excerpt from the words intertwined and ivy. Complexity refers to an environment in which systems are interrelated, interacting, and connected [32, 47, 75].

The essence of the concepts of chaos and complexity arising from the nonlinear science approach is that everything is in a relationship with each other, relationships are constantly changing, and small things can produce big results by creating a snowball effect [91]. While chaos theory is more concerned with the order in disorder [79: 46], complexity theory deals with how order can be created from a complex and dynamic system [53: 13].

Occurrence of unexpected situations and resulting in chaos or complexity in variable and dynamic environmental conditions have become common developments for organizations [85]. For this reason, chaos and complexity theories aim to be prepared for changing conditions and turn crisis into opportunity [46: 67].

The biggest aim of organizations is to make their lives sustainable and to maintain their competitive advantage. Especially in today's business world where chaos and complexity prevail, organizations have to maintain their competitive structures by providing an order in disorder and a simplicity in complexity. For this reason, the agenda of organizations is on finding searches that will increase the chance of life and competitiveness in the long term.

In this quest, "the evolutionary change theory of biological species" put forward by Darwin draws attention. In this view, non-adaptive and vulnerable species will be threatened by environmental changes. For this reason, they need to make a change and transformation in harmony with their environment in order to survive [36, 94: 29]. Darwin's theory has been adapted to management and business literature. Organizations, just like biological species, should adapt to environmental elements and make necessary changes in their structures according to these elements. These reflexes are very important in today's conditions where chaos and complexity prevail.

Due to the developments in the fields of communication, information and technology and the conditions created by global competition, organizations have shifted their focus to the relations between the environment and the organization instead of issues such as profitability, performance, rationality, efficiency and productivity [47: 363]. Because the adaptation of organizations to the environment and the changes and transformations to be made within the organization accordingly have become more vital for organizations.

Social, technological, economic and cultural changes and globalization drive organizations to think and act on an international and global scale. As a result, organizations and action areas began to become chaotic and complex. Because chaotic behaviors are the result of complex systems [37, 59].

As a result of this new adaptation approach adopted by organizations, organizations are no longer closed to their environment, but have become structures that interact and communicate with their environment. While organizations were seen as machines that were closed to their external environment, effective and efficient, nowadays, they are seen as living organisms that interact with their external environment, can adapt to their environment or adapt their environment [40: 225].

According to this approach, organizations must act as adaptive systems, renew constantly, change, develop and establish new relationships in order to survive [82]. Organizations will only be able to survive in this way, in complex and disordered relationships.

## What is Qualified Human Resources?

Qualified human resources for organizations are middle and senior managers, who mostly work at the top of the management pyramid. In addition to these, newly emerged and increasingly widespread use of executive, CEO, C-level officers, president, vice president, executive vice-president, director, coordinator, leader, coach, mentor, supervisor, facilitator, enabler and sponsor are in qualified human resources. Table 1 summarizes the definitions, duties and titles of these manager types.

## What is Life Story Analysis?

Life story analysis, which is used as a method in subjects such as human behavior [57], identity development and human life [50], motivation [30], clinical studies [83], is used in many disciplines such as psychology, sociology and education.

Life story analysis, which enables to see individuals' lives differentially [18], can be expressed as recording personal experiences and comments in the face of situations and events through the interview technique and collecting information about the lives of individuals [39]. Life story analysis is defined as the manifestation and expression of events perceived and interpreted by the storyteller [71]. Atkinson [5] states that life story research can provide clues about the biggest struggles, successes and failures of the individual, their most meaningful values and life searches.

The life story method, a type of narrative approach, is a technique with various benefits. These benefits are Atkinson [5: 127–128]; (1) To clarify feelings and experiences, and to give meaning to experiences, (2) To increase the knowledge, belief and respect related to person whose life is being studied, (3) To ensure that valuable experiences and insights are shared with others, (4) To provide inner peace and satisfaction through sharing stories, (5) To expose and heal boredom and grief by telling stories, (6) To inspire others, (7) To provide the opportunity to be known by others with aspects they have never known and noticed before, (8) To provide opportunities to persons to understand the story and how they want to tell and end stories better, and (9) To provide them with a better perspective on their future goals by understanding their past.

McAdams [51, 52] developed an *interview format* and provided a framework for how life story research should be done. He says that it is possible to divide the lives of individuals into three periods as childhood, adolescence and adulthood, McAdams

**Table 1** Definition, title and duties of qualified managers

Senior executives	They are at the top of the organization. They can hold titles such as chairman of the executive board, general manager, chairman, coordinator, chairman, CEO, mayor, governor, rector, undersecretary, minister, provincial director. These managers have duties such as determining the vision, mission, purpose, goals and policies of the organization, making environmental analysis and evaluation of the business, and producing long-term plans and strategies
Mid-level managers	They are found between lower and upper level managers. They act as a bridge between upper and lower level managers. Usually they manage the functions of the business. They have titles such as manager, assistant manager, department, factory manager/head/supervisor, project leader, director, regional/production/sales manager, dean, secretary general and auditor. They detail the goals, strategies and policies for lower-level managers. And they direct, coordinate and supervise lower level managers for implementation
Manager	They are the managers who directly manage and control the employees
Administrator	In English literature, it is used instead of the term manager
Executive	It means senior manager. They have duties such as showing direction and determining strategy
CEO	It stands for chief executive officer. The CEO is the executive at the top of an organization. Definitions such as executive director, senior manager, top manager, strategically authorized general manager, general coordinator, group chairman, chairman of the board of directors, chairman of the executive board, company chairman are used instead of the CEO. These managers are the highest authorized person responsible for all activities. They take care of the coordination and strategic plan of all business lines
C-level officers	Managers with other C-tier titles except CEO. They can work in an equal position, in coordination with the CEO, or as assistant CEO. It has uses such as COO: Chief Operating Officer, CECO: Chief Ethics and Compliance Officer, CFO: Chief Financial Officer, CMO: Chief Marketing Officer, CIO: Chief Information Officer and CTO: Chief Technical Officer
COO	It stands for chief operating officer. It is seen that it is used as general manager, president and authorized operational manager. It is responsible for the execution of daily work and activities, and the supervision of the units
CECO	It stands for chief ethics and compliance officer. It is responsible for ensuring and supervising the company's activities to comply with ethical principles and international rules
President	President means company president and general manager. It has uses in the form of vice president and executive vice-president. Executive vice-president means senior/first assistant general manager. They have more authority and responsibility than other assistants

(continued)



**Table 1** (continued)

Director	In Turkish, it is used as a member of the board of directors as well as as a director of HR, Purchasing or Marketing. The managing director is the general manager responsible for daily activities. The executive director is used to mark a higher level position. This title refers to the senior director, the executive members, the most authorized executives at the top of the organization or the members of the board of directors
Coordinator	Instead of actually doing things, they control the people who actually do things. In Turkish, it has uses such as general coordinator, HR coordinator
Leader	They are people who drag, influence, direct, mobilize, motivate others for a certain purpose. There are uses in Turkish such as leader, leader-manager, manager-leader
Coach	Coaches are the managers who guide promising managers. It works for learners to gain new knowledge and skills. It makes comments, gives feedback, motivates. It works to reveal the potential and development of its followers. These managers set examples for the work to be done, answer questions, criticize, warn and make suggestions
Mentor	Mentor is a reliable and experienced teacher who trains, educates, guides, gives information and support, and advises inexperienced managers in order to increase their knowledge and skills. They have duties such as being a role model, gaining professional knowledge and behavior, socializing and consulting
Supervisor	They are expert, knowledgeable, experienced and advisory managers, whose opinions and suggestions are taken for consultation purposes in order to make more accurate decisions
Facilitator	They are people who prepare an environment and opportunity for managers to be more successful and help them for their career development
Enabler	They are the people who strive to increase the performance and qualifications of the employees to higher levels and provide possible conditions for this
Sponsor	They are the people who support young and inexperienced managers to take more responsibility and authority, to be promoted and to gain power

*Resources* Akdemir [2: 155–157], Barutçugil [11: 24], Besler [14: 15], Bingöl [15: 305], Boone and Kurtz [16: 219], Bozeman and Feeney [17], Can and Güney [19: 145], Çakırcı [88: 126], Çınar [90], Diñer and Fidan [27: 45–46], Güney [38: 138], Hart [41], Karalar [43: 14, 194], Koçel [47: 69–70, 99 and 193–195], Koçel [48: 209–211], Mirze [55: 40–41], Özalp [92: 531], Parsloe and Wray [63], Paşaoğlu [64: 11], Raymond [65: 246], Robbins et al. [68: 5–6], Şimşek [95: 108–116], Tuncer et al. [95: 172], Ulukan [81: 112]

mentioned that each period can have its own low and high moments, successes and mistakes, struggles and victories.

The format determined by McAdams is as follows with main headings; (1) Life episodes (childhood, youth, adulthood, old age, etc.), (2) Critical life events (the best and bad experiences, turning points that cause radical changes in life, the most meaningful, unforgettable, positive and negative childhood memories, adulthood memories, wise decisions, religious and spiritual experiences etc.), (3) Future scenario

(hopes and plans for the future, life project etc.), (4) Life struggles (biggest struggles, health problems, crisis, difficulties, losses, breakups, mistakes, failures, regrets, etc.), (5) People, groups and institutions that influence the life story, (6) Individual ideology (religious, moral, political and social values, etc.), (7) Life philosophy and (8) Reflections. Questions about family characteristics, environment, upbringing and style, cultural environment, when and how managerial skills were first discovered, first management experience, meaning attributed to management, management motivation, principles, activities and habits can also be added.

There are some recommendations for successful life history research. These recommendations are as follows [28]; (1) Participants should be evaluated within the culture they live in, (2) The importance of the family should not be denied in reflecting the culture, (3) Experiences from childhood to adulthood should be conveyed in an interrelated whole, (4) Social situation should not be seen as an important factor, (5) Life story should be interpreted and conceptualized, and (6) Life story should be organized and presented.

Also, there are critical points to be considered in life story research. These critical points are Dolard [28]; (1) Life story is a cultural event, (2) Life story should be considered under the influence of culture, (3) When conducting life history research, it is important to pay attention to impartiality and scientificity, (4) Life history research should be done considering who it was written for and the aim, and (5) The purpose of writing should not be forgotten when conducting a life history research.

Life history research is a method that takes place in the atmosphere of free conversation, and consists of a series of in-depth face-to-face interviews for one or two hours, of open-ended questions to learn about the life of the individual and allows the person to reconstruct his past memories [18]. In the narrative process of life story research, some issues should be sensitive. These subjects are follow; Bulut [18]; (1) Participants should be encouraged about their stories, even if their lives are full of unpleasant events. (2) Measures should be taken against psychological risks that may occur in sensitive subjects. (3) Participants should be prepared for the interview process in advance. (4) In order to get richer content and be explanatory, the interview should be interfered by intervening where necessary. (5) However, if possible, the interview should be left to its natural course without any intervention.

Gürbüz and Şahin [39: 423] emphasized that there is no standard approach in the classification, analysis and interpretation of data in life story studies. Nevertheless, attempts can be made to reveal findings, inferences and generalizations related to the research subject life. In the life story technique, determining a research question and taking a specific event or phenomenon as a basis will be useful properly to interact with the people to be included in the sample [39: 423]. For this, structured tools can be used as data collection technique in life story research, and unstructured tools can also be used as well.

## Selection and Development of Qualified Human Resources

*The selection of managers* is made to find the most suitable managers for the needs of the business. While doing this, it is necessary to look at the qualifications of the candidate. Organizations should take care in doing this work. Because a wrong choice can cause vital consequences for the organization. Incorrect selection means loss cost and time for the organization. For this reason, businesses use a variety of selection methods to find managers with the appropriate qualifications for the job. *Intelligence, knowledge, expertise, skill, achievement, interest, motivation, attention, awareness of responsibility, personality and competence tests, written and oral exams, interviews and reference control* are among the most used methods.

*Ability tests* measure the mental and physical skills and competencies possessed to do a job [78: 71–72, 89: 81]. *Knowledge tests* are tests performed on subjects such as grammar and expertise, which are conducted to reveal the knowledge that managers have already learned [78: 71–72]. *Intelligence tests* are performed to measure the verbal and numerical skills and intelligence capacity required to do a job. Intelligence tests measure intellectual abilities such as understanding, comprehension, memory, interpretation, comparison and reasoning. However, intelligence tests measure mental abilities such as memory, verbal and numerical fluency [78: 71–72, 56: 81, 80: 381].

*Personality (psychological) tests* are performed to determine whether the candidates have personality traits that are suitable for the requirements of the job, or not. Personality tests are applied to detect personality traits such as introversion, balance, and determination. Psychological tests use measurement tools such as California Psychological Inventory, Minnesota Personality Inventory, Big Five, Cattell 16 PF Personality Factor and Hogan Personnel Selection Series [56: 181]; Tonus, [78: 71–72; 89: 81]. *Interviews* are conducted to get information on subjects such as experience, past performance, skills, education, interest and stress control. Interviews are conducted in depth or superficially, with structured or unstructured questions.

The issue of *managers' development* can be considered as an organizational activity that aims to help managers adapt to variable environmental conditions, gain flexibility, renewal, increase their knowledge, skills and experience, and be more useful to the organization. The purpose of developing managers is to encourage managers to be promoted to higher levels, to get to know managers better, and to increase the skills and knowledge of managers.

Management development programs can be implemented on the job or outside of the work. *On-the-job programs* are coaching, mentoring, consulting, delegation, stunt, rotation, assignment in projects, learning from each other and role models. *Programs applied outside of work* are case studies, role playing, games, volunteer work, research-presentation, business plan preparation, simulation, T group, outdoor trainings, conference-seminar, brainstorming, experience sharing and reading-watching programs. It can also be applied in the form of *distance learning (e-learning)*.

*Coaching* is the process of guiding managers who have potential and are valued. Coach teaches his followers new knowledge and techniques, mediates their achievement of their goals, trains, watches, guides, prepares them for difficulties, makes suggestions to them, corrects their mistakes [56: 187, 93: 219, 95: 107–108]. *Mentoring* is the consultancy of an experienced and expert manager with techniques such as accompaniment, inculcating belief, mediation and demonstration for the development of inexperienced managers [95: 111–113]. *Consultancy* is the provision of options and suggestions based on expertise to managers whose development is desired [95: 114].

In *role playing technique*, in order to create a realistic situation, for a problem and its solution in business life, the participants are asked to do their work pretending to be managers. In the *case study method*, sample cases and problems are prepared and the participants are asked to produce definitions, analyzes and solutions [10: 189, 89: 110, 56: 96]. *Professional meetings* are programs such as seminars, workshops, congresses, symposiums, conferences. With this technique, it is tried to increase the knowledge, experience and qualifications of managers by ensuring their participation in these programs.

Managers should have knowledge and skills about the situations, problems, tasks and jobs they will manage and organize. The source of this skill not only depends on the education and training acquired through formal means, but also depends on the manager's intuition, natural inclinations and life experiences [58: 3–8]. Researchers such as Shamir et al. [71], Bennis [13], Gibbons [35], Avolio and Gibbons [9], DiPaolo [26] report that management and leadership skills are acquired later.

As it is seen, even if the development of the manager is generally handled from an organizational point of view, this is not a sufficient point of view. Because the manager's development process is a lifelong process. The development of managers depends on the experience, knowledge and skills gained from life story elements such as critical events, struggles, turning points in the past life, as well as organizational training and development activities. That is, managerial knowledge and skills are something learned through experience or training over time. The development of managers should be considered as a process in which a manager acquires the ability to manage in formal or informal ways.

## **The Use of Life Story Analysis in the Selection and Development of Qualified Human Resources**

Humans are beings who continue to learn from cradle to grave. *Lifelong Learning Theory* states that the learning process is not limited to any period of their lives, on the contrary, it is a process that lasts throughout life [70: 19]. Accordingly, individuals can learn something in the future just as they learnt from experiences and events in their past lives.

According to *Super's Self (Role) Theory* conveyed by Taylor and Giannantonio [76]; the interaction of environmental factors such as culture, economic factors, social factors and living conditions with the knowledge, experience and skills gained throughout life is important in career choice and career development. As cited by Anne [3] and Erdoğan [31], *Bordin's Psychoanalytic Career Choice Theory* and *Roe's Personality Development Theory* point out that childhood games, experiences and family characteristics affect career choice and development.

According to Kegan [44: 220], life stories can offer managers an opportunity to behave uniquely, interpret reality, and give personal meaning to their actions. Adler [1], supporting this interpretation, stated that there is no such thing as random moments in human life. Adler stated that every person chooses and uses those that will benefit their development from their lives and experiences. According to Adler, these make up the life stories of people. Individuals keep and use their life stories in order to take them into accounting, to warn and console them, not to deviate from their goals, not to make mistakes again, not to regret and to make their lives easier in the future.

Ruderman and Ohlott [69: 7–20] think that interests, roles and responsibilities out of work life can be used as creative and supportive resources to become a better and successful manager. Namely; activities done after work such as team captainship, collecting donations, and taking part in volunteering projects contribute to the skills and development of managers. In addition, such activities provide support in matters such as psychological support, trust, risk taking, motivation and learning. Ruderman and Ohlott [69: 7–20] emphasized that if we are aware of roles and experiences outside the work containing important lessons in terms of management development, they can turn into a laboratory used to master management skills. If inspiration is learned from these lessons, it can support subjects such as human relations, multitasking and gaining leadership skills.

Life events and experiences have a formative and transformative effect on individuals. A turning point, critical event, moment of break, difficulty or struggle that occur at any time in life may cause sudden or cumulative changes in individuals. The formation of a sense of self, the emergence of management or leadership ability, and a radical change in life can be given as examples of changes.

There are studies that support this view. Triggering life events [42], life struggles [45, 71], and challenging trials [12] affect leadership and management development. Researchers such as Restine [66] and Thomas and Cheese [77] talk about the contribution of traumatic experiences, direction, early leadership and management experiences on leadership and management development.

In addition to these studies, Atwater et al. [6] found that life experiences are related to both the emergence of leadership skills and the effectiveness of leadership skills. Bennis and Nanus [12] theoretically argued that most effective managers and leaders are skilled in learning from their experiences. Again, Zaleznik [87] stated that early life experiences contribute to individuals becoming managers and leaders. DiPaolo [26] stated that early socialization experiences are the basis for the development of leaders. Avolio [7] found a relationship between some life experiences such as

school experience and positive work experiences and transformational leadership development.

Critical and triggering events such as the loss of an important person, health problem, financial crisis, a major promotion, career change, reading a unique leadership book, meeting an inspiring person [8, 33, 49], life experiences such as childhood experiences, past management experiences, family, culture, education, work experience [33]; individual narratives such as personal life stories [62, 72, 74] contributes to management or leadership development.

Shamir et al. [71] and Shamir and Eilam [72] found that life characteristics, experiences, beliefs and values contribute to leadership development. Luthans and Avolio [49] stated that life events and experiences, no matter how tragic or negative, can be formative. Authentic leadership is influenced by past challenges, experiences and events.

According to the research conducted by Mücevher [60]; life story elements such as family, habitat, upbringing, critical life events, milestones, struggles, persons, groups and organizations, individual ideologies, activities, habits and first managerial ability discoveries are decisive in the development of successful managers. According to the research, the life stories of the managers bring managerial skills, learning-development focus, action-orientedness, character-virtue, reputation, environmental acquisition and personal development.

As can be seen, it is very important to focus on the critical life events and experiences in the life stories of the managers in the selection and development of qualified managers. As stated in the sections above, the format developed by McAdams [51, 52] can be used as the interview form in life story analysis.

Additionally, George et al. The interview form put forward by George et al. [34] can be used. According to this form, in order to discover the way and basis needed to become an authentic leader, a manager can be asked the following questions about his life; (1) What are the persons and experiences that affect early life?, (2) What are the tools used for self-definition?, (3) What are the deepest values?, (4) What are the extrinsic and intrinsic sources of motivation?, (5) Are their lives integrated? (Is it the same people in lives such as individual, business, family and society?), (6) What is the meaning of being authentic?, and (7) What are the steps to be taken today, tomorrow and in the following years to develop leadership?

After this point, *how to analyze the obtained data* comes into questions. Ultimately, life story analysis is a qualitative research method. For this reason, first of all, the analysis, validity and reliability steps of qualitative research should be followed. However, the life story method is a type of narrative research that is a pattern of qualitative research. For this reason, analysis steps in narrative research should be followed in life story analysis.

*In narrative research, data analysis and presentation*, it is beneficial to follow the procedures shown in Table 2 [24: 190–191];

The data collected in narrative researches are analyzed in order to reveal the story told, the chronology of the events, turning points or manifestations [24: 189–193]. (1) Story structure approach [84], (2) Three-dimensional space approach [20], (3)

**Table 2** Data analysis and presentation processes for narrative research

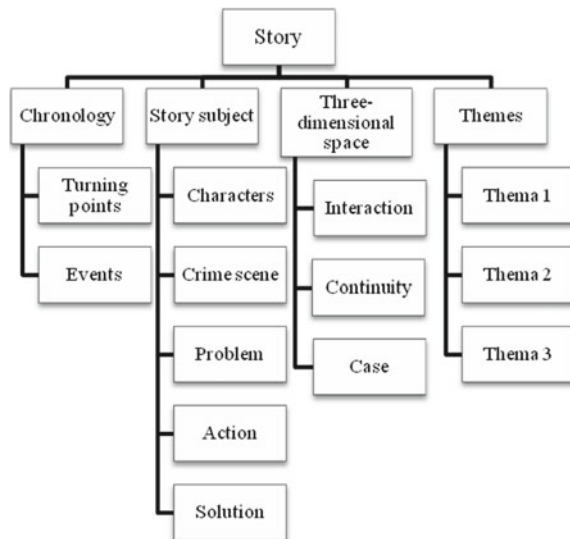
Steps	Things to do
Data organization	Creating files for data, editing data
Reading, taking short notes	Reading the text, getting edge notes, creating precode
Describing data within codes and themes	Describe the story or series of experiences and place them chronologically
Classifying data within codes and themes	Identifying stories, finding milestones, defining contextual materials
Interpreting the data	Interpreting the broader meanings of the story
Presenting, visualizing data	The narrative; presenting with a focus on processes, theories and unique-general features of life

Chronological approach [25], or (4) Four analytical data analysis typologies [67], the desired goal can be achieved by choosing one of the ways.

Or, one of my narrative analysis approaches suggested by Elliot [29] can be preferred. These approaches are; (1) Content-focused approach (deals with the content of the story, i.e. events and experiences told in the story.), (2) Structure-oriented approach (deals with the form or structure of the story), and (3) an approach that focuses on the realization or performance of the stories (where stories are created, told, and it deals with the interactional and institutional contexts in which it is consumed).

In Fig. 1, it is possible to see the *analysis approaches and strategies* that offer different ways of analysis for narrative research [24: 207].

**Fig. 1** Coding template for narrative research



It is useful to explain some of them briefly. In *the story structure approach*; data are analyzed through five elements of the story structure. These factors are: character, crime scene, problem, activities and solution [84]. According to *the three-dimensional space approach*, analysis is performed by emphasizing interaction (personal and social), continuity (past, present and future) and situation elements (spaces) [20]. *The chronological approach* is applied to reveal the stories and milestones emerging from the individual's diaries or interviews and to develop a chronology of life. The chronological approach explores stages or experiences such as childhood, marriage, and work. In this way, the chronological approach tries to determine the factors that shape lives [25].

In the *four analytical data analysis typologies*, Riessman [67] put forward, the data are analyzed using one or more of thematic analysis, structural analysis, dialogic analysis and presentation analysis methods. *Thematic analysis* is the analysis of what the participants said by analyzing the content of the interview data. *Structural analysis* focuses on how a story is told. *Dialogical analysis* is the production of the story based on the dialogue and mutual interaction between the researcher and the participant. *Presentation analysis* is the analysis of the gesture, facial expressions and body language used by the participant while presenting her story.

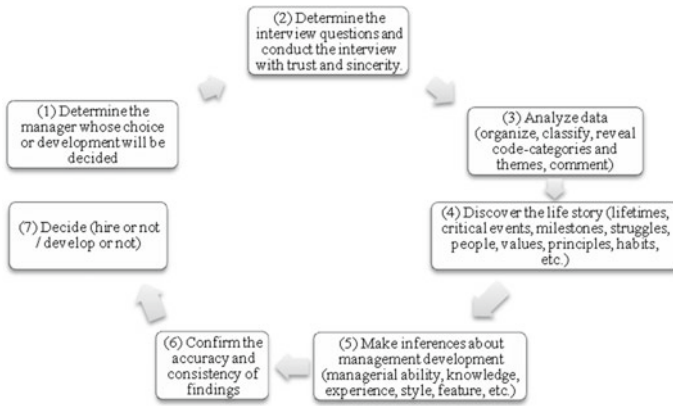
The researcher can use any of these analysis approaches. However, while doing this, care should be taken to evaluate the *validity* and *reliability* of the findings. Creswell and Miller [23: 124–129] proposed a strategy consisting of eight steps to ensure validity; (1) Long-term participation and continuous observation, (2) Triangulation, (3) Peer review, (4) Negative situation analysis, (5) Explanation of researcher bias, (6) Member control, (7) Rich, intense description, and (8) External audit (expert review).

Using at least two of these strategies is sufficient for validity [24:250–253, 86: 265–269]. *Long-term participation and continuous observation* refer to the researcher's long-term interaction with data sources. *Triangulation* is done in order to reveal different perspectives and sources on the subject under investigation. This means that multiple and different sources, methods, researches and theories provide evidence to document a code or theme.

*Peer inquiry* refers to the control of the research process by an outside person. *The explanation of the bias of the researcher* is the comment of the researcher on past experiences and prejudices. *Rich and dense description* gives details when describing a situation or writing about a theme. *External audit* is the review and evaluation of both the research process and the research results by an expert.

For *reliability*, consensus among coders (consistency analysis) [24] and field notes [73] can be used. Or, as in validity strategies; triangulation, expert examination, determining the position of the researcher and checking technique [54: 213] can be used. *Consensus among coders* is done to look at the research from an outside perspective. Multiple encoders are used in the analysis of data to check the consistency of the researcher [24: 272, 86]. *Confirmation examination* means that an external expert compares the raw data with the research results [86: 272]. *Field notes* can be expressed as keeping interview notes about the participants and keeping a researcher diary throughout the research process.





**Fig. 2** Systematic of life story analysis in the selection and development of qualified managers

In summary, in Fig. 2, an analysis systematic is proposed regarding the use of life story analysis method in the selection and development of qualified human resources, in order to summarize the subject and to reveal the steps to be followed.

## Result

Especially, changes and developments in the fields of technology, information and communication in particular inevitably organizations affect as well as all social, cultural and economic structures. Therefore, organizations show various reflexes to keep up with the developments and changes in their environment. These reflexes can be in the form of adapting to the environment (being affected by the environment) or adjusting the environment (affecting the environment).

Because organizations have to either create or catch up with the changes. Organizations that fail to display one of these two reflexes are doomed to disappear. Therefore organizations must be cautious against environmental factors. Because in environmental conditions where confusion and complexity are continuous, the environment can be mixed and changed at any time. For this reason, organizations that have to continue their activities in variable, complex and chaotic environments should be prepared against the situations they will face.

In order to be made of these preparations, organizations need qualified manpower that can overcome chaotic and complex situations, solve crises and problems, and take necessary measures. In this context, organizations should adopt a chaotic and complexity-oriented approach and take care in the selection and development of qualified human resources.

While deciding on the selection and development of qualified human resources, the use of life story analysis method is an issue that needs to be emphasized for organizations that want to protect and maintain their competitive structures, especially in

variable, chaotic and complex environments. Because in today's conditions where chaos and complexity are determinant, organizations need managers who are able to adapt to changing environmental conditions, and are flexible, innovative, learning and development-oriented, good human relations, strong persuasive, able to manage emotions, predictive, proactive, determined, sociable, taking initiative, brave and strong intuitions.

If we look closely, specified qualifications are some of the characteristics required in leading people. Essentially, leadership is one of the functions of successful management. Because if a manager desires to achieve his goals, he must influence, motivate, guide, persuade, drag his followers, that is, he leads them. Especially, in today's businesses where team organizations are increasing, the way of success passes through leaders-managers.

Life story analysis is a method that should especially be emphasized in the selection and development of leader-managers. Everyone has a life story. When someone is asked to talk about himself, he begins to tell a chronological or complex story. Life story analysis is based on systematically analyzing, uncovering, scrutinizing and making various inferences about everyone's already existing stories. The implications may be different for everyone. What matters is that life stories give them what kind of skills, knowledge, experience and competence. In this respect, it may be important to refer life story analysis for qualified human resources whose selection or development will be decided by organizations.

In this study, it is suggested that the life story analysis, which allows making inferences about managerial competencies and development by examining the lives of managers, should be used as an evaluation criterion for the selection and development of qualified manpower.

Supporting this view, Cochran [22] claims that stories help to find meaning in life, the story told helps to make sense of past events, the life story can be used for ensuring of career development and solve of career problems. Already, *narrative approach technique* has been used as an organizational career development practice [61: 112]. According to this method, they (managers) are asked to create life stories so that the personnel, to be developed, are known and understood better, and express themselves better.

Also, while coaching and mentoring methods are used for the manager whose development and training is desired, it is seen that *my story technique* is used to be understood of the life and the career of the person. It is understood that this technique is applied to establish a bridge between the past life and the future life of the manager who is desired to develop or grow, and to reverse his mistakes, regrets and failures [4: 162].

Clutterbuck and Megginson [21], in the story to be told; they stated that the subject of the story, subtopics, people in the story, place, environment, culture, moral values, alternatives, dilemmas, failures and successes can be included. As it is seen, *the story (narrative) approach* is a method that has started to be used in about the development of qualified managers and is becoming increasingly important.

As it is seen, *life story analysis*, which is tried to be explained in detail and presented as a framework in this study, is a promising technique that is suitable for being used in the selection and development of qualified human resources.

## References

1. Adler, A. (2011). *The meaning and purpose of life* (K. Şipal, Trans.) (9th ed.). Istanbul: Say Publications.
2. Akdemir, A. (2014). *Business in new economy and new world*. Istanbul: Umuttepe Publications.
3. Anne, R. (1957). Early determinants of vocational choice. *Journal of Vocational Psychology*, 4(3), 212–217.
4. Atak, S. (2014). Mentoring and coaching techniques and applications. In A. L. A. Ç. Ali Erkan (Ed.), *Training and development in human resources management*. Ankara: Seçkin Publications.
5. Atkinson, R. (2002). The life story interview. In J. F. Gubrium & J. A. Holstein (Eds.), *Handbook of interview research: Context and method* (pp. 121–140). Thousand Oaks, CA: Sage.
6. Atwater, L. E., Dionne, S. D., Aviolo, B. J., Camobreco, J. F., & Lau, A. W. (1999). A longitudinal study of the leadership development process: Individual differences predicting leader effectiveness. *Human Relations*, 52(12), 1543–1562.
7. Avolio, B. J. (1994). The “Natural”: Some antecedents to transformational leadership. *International Journal of Public Administration*, 17(9), 1559–1581.
8. Avolio, B. J. (2005). *Leadership development in balance: Made/born*. Mahwah, NJ: Lawrence Erlbaum Associates.
9. Avolio, B. J., & Gibbons, T. C. (1988). Developing transformational leaders: A life span approach. In J. A. Conger & R. N. Kanungo (Eds.), *The Jossey-Bass management series, charismatic leadership: The elusive factor in organizational effectiveness* (pp. 276–308). San Francisco, CA, US: Jossey-Bass.
10. Baraz, A. B. (2013). *Recruitment and human resources training, in human resources management* (R. Geylan, & H. Zümrüt Tonus, Ed.), Eskişehir: Anadolu University Publications.
11. Barutçugül, İ. (2006). *Manager's management*. Istanbul: Kariyer Publications.
12. Bennis, W., & Nanus, B. (2007). *Leaders* (2nd ed.). New York: Harper Collins.
13. Bennis, W. (2003). *On becoming a leader* (Updated and Expanded Ed.). New York: Basic Books.
14. Besler, S. (2012). *Management science-I* (S. Besler and Ö. Oktal, Ed.) (1st ed.). Eskişehir: Anadolu University Publications.
15. Bingöl, D. (2013). *Human resources management*. Istanbul: Beta Publications.
16. Boone, L. E., & Kurtz, D. L. (2013). *Contemporary business* (A. Yalçın, Trans. and Ed.) (14th ed.). Istanbul: Nobel Publications.
17. Bozeman, B., & Feeney, M. K. (2007). Toward a useful theory of mentoring: A conceptual analysis and critique. *Administration and Society*, 39(6), 719–739.
18. Bulut, S. (2014). Life story inquiry. *International Journal of Human Sciences*, 11(1), 880–895.
19. Can, H., & Güney, S. (2011). *General business* (2nd ed.). Ankara: Siyasal Publications.
20. Clandinin, D. J., & Connelly, F. M. (2000). *Narrative inquiry: Experience and story in qualitative research*. San Francisco: Jossey-Bass.
21. Clutterbuck, D., & Megginson, D. (2005). *Techniques of coaching and mentoring*. UK: Elsevier Butterworth-Heinemann.
22. Cochran, L. (1997). *Career counseling: A narrative approach*. Thousand Oaks, CA: Sage.
23. Creswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory Into Practice*, 39(3), 124–130.
24. Creswell, J. W. (2016). *Qualitative inquiry and research design: choosing among five approaches* (M. Büttin, & S. B. Demir, Trans. and Eds.) (3rd ed.). Ankara: Siyasal Publications.

25. Denzin, N. K. (1989). *Interpretive biography*. Newbury Park, CA: Sage.
26. DiPaolo, D. G. (2002). Voices of leadership. *Journal of Leadership Education*, 1(2), 62–76.
27. Dinçer, Ö., & Fidan, Y. (2012). *Introduction to business management*. Istanbul: Alfa Publications.
28. Dollard, J. (1935). *Criteria for the life history, with analysis of six notable documents*. New Haven: Yale University Press.
29. Elliot, J. (2005). *Using narrative in social research: Qualitative and quantitative approaches*. Londra: Sage.
30. Emmons, R. A. (1986). Personal strivings: An approach to personality and subjective well-being. *Journal of Personality and Psychology*, 51, 1058–1068.
31. Erdoğan, N. (2003). *Career development theory and practice*. Ankara: Nobel Publications.
32. Etimolojiturkçe. (2020). Access place. Retrieved November 15, 2020, from <https://www.etimolojiturkce.com/>.
33. Gardner, W. L., Avolio, B. J., & Walumbwa, F. O. (2005). *Authentic leadership theory and practice: Origins, effects and development* (vol. 3). Gulf Professional Publishing.
34. George, B., Sims, P., McLean, A. N., & Mayer, D. (2007, February). Discovering your authentic leadership. *Harvard Business Review*.
35. Gibbons, T. C. (1986). *Revisiting the question of born vs. Made: Toward a theory of development of transformational leaders*. Doctoral Dissertation, The Fielding Institute, Access place: Proquest.
36. Gould, S. J. (1977). *Ever since Darwin*. New York: Norton.
37. Gökmen, A. (2009). Balanced scorecard: BSC Oluşturma Süreci ve Uygulama Yöntemi. *Hitit University Institute of Social Sciences Journal*, 2(1), 11–23.
38. Güney, S. (2015). *Human resources management*. Ankara: Nobel Publications.
39. Gürbüz, S., & Şahin, F. (2016). *Research methods in social sciences: Philosophy-method-analysis* (3rd ed.). Ankara: Seçkin Publications.
40. Gürsakal, N., & Gürsakal, G. (2004). *Social sciences and chaos, 2nd national chaos, logic*. Mathematics and philosophy symposium booklet, 49. Istanbul: Istanbul Kultur University Publications.
41. Hart, E. W. (2009). *Seven keys to successful mentoring*. Greensboro, NC: Center for Creative Leadership.
42. Janson, A. (2008). Extracting leadership knowledge from formative experiences. *Leadership*, 4(1), 73–94.
43. Karalar, R. (2009). *General business: Basics*. Functions, Izmir: Meta Publications.
44. Kegan, R. (1983). *The evolving self: Problem and process in human development*. Cambridge, MA: Harvard University Press.
45. Khaleelee, O., & Woolf, R. (1996). Personality, life experience and leadership capability. *Leadership and Organization Development Journal*, 17(6), 5.
46. Koçel, T. (2004). *Business management*. Istanbul: Beta Publications.
47. Koçel, T. (2011). *Business management* (13th ed.). Istanbul: Beta Publications.
48. Koçel, T. (2015). *Business management* (16th ed.). Istanbul: Beta Publications.
49. Luthans, F., & Avolio, B. J. (2003). Authentic leadership development. In K. S. Cameron, J. E. Dutton, & R. E. Quinn (Eds.), *Positive organizational scholarship: Foundations of a new discipline* (pp. 241–258). San Francisco, CA: Berrett-Koehler.
50. McAdams, D. P., & Ochberg, R. L. (1988). *Psychobiography and life narratives*. Durham, NC: Duke University.
51. McAdams, D. P. (1995). *The life story interview*. Northwestern University, Revised: 1995. Retrieved February 7, 2019, from <https://www.coursehero.com/file/6036675/LifeStoryInterviewRevised-McAdams95/>.
52. McAdams, D. P. (2008). *The life story interview*. The Foley Center for the Study of Lives Northwestern University, Revised: February 2008. Retrieved February 7, 2019, from <https://www.sesp.northwestern.edu/foley/instruments/interview/>.
53. McDaniel, R. R., & Driebe, D. J. (2001). Complexity science and health management. *Journal of Advances in Health Care Management*, 2, 11–36.

54. Merriam, S. B. (2015). *Qualitative research: A guide to pattern and practice* (S. Turan, Trans. and Ed.). Ankara: Nobel Publishing.
55. Mirze, S. K. (2014). *Introduction to business*. Istanbul: Literatür Publishing.
56. Mirze, S. K. (2019). *Introduction to business* (6th ed.). Istanbul: Literatür Publishing.
57. Mischel, W., & Shoda, Y. (1995). A cognitive-affective systems theory of personality: Reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychological Review*, *102*, 246–268.
58. Morgan, G. (2006). *Images of organization*. Sage.
59. Mutlu, A., & Sakıncı, İ. (2006). Chaos in management. *Journal of Istanbul Kultur University*, *4*(3), 1–12.
60. Mücevher, M. H. (2019). *Vital stories from successful managers*. Istanbul: Hiper Publishing.
61. Niles, S. G., & Harris-Bowlsbey, J. (2013). *Career development interventions in the 21st century* (F. K. Owen, Trans. and Ed.). Ankara: Nobel Publishing.
62. Northouse, P. G. (2013). *Introduction to leadership: Concepts and practice* (2nd ed.). Thousand Oak, California: Sage Publications Inc.
63. Parsloe, E., & Wray, M. J. (2000). *Coaching and mentoring: Pratical methods to improve learnig*. London: Kogan Page.
64. Paşaoğlu, D. (2013). *Management and organization* (C. Koparal, & İ. Özalp, Eds.). Eskişehir: Anadolu University Publishing.
65. Raymond, A. N. (1999). *Training and development of human resources* (Çev. Canan Çetin). İnsanbul: Beta Publishing.
66. Restine, L. Nan. (1997). Experience, meaning and principal development. *Journal of Educational Administration*, *35*(3), 253–264.
67. Riessman, C. K. (2008). *Narrative methods for the human sciences*. Los Angeles, CA: Sage.
68. Robbins, S. P., Decenzo, D. A., & Coulter, M. (2013). *Fundamentals of management: Basic concepts and applications* (A. Ögüt, Trans.) (8th ed.). Istanbul: Nobel Publishing.
69. Ruderman, M. N., & Ohlott, P. J. (2004). *Taking lessons from life; transforming life experiences into leadership experiences* (G. Günay, Trans.). Istanbul: UKM Publishing.
70. Sevinç, A. (2014). Lifelong learning and learning organizations. In *Training and development in human resources management* (A. E. Alaç, Trans.), Ankara: Seçkin Publishing.
71. Shamir, B., Dayan-Horesh, H., & Adler, D. (2005). Leading by biography: Towards a life-story approach to the study of the leadership. *Leadership*, *1*(1), 13–29.
72. Shamir, B., & Eliam, G. (2005). What's your story? A life-stories approach to authentic leadership development. *The Leadership Quarterly*, *16*, 395–417.
73. Silverman, D. (2013). *Doing qualitative research* (4th ed.). Los Angeles: Sage.
74. Sparrowe, R. T. (2005). Authentic leadership and the narrative self. *The Leadership Quarterly*, *16*(3), 419–439.
75. TDK. (2020). Retrieved November 15, 2020, from <https://sozluk.gov.tr/>.
76. Taylor, M. S., & Giannantonio, C. M. (1990). *Vocational guidance* (C. L. Cooper, & I. T. Robertson, Eds.). *International Review of Industrial and Organizational Psychology*, *5*, 281–323.
77. Thomas, R. J., & Cheese, P. (2005). Leadership: Experience is the best teacher. *Strategy and Leadership*, *33*(3), 24.
78. Tonus, H. Z. (2013). Recruiting. In R. Geylan & H. Zümürüt Tonus (Eds.), *Human resources management*. Eskişehir: Anadolu University Publications.
79. Tosun, T. (2006). *Derivative instruments, chaos theory application of fractal structures in futures time series*. Marmara University Banking and Insurance Institute Master's Thesis, Istanbul.
80. Tuncer, D., Ayhan, D. Y., & Varoğlu, D. (2014). *General business information* (6th ed.). Ankara: Siyasal Publications.
81. Ulukan, C. (2015). *General business* (Z. Erdoğan, & A. Hepkul, Ed.) (5th ed.). Eskişehir: Anadolu University Publications.
82. Vergilil Tüz, M. (2001). *Self-organization behavior in chaos environment*. Istanbul: Alfa Publications.

83. White, M., & Epston, D. (1990). *Narrative means to therapeutic ends*. New York, NY: Norton.
84. Yussen, S. R., & Ozcan, N. M. (1997). The development of knowledge about narratives, issue in educational psychology: Contributions from educational. *Psychology*, 2, 1–68.
85. Yüksel, M., & Esmer, Y. (2019). Chaos approach in business management: A theoretical overview. *OPUS—International Journal of Society Studies*, 12, 937–952.
86. Yıldırım, A., & Şimşek, H. (2011). *Qualitative research methods in the social sciences*. Ankara: Seçkin Publications.
87. Zaleznik, A. (1977). Managers and leaders: Are they different? *Harvard Business Review*, 15, 67–78.
88. Çakırer, M. A. (2013). *Business administration*. Bursa: Ekin Publications.
89. Çetin, C., Arslan, M. L., & Dinç, E. (2015). *Human resources management* (4th ed.). Istanbul: Beta Publications.
90. Çınar, Z. (2007). Coacing ve mentoring. *Paradoks Journal*, 3(1), 1–25.
91. Çıraklı, Ü., Dalkılıç, S., & Hacıhasanoğlu, T. (2017). Chaos theory, complexity theory, complex adaptive systems: A review from a healthcare. *Perspective*, 3(16), 330–343.
92. Özalp, İ. (2014). *Business administration*. Ankara: Nisan Publishing.
93. Özer, M. A. (2011). *Management and managers in the 21st century* (2nd ed.). Istanbul: Nobel Publishing.
94. Ülgen, H., & Mirze, S. K. (2007). *Strategic management in business*. Istanbul: Arıkan Publications.
95. Şimşek, A. (2013). Development methods. In A. Şimşek, & H. Zümürüt Tonus (Eds.), *Training and development in business* (2nd ed.). Eskişehir: Anadolu University Publications.

# The Chaos in Syria in Terms of Human Security



İdris Turan

**Abstract** Syria has been in a state of chaos since March 2011. Having responded to the first demonstrations of the opposition with an armed attack, Bashar al-Assad was neither fully powerful nor able to eliminate the chaos. International and regional powers such as Russia, USA, Iran and Turkey have not or have failed to resolve the crisis. Therefore, there is a full state of chaos in the country. The USA has strengthened the YPG/PKK in the region and created a terrorist corridor. Russia has solidified its fortifications at the Port of Tartus and guaranteed its presence in the Middle East. Iran has backed Assad and sent fighters against the opposition. Turkey, on the other hand, has supported the opposition and, with the help of the Syrian National Army, fought against the YPG with the operations of Operation Euphrates Shield, Olive Branch Operation and Operation Peace Spring. In addition, the Astana Trio (Russia, Turkey and Iran) have made attempts to soften the chaos in Syria. The human security approach is one that is centered on protecting human rights. This approach is based on the elimination of threats to human rights and freedoms. The overall objective of the human security approach is to protect individuals from any threat. In this context, the Humanitarian Development Report in 1994 listed threats in seven areas: Economic security, food safety, health security, environmental security, personal security, community security and political security. Consequently, it can be observed that there has been a state of chaos in Syria since March 2011. There is a terrorist corridor in northern Syria occupied by the US-backed YPG/PKK. Furthermore, there are also opposition groups supported by Turkey. Thus, the north of Syria is outside Assad's control.

**Keywords** Syria · Chaos · Human security approach

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## Introduction

After the death of Hafez al-Assad on June 10, 2000 [21], his son Bashar al-Assad came to rule by giving hope for Syria. The reason for this is that Assad was a leader who had internalized Western values to some extent. Forming close relations with Turkey, Assad vacationed in Turkey with Recep Tayyip Erdoğan and his family. In the context of these positive relations, Assad promised to Erdoğan that he would make democratic and libertarian reforms in Syria. Syrian society also demanded such democratic developments.

When the reform-demanding demonstrations began in March 2011, Assad responded to the demonstrators by armed attacks. Although Turkey initially tried to persuade Assad to make reforms, it then began to follow a strategy to dismiss Assad.

In this vein, Turkey started to support the opposition and is continuing to support these groups. Turkey in particular supports the Syrian National Army (SNA) and is conducting operations with the SNA.

In addition, Turkey has created a safe zone in Idlib together with Russia. However, Russia has strategies for Assad to remain and has supported Assad in this line. Moreover, Iran has also supported Assad to obtain power. The USA, on the other hand, has created a terrorist corridor in northern Syria and is trying to be permanent in Syria. It is a handful of dissidents and Turkey who want Assad gone. Turkey is planning a Syria without Assad for humanitarian reasons. Additionally, there is a belief that Syria would be managed by Turkey, if a Sunni government came to power in Syria.

Within this framework, this study will first investigate the human security approach, and then analyze the US position in Syria, Turkey's operations in Syria and the Astana Trio. The study will then be completed with the conclusion and evaluation.

## The Human Security Approach

Throughout history, state systems have undergone changes to center on human rights, freedom and democracy. The human security approach is based on human rights. The human security approach was mentioned in the United Nations Development Programme (UNDP) Developing Report in 1994 [31]. According to this report, human security is based on eliminating bad situations in human rights and freedoms. In this regard, human security is universal and it should be rendered applicable to other countries rather than only developed countries [29].

In the broad definition of human security, there is a need to save people/person against any threat [29]. According to this perspective, human security is the liberation of humans, i.e. protection of human life and protect from threats [19]. Humanity must also be protected from wars, disasters or collapsed states [20]. The human security approach is centered on the individual/human [36: 160]. In this context,



human security is meant to protect human existence from threats about economic, environmental, health, food and political issues [10]. In 1994, the Humanitarian Development Report specified seven areas of threats pertaining to human security. These are economic security, food safety, health security, environmental security, personal security, community security and political security [28, 44].

Economic security means to ensure that individuals have the economic freedom to achieve honorable living standards. Food safety highlights the need for people to eat healthily. In health security, centers (such as hospitals) where people's health problems are solved are required to operate actively in a country. Environmental security requires protection of the living environment of people and other creatures. Personal security is meant to protect a person from physical or psychological violence. In community security, on the other hand, individuals must be able to become members to any community and not harmed for this reason. Finally, in political security, people living in a country must be able to govern themselves through democratic methods.

In the United Nations (UN) Human Security Commission's 2003 report, human security is defined as freedom from fear and oppression as well as freedom of acting on one's behalf [16: XIX]. The freedom of next generations to live on the planet was also added to the definition of the human security concept in the UN Millennium Report dated April 3, 2000 [46]. Moreover, liberation from poverty, political oppression [48] and organized violence were also mentioned in the report [30: 122].

The human security approach focuses on issues such as armed conflict, scarcity, poverty, human trafficking, disasters, terrorism, human rights violations and handles them as security threats [17: 26].

UNDP has determined four fundamental characteristics pertaining to human security [17: 29]:

- Human security is universal and is about all nations' people.
- Human security issues in a region affects people in other regions as well.
- Human security can be guaranteed via proactive measures.
- Human security takes human in a center.

The concept of human security is closely related to money issues, sphere and security [11]. As former US president Benjamin Franklin said, "If we compromise our freedom for our security, we can ensure neither our freedom nor our security" [12]. If President Franklin had said that today, he would have emphasized the prevalence of human security in world politics.

## Chaos in Syria

Means of chaos can be determined as a disorder and turbulence [1: 33]. "...it has its own to power generate a change. Chaos theory is subfield of mathematics normally but it has different application to physics, engineering, economics and social sciences. It was first proposed by Poincare in 1880s." [1: 33].

Lorenz found chaos theory when he was trying to make weather prediction in 1961. Through his analysis attempt, he noticed that even the minor differences in initial conditions give completely different results. In other words, Lorenz noticed that this small amount of changing and its effect will be huge in the system. So, chaos is very dependent on its initial conditions it famously called “butterfly effect” which suggest that flutter of butterfly’s wing in Beijing can be responsible for producing hurricane in South America [1: 33]

Syria has been in chaotic environment since March 2011. An event in Dera pushed all country into a storm. It was like butterfly effect. A small protest was crushed by guns by Esad’s army. And protests are increased in all around country. Syria’s situation in these days can be seen as follows.

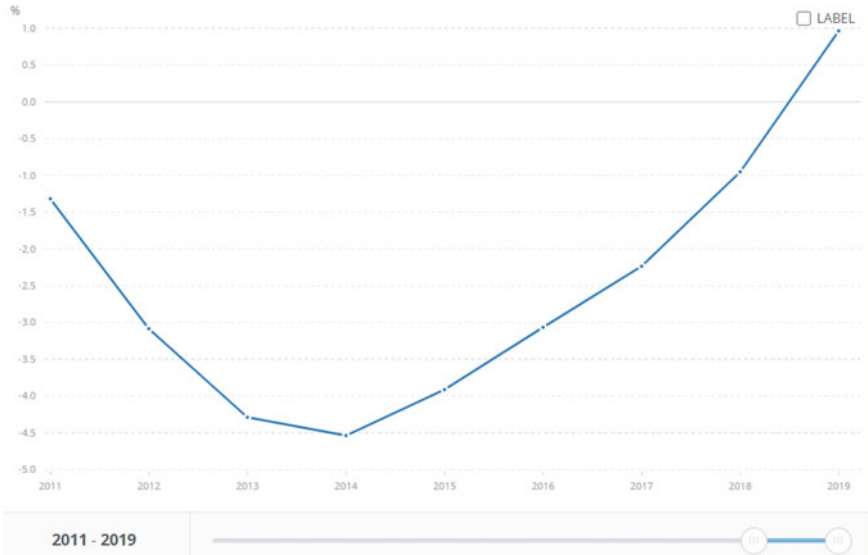
Syria’s situation before 2011 was as follows: Syria is a country with an area of 185,180 km<sup>2</sup> and a population of 18.3 million according to the 2003 census [27]. In Syria, with a population of 21,262,529 in 2010, the population fell to 21,082,966 in 2011, and saw its lowest point in 2018 with 16,906,283, while the population was 17,070,135 in 2019 [41]. About 90% of Syria is Arab, 9% Kurdish and the rest is Circassian and Turkmen [27]. 74% of the population is Sunni Muslim, 12% is Alawite, 10% is Christian, and the rest are Druse, Jewish, Pagan, Yezidi [27].

According to September 10, 2020 figures, the number of Syrian citizens who are asylum seekers is 5,560,618: Turkey (3,616,735), Lebanon (880,414), Jordan (658,756), Iraq (243,011), Egypt (130,045) and the remaining 31,657 are in various other countries [45]. Hence, about 25% of the population consists of asylum seekers.

As can be seen in Fig. 1, the population of Syria, which had negative population growth from 2011 to 2019, has started to grow positively in 2019. This means an increase in the number of asylum seekers returning to the country in 2019. As a matter of fact, according to a source of data, the number of asylum seekers who voluntarily left Turkey for Syria after Euphrates Shield and Olive Branch Operations was 190,000 in Basın İlan Kurumu [7]. According to Interior Minister Süleyman Soylu’s statement on September 19, 2019, 354,000 asylum seekers returned to Syria [15]. In 2014, when the civil war escalated, the population decline rate was 4,537%, according to the figure.

Before the civil war in Syria, bribery was everywhere. Partisanship (Baath fandom) and favoritism was exorbitant. There were torture practices and media restrictions. Bashar al-Assad’s armed response to the demonstrations that began in Deraa on March 15, 2011 [33] light the touch paper of the crisis. Afterwards, the dissidents began to organize. The most effective group among the opposition is the Syrian National Army (SNA). The SNA was formed in December 2017 [9]. The SNA opposes both Assad and the YPG/PKK (People’s Protection Units—*Yekîneyên Parastina Gel*/Kurdistan Workers’ Party—*Partiya Karkerên Kurdistanê*) [6].

The chaos in Syria has the influence of groups such as the USA-YPG/PKK, Russia-Assad, Iran-Assad and Turkey-SNA. The USA wants to be permanent in Syria by providing military and economic support to the YPG/PKK (also known as the Syrian Democratic Forces (SDF)). On the other hand, Russia desires to keep Assad in power due to its bases in Tartus and Latakia as well as their geostrategic significance. Iran wants Assad to stay, since the corridor leading to Hezbollah runs



**Fig. 1** The rate of change in Syria's population from 2011 to 2019 (%) (The population decreased from 19,584,274 in 2013 to 18,715,672 in 2014) (The World Bank [41]). *Source* The World Bank [42]

through Syria. Turkey, on the other hand, wants Sunni Muslims to come to power and plays the card for Assad to leave. Furthermore, Turkey takes into account the human dimension of the chaos. The reason for this is that Turkey hosts close to four million asylum seekers in its country.

### The USA and YPG/PKK in Syria

The United States of America (USA) is allied with the SDF, which the YPG/PKK<sup>1</sup> has formed by renaming itself, and has provided them with thousands of containers (33,000 trucks according to 2019 figures [38]) of weapons and weapons equipment, as well as military training. In addition, the USA has trained a group of 70,000 people to create a Kurdish region [35].

The USA has carried out military operations in Iraq and Afghanistan, and has not been willing to pay such a price in Syria. Thus, it has attempted to create a terrorist corridor in Syria through YPG/PKK. However, as a result of Turkey's operations, this corridor lost its way to the Mediterranean Sea and the SDF acquired a place in northeastern Syria. The oil wells there have been entrusted to the YPG/PKK and an oil deal has been made between the USA-based company Delta Crescent Energy LLC and the SDF [5].

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<sup>1</sup> For the organic link between YPG and PKK terrorist organizations, see: Çalışkan [14].

In the past, the USA directed its policies in the region with the PKK. Nonetheless, the USA later chose to help the YPG/PKK as the PKK's recognition as a terrorist organization and aiding it would harm the USA in terms of international law. In other words, the PKK has been replaced by the YPG/PKK. It seems that the USA will endeavor to stay permanently in the region by means of SDF (i.e. YPG/PKK).

## Turkey in Syria: Turkey's Syria Operations

With the Operation Euphrates Shield in 2016, the Olive Branch Operation in 2018 and the Operation Peace Spring in 2019<sup>2</sup> [6], Turkey has been taking control of northern Syria by taking some regions left from the YPG/PKK and from ISIS (Islamic State of Iraq and the Levant) in Syria. This secure line is approximately 220 km [35]. Turkey conducted these operations with the SNA (Arabs, Turkmens [6] and Kurds—Kurdish Falcons—[9] and previously with the Free Syrian Army (FSA). Turkey carried out these operations in northern Syria, where the PYD (The Democratic Union Party-*Partiya Yekîtiya Demokrat-PYD*) organized with the Kurdistan Communities Association (*Koma Civakên Kurdistan-KCK*) including Al-Jazeera, Ayn al-Arab and Afrin [35]. Turkey completed these operations in accordance with Article 51 of the United Nations (UN) Charter (right to self-defense) and other resolutions taken at the UN.

### *Operation Euphrates Shield*

On August 24, 2016, Operation Euphrates Shield began in the west of the Euphrates River with Turkish Armed Forces (TAF) and FSA forces [35]. The objectives of the operation are as follows [40].

To ensure the safety and security of citizens by taking ISIS away from the border area, to ensure Turkey's territorial integrity and sovereignty, to provide public support for the Turkish Armed Forces, to ensure international dialogue, to turn the international media in its favor in the fight against terrorism, to prevent the PYD/YPG (People's Protection Units) from forming a de facto autonomous region by combining the territories it controls in northern Syria, to guarantee Turkey's access to the Middle East and the Arab world in the long term, to strengthen Syria's position on the political solution table, to form a 40 km-wide and 90 km-long "security zone" in northern Syria in order to be able to prevent the influx of Syrian asylum seekers to Turkey and to prepare opportunities for the return of Syrians in Turkey to Syria. It is intended with the security zone to disconnect the two cantons created in Syria and to ensure the territorial integrity of Syria through the Operation and to prevent the spread of terrorism.

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<sup>2</sup> For the legal basis of these three operations, see: İnce [22].

With Operation Euphrates Shield, Turkey has shown that it exists in the region and has strengthened its hand at the table.

### ***The Olive Branch Operation***

On January 20, 2018, TAF and FSA began operations in Afrin [35]. The objective of the operation was to “defuse the PKK/KCK/PYD-YPG and ISIS terrorists in Afrin region in northwestern Syria” [8]. The reasons for the operation are described by the Prime Minister’s Office of Public Diplomacy Coordinator as follows [26]:

- To ensure that an area of 10,000 km<sup>2</sup> is penetrated by the FSA,
- To completely block the PKK strap aiming to reach the eastern Mediterranean,
- To eliminate the possibility of Turkey’s geographical disconnect from the Arab world,
- To ensure the security of our borders with Syria,
- To prevent PYD/PKK infiltration into Turkey through the Amanos Mountains,
- To prevent the terrorist organization from extending to the Mediterranean and from there to the world,
- To ensure the security and continuity of the Euphrates Shield,
- To take control of the Tel Rifat region and ensure the return of civilians to their homes,
- To prevent the US support for terrorist organizations,
- Afrin is critical in ensuring the security of Turkey’s border provinces and protecting the Euphrates Shield,
- The presence of terrorist organizations in Afrin means that the whole of Kilis province and most of Hatay province are within firing range of terrorist organizations,
- Turkey sees the merger of Afrin and Kobani as the most important pillar of the “Kurdish corridor” project.

With the Olive Branch Operation, Turkey has acquired a place in the field in northwestern Syria.

### ***Operation Peace Spring***

On October 9, 2019, Operation Peace Spring was launched by TAF and SNA [35]. The goal of the operation was to establish a security zone in northern Syria with a depth of 32 km and a width of 444 km [37]. Erdoğan described the purpose of the operation as follows: “Our goal is to destroy the terrorist corridor that is being created on our southern border and to bring peace and welfare to the region” [22]. The date on which this operation ended has not been officially announced [22] (Fig. 2).



Fig. 2 The situation in Syria after May 25, 2020 following the operations. Source Congressional Research Service [13]

### Astana Trio in Syria: Russia, Turkey and Iran

Syrian dissidents and Syrian Government officials met for the first time in Astana on January 23, 2017, accompanied by guarantors in different rooms [43]. The common conclusion of the heads of state summits of the Astana Trio (Russia, Turkey, Iran) was that Syria’s territorial integrity had been the most important issue [3]. The summits of the three heads of state were as follows: November 22, 2017 (Sochi/Russia), April 4, 2018 (Ankara/Turkey), September 7, 2018 (Tehran/Iran), February 14, 2019 (Sochi/Russia), and September 16, 2019 (Ankara Turkey). The sixth summit was held on July 1, 2020 by video conferencing method [4] (Fig. 3).



**Fig. 3** A photo of the Astana Trio heads of state meeting. *Source* Anadolu Ajansı [3]

### ***Russia and Syria***

In historical terms, the USSR (Union of Soviet Socialist Republics) became interested in Syria after World War II, and obtained a port in Tartus. Since then, Syria has been Russia's gateway to the Mediterranean and the Middle East. Another reason for the proximity between Syria and Russia is that the Baath Party, which stands close to the USSR, is in power in Syria [2].

Russia considers that the USA initiatives in Syria are based on weakening Iran and ensuring Israel's security in the region. In this case, Russia is doing its best to maintain Assad's presence in the region against the insidious plans of the USA. Moreover, the incidents in Syria are Syria's internal affairs and should not be intervened, according to Russia.

On September 30, 2015, Russia conducted an operation in Syria to support Assad [32]. Russia also obtained an air base in Latakia [2]. Russia backed Assad with weapons, vetoed bills against Assad in the UNSC (the United Nations Security Council), thereby increasing Assad's power, causing the Syrian civil war to be prolonged [2].

### ***Iran and Syria***

Good relations between Syria and Iran date back to the year 1979. Syria was left alone after other Arab countries reached a peace deal with Israel, and thus, Syria allied with Iran [25]. In addition, Hezbollah and Iran and Syria are allies due to sectarian



proximity [25]. Indeed, Iran has supported Assad in Syria since the beginning of the civil war. Furthermore, Iran has trained paramilitary groups in Syria [47]. Iran sent the Jerusalem Forces and also General Kasim Suleimani to Syria [47]. In addition, Iran transferred billions of dollars in resources to Assad [23]. Iran also made sure that Hezbollah send militants in support of Assad [23]. The reason for this policy is that the corridor leading to Hezbollah runs through Syria and Assad supports Iran's policies. In this regard, Iran's main goal is to keep Assad in power in Syria [34].

### *Turkey and Syria*<sup>3</sup>

Turkey has faced serious security problems due to the Syrian civil war that began in 2011. In addition, Turkey has so encountered severe sociological problems due to the Syrian asylum-seekers it hosts. Turkey's priority in Syria is to prevent the formation of a Kurdish terrorist corridor in the north [39]. Furthermore, Turkey is planning a Syria without Assad. Therefore, Turkey supports the opponent groups (especially FSA [24] and later the SNA) [33].

Before 2011, Assad promised Turkey that he would make democratic reforms. However, he broke those promises, and on top of that, he responded to the demonstrators with armed attacks in 2011. Hence, the relations between Turkey and Syria came to a breaking point their ties were severed. The reason for this is that Turkey is looking at the developments in Syria on a humanitarian basis. It is for this reason that Turkey has opened its doors to close to four million Syrian asylum seekers and has been meeting their needs for almost nine years.

Another reason that Turkey wants a Syria without Assad is its belief that a Sunni Syrian government could be established. Thus, it would be possible to have a Syria under the influence of Turkey rather than the influence of Iran [24].

If Turkey had looked at the situation from a realpolitik point of view rather than a humanitarian perspective, it would have made moves to destroy the Kurdish terrorist corridor in northern Syria by agreeing with Assad. Although Turkey has carried out three operations, it is not possible to completely destroy the YPG/PKK without a deal with Assad. Hence, Turkey should fight against the YPG/PKK while helping asylum seekers by protecting humanitarian sensitivities. This is required by Turkey's national interests.

## **Conclusion and Evaluation**

There has been a civil war in Syria for over nine years until September 2020. In this regard, Syria is a collapsed state. Preparations are undergoing for a new constitution.

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<sup>3</sup> To examine the historical dimension of Turkey-Syria relations, see: Ekşi [18].



Syria, on the other hand, is currently a fragmented structure. In the north, the USA-supported YPG/PKK (SDF with its new name) terrorists have assured dominance. SNA is located in northwestern Syria and west of the Euphrates River. Russia and Turkey have established a security zone in Idlib. Nevertheless, there has been chaos in Syria since March 2011 and there is a terrorist corridor in northern Syria occupied by the USA-backed YPG/PKK. There are also opposition groups supported by Turkey. Therefore, the north of Syria is outside Assad's control. Assad dominates about nearly half of Syria.

Assad is now the strongest candidate for presidency in Syria. The reason for this is that opposition groups are not in a position to unite and nominate a candidate. It is possible that Assad could be re-elected in the election, which will take place after the constitution is made.

The common concern of the Astana Trio is the territorial integrity of Syria. Gathering around this point, this trio can accelerate the preparation of the constitution. A UN Peace Force maybe deployed in Syria with a UNSC resolution as well.

- Looking from the perspective of human security, there has been a tragedy in Syria. Although there has been a certain softening after 2019, there is still a collapsed state.
- From the perspective of economic security, there has not yet been a stable economic order.
- In terms of food safety, people lack access to sufficient nutrition sources.
- In terms of health security, health centers are still not functioning properly or effectively.
- In terms of environmental security, it can be argued that Syria's environment is worn-out. Furthermore, Syria is need of zoning and public improvements.
- In terms of personal security, people are not able to walk on the streets freely and comfortably.
- In terms of community security, some communities and people are still otherized and attack due to their identities.
- In terms of political security, on the other hand, Syria does not have a constitution, and it is unclear when the elections will be held.

In order to get rid of the chaos environment, constitution agreed by groups in Syria must be prepared first. Then the natural resources in the country should be made available to the whole society in Syria. In order to do this, the terrorist corridor in the north must be eliminated.<sup>4</sup>other words, Erdoğan and Assad should go back to dialogue. Then the groups in the country need to be disarmed and a UN (United Nations) Peacekeeping Force must temporarily be placed in Syria. Followed by this, a government must be established by democratic elections. Then, initiatives should be started to ensure economic integration of Syria first with the countries in the region, and then with the international community. There are no safe living standards assured

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<sup>4</sup> Progress can be made in this regard with the joint work of Syria and Turkey. In other words, Erdoğan and Assad should go back to dialogue.

by the human security approach in Syria. If the above-given measures are taken, Syria can become a democratic and free country, and provide human security in the country.

## References

1. Açıklım, Ş. N., & Bölücek, C. A. (2014). Understanding of Arab spring with chaos theory—Uprising or revolution. In S. Banerjee, Ş. Ş. Erçetin, & A. Tekin. (Eds.), *Chaos theory in politics* (pp. 29–46). New York & London: Springer.
2. Akengin, H., & Yaşar, A. (2018). Suriye'nin Jeopolitik Konumu Bağlamında Suriye-Rusya İlişkileri. *Journal of Süleyman Demirel University Institute of Social Sciences*, 32, 25–57.
3. Anadolu Ajansı. (2019). Suriye için çözüm yolları beşinci kez Üçlü Zirve Toplantısında ele alınıyor. Retrieved from <https://www.aa.com.tr/tr/politika/suriye-icin-cozum-yollari-besinci-kez-uclu-zirve-toplantısında-ele-aliniyor/1584993>.
4. Anadolu Ajansı. (2020a). Türkiye-Rusya-İran Üçlü Videokonferans Zirvesi sonrası ortak açıklama. Retrieved from <https://www.aa.com.tr/tr/turkiye/turkiye-rusya-iran-uclu-videokonferans-zirvesi-sonrasi-ortak-aciklama-/1896124>.
5. Anadolu Ajansı. (2020b). Prof. Dr. Çaşın: ABD'li şirketin YPG/PKK ile yaptığı petrol anlaşması uluslararası hukuka aykırı. Retrieved from <https://www.aa.com.tr/tr/dunya/prof-dr-casin-abdli-sirketin-ypg-pkk-ile-yaptigi-petrol-anlasmasi-uluslararası-hukuka-aykiri/1932320>.
6. Azimov, H. Y. (2019). The emergence of the Syrian crisis and the impact of the external forces on it. *Bulletin Social-Economic and Humanitarian Research*, 4(6), 92–97. <https://doi.org/10.5281/zenodo.3594434>.
7. Basın İlan Kurumu. (2018). Türkiye'den ülkesine dönen Suriyeli sayısı açıklandı. Retrieved from <https://www.bik.gov.tr/turkiyeden-ulkesine-donen-suriyeli-sayisi-aciklandi/>.
8. Bayraktar, B. (2019). Suriye İç Savaşı Açısından Zeytin Dalı (Afrin) Harekatı. *Bilge Strateji*, 11(20), 51–66. <https://doi.org/10.35705/bs.751598>.
9. BBC. (2019). Barış Pınarı Harekâtı—Suriye Milli Ordusu nedir; ne zaman ve neden kuruldu? Retrieved from <https://www.bbc.com/turkce/haberler-dunya-49999444>.
10. Benedek, W. (2008). *Human security and human rights interaction* (pp. 7–17). Blackwell Publishing Ltd.
11. Bo, M. (2010). Comprehensive security: Challenge for China in the age of globalization. *Journal of US-China Public Administration*, 7(6).
12. Bozkurt, E., & Kanat, S. (2007). *Uluslararası Toplumun Paradoksu: Terörizm, İnsan Hakları, Güvenlik ve 11 Eylül Sonrası Meydana Gelen Değişiklikler*. Ankara: Asil Yayınları.
13. Congressional Research Service. (2020). *Armed conflict in Syria: Overview and U.S. response*. Report No: RL33487. Retrieved from <https://crsreports.congress.gov/product/pdf/RL/RL33487/169>.
14. Çalışkan, M. (2020). Suriye'de PKK Faaliyetlerinin Tarihî Arka Planı ve PYD Terör Örgütünün Siyasallaşma Çabaları. *Üsküdar Üniversitesi Sosyal Bilimler Dergisi*, 10, 63–91. <http://doi.org/10.32739/uskudarsbd.6.10.69>.
15. Demirkol, F. (2020). Kamu Diplomasisi Bağlamında Barış Pınarı Harekâtı. *Bartın University Journal of Faculty of Economics and Administrative Sciences*, 11(21), 72–87.
16. Edwards, A., & Ferstman, C. (Eds.). (2010a). *Human security and non-citizens*. UK: Cambridge University Press.
17. Edwards, A., & Ferstman, C. (2010b). Humanising non-citizens: The convergence of human rights and human security. In A. Edwards, & C. Ferstman (Eds.), *Human security and non-citizens*. UK: Cambridge University Press.
18. Ekşi, M. (2018). Türk Dış Politikasının Ultimo Ratio'su: Yumuşak Güçten Sert Güce Türkiye'nin Suriye Politikası. *Karadeniz Araştırmaları*, 15(60), 71–99.

19. Gharaibeh, F. A. (2011). Human security, terrorism and human rights in the middle east: Implications for social work practice. *European Journal of Social Sciences*, 20(2), 228–239.
20. Graf, R. (2010). Between national and human security: energy security in the United States and Western Europe in the 1970s. *Historical Social Research*, 35(4), 329–348.
21. Hürriyet. (2000). “‘Şam Aslanı’ öldü”. Retrieved from <https://www.hurriyet.com.tr/dunya/sam-aslani-oldu-39160555>.
22. İnce, G. S. A. (2020). Uluslararası Hukuk Bağlamında Fırat Kalkanı, Zeytin Dalı ve Barış Pınarı Harekâtları. *Malatya Turgut Özal University Journal of Business and Administrative Sciences*, 1(1), 65–92.
23. Juneau, T. (2020). Iran’s costly intervention in Syria: A pyrrhic victory. *Mediterranean Politics*, 25(1), 26–44. <https://doi.org/10.1080/13629395.2018.1479362>.
24. Kızılkcan, Z. B. (2019). Changing policies of Turkey and the EU to the Syrian conflict. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 33(1), 321–336.
25. Kışman, Z. A., & Boyraz, B. (2019). Suriye Bağlamında Rusya ve İran İşbirliği. *Adıyaman Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 31, 563–583.
26. Köylü, M. (2018). Suriye, PYD/YPG Yapılanması ve Zeytin Dalı Harekâtı. *ASSAM International Refereed Journal*, 11, 70–86.
27. Library of Congress- Federal Research Division. (2005). *Country profile: Syria*. Retrieved from <https://www.loc.gov/frd/cs/profiles/Syria-new.pdf>.
28. Mobley, A. (2011). Decarceration nation? Penal Down sizing and the Human Security Framework. *Mobley/Western Criminology Review*, 10–20.
29. Neag, M. M., & Coman, D. (2010). Dimensions of the human security concept. *Social-Behavioural Sciences Revista Academiei Forelor Terestre* (1).
30. Nicholson, F. (2010). Protection and empowerment: Strategies to strengthen refugees’ human security. In A. Edwards & C. Ferstman (Eds.), *Human security and non-citizens*. UK: Cambridge University Press.
31. Oberleitner, G. (2005). Human security: A challenge to international law? *Global Governance*, 11, 185–203.
32. Özalp, M. (2018). Türkiye’nin Suriye’ye Düzenlemiş Olduğu Fırat Kalkanı Operasyonu. *Bartın University Journal of Faculty of Economics and Administrative Sciences*, 9(18), 169–186.
33. Özden, H. (2016). Turkey and Syria from 2011 to 2013: from Intimacy to a Dilemma. *Turkish Studies: International Periodical for the Languages, Literature and History of Turkish or Turkic*, 11(2), 1029–1048. <https://doi.org/10.7827/TurkishStudies.9302>.
34. Piotrowski, M. A. (2017). Mosaic defence: Iran’s hybrid warfare in Syria 2011–2016. *The Polish Quarterly of International Affairs*, 3, 18–67.
35. Polat, D. Ş. (2020). Türkiye’nin Suriye’nin Kuzeyindeki Askerî Harekâtının Amaçları ve Sonuçları. *Güvenlik Stratejileri Dergisi*, 16(33), 53–96. <https://doi.org/10.17752/guvenlikstrj.719968>.
36. Roberts, D. (2010). *Global governance and biopolitics, regulating human security*. London & New York: ZedBooks.
37. Sağıncı, F., & Aras, İ. (2020). Körfez Arap Ülkelerinin Türkiye’nin Suriye’deki Barış Pınarı Harekâtı’na Yaklaşımı. *Journal of International Relations and Diplomacy*, 3(1), 44–56.
38. Sputnik. (2019). Erdoğan: YPG’ye 33 bin tır silah verildi, depoladıkları yerleri bulduk, topluyoruz. Retrieved from <https://tr.sputniknews.com/turkiye/201911221040679899-erdogan-ypgye-33-bin-tir-silah-verildi-depoladiklari-yerleri-bulduk-topluyoruz/>.
39. Stepanova, E. (2020). Russia’s foreign and security policy in the middle east: Entering the 2020s. *IAI (Istituto Affari Internazionali) Papers*, 20(16), 1–26. Retrieved from <https://www.imemo.ru/files/File/ru/events/2020/10062020/iaip2016.pdf>.
40. Taşdemir, F. & Özer, A. (2017). Kuvvet Kullanma Hukuku Açısından Fırat Kalkanı Operasyonu. *The Academic Elegance*, 53–70.
41. The World Bank. (2020a). *Syrian Arab Republic*. Retrieved from <https://data.worldbank.org/country/syrian-arab-republic?view=chart>.
42. The World Bank. (2020b). *Population growth (annual %)—Syrian Arab Republic*. Retrieved from <https://data.worldbank.org/indicator/SP.POP.GROW?end=2019&locations=SY&start=1961&view=chart>.

43. TRT Haber. (2019). *Dünden bugüne Astana görüşmeleri*. Retrieved from <https://www.trthaber.com/haber/dunya/dunden-bugune-astana-gorusmeleri-445403.html>.
44. UNDP. (1994). *Development Report 1994*. Retrieved from [http://hdr.undp.org/sites/default/files/reports/255/hdr\\_1994\\_en\\_complete\\_nostats.pdf](http://hdr.undp.org/sites/default/files/reports/255/hdr_1994_en_complete_nostats.pdf).
45. UNHCR. (2020). *Situation Syria regional refugee response*. Retrieved from [https://data2.unhcr.org/en/situations/syria#\\_ga=2.8459447.369758410.1600101423-703685059.1600101423](https://data2.unhcr.org/en/situations/syria#_ga=2.8459447.369758410.1600101423-703685059.1600101423).
46. United Nations. (2000). *The role of the UN in 21st century*. Retrieved from <http://www.un.org/millennium/sg/report/state.htm>.
47. Wastnidge, E. (2017). Iran and Syria: An enduring axis. *Middle East Policy*, XXIV, 2, 148–159.
48. Zwierlein, C., & Graf, R. (2010). The production of human security in premodern and contemporary history. *Historical Social Research*, 35(4), 7–21.

# Authentic Leadership in Health Employees: A Systematic Review



Gözde Yeşilaydın and Yasemin Hancıoğlu

**Abstract** This study was conducted in order to systematically examine the researches about authentic leadership in health employees, to determine the target groups and the concepts related to authentic leadership. Prisma method was used in this study. Researches on authentic leadership were obtained by Scopus and ISI Web of Science (WOS) databases. Studies with the words authentic leadership, health and nurse in the title were scanned. A total of 101 studies have been reached. Duplicate publications, studies whose publication language was not English, whose full text could not be accessed, samples of which were not health employees and without research articles were excluded from the study, and as a result, 42 studies were evaluated. It was determined that authentic leadership studies, which were examined in line with the inclusion criteria, started to be carried out since 2009. The survey method was used in most of the studies and the research design of the studies was planned quantitatively. The samples of more than half of the studies were nurses. Burnout, work engagement, trust, job satisfaction, and turnover intention were concepts associated with authentic leadership. In studies, a negative relationship was found between authentic leadership and burnout, turnover intention; a positive relationship was found between authentic leadership and work engagement, trust and job satisfaction. This study will be a guide for future studies, it is recommended to conduct researches in different healthcare professionals such as physicians, dentists, health administrator and also focus on qualitative studies.

**Keywords** Nurse · Authentic leadership · Health · Systematic analysis

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## Introduction

The effects of globalization, the pace of change in information and communication technologies, ever-increasing competition, the long-term survival of organizations in information societies, that is, their sustainability depends on revealing and developing the strengths of human capital. It can be argued that this is the main characteristic of positive psychology. It can be stated that the positive organizational behavior approach has emerged as a result of the implementation of positive psychology understanding in the organizational field, especially in all segments of the society, and the efforts of enterprises in this direction [4].

The developments occurring with the effects of the positive psychology approach in the field of management and leadership and the current leadership approaches, called positive leadership approaches, can be said to be among the remarkable issues of the twenty-first century. The authentic leadership approach is one of the basic positive leadership approaches. Authentic leadership places the concept of authenticity, which is defined as “being honest with oneself”, at its center and is based on reason, morality, and emotion [4].

Leadership has always been more difficult in challenging times than ever, but the stress factors faced by organizations around the world today require refocusing on what constitutes true leadership [1]. The adoption of a macro-level perspective, misuse of management, and some social difficulties faced by public and private organizations have all contributed to the recent interest in authentic leadership [18].

With ever-evolving technology, growing global competitive pressures, and an uncertain economic and ethical climate, leaders in various types and levels of organizations are faced with diminishing hope and confidence in themselves and their colleagues. However, comprehension of the necessary positive leadership, the development process, and its implementation remain inadequate in front of both leadership and emerging positive psychology fields [13: 241].

## Authenticity and Authentic Leadership Concept

The concept of authenticity (i.e. the idea of “being oneself” or “being honest with oneself”) has become the focus of the responsible behaviors of leaders. While authenticity was attributed only to leaders who “put themselves forward” in ancient Greece [6], the authenticity of leaders today is more broadly defined as the determination to take responsibility for personal freedom and organizational and social obligations. Thus, leaders can make choices that will help them build themselves as moral individuals [16: 64].

The concept of authenticity is defined as the “self-awareness in connection with one’s thoughts, feelings, beliefs, or needs” [9]. In other words, authenticity means what is true or correct [17]. Authentic leadership, on the other hand, is a leader behavior model that promotes a positive ethical climate and positive psychological

capacity and highlighting an internalized moral perspective, balanced processing of information, more self-awareness, and transparency in relationships [18].

Luthans and Avolio [13: 243] initially defined authentic leadership as “a process that takes advantage of both positive psychological capacity and organizational context”, argued that this process promotes positive personal development as a result of both more self-awareness and self-regulating positive behaviors of leaders and partners.

Shamir and Eilam [17: 399] defined authentic leaders as individuals with the following characteristics: (1) “Leader’s role is a central component of their self-concept, (2) they achieve a high level of self-determination or self-concept clarity, (3) their goals are compatible with themselves, and (4) their behaviors express themselves.”

Authentic leaders are self-confident, hopeful, optimistic, flexible, transparent, moral/ethical, and future-oriented and prioritize the development of employees to become a leader. They are loyal to themselves. They do not force their partners, i.e. their associates, and they do not try to persuade them to act rationally; instead, the authentic values, beliefs, and behaviors of the leader help shape the development of the associates [13: 243].

Authentic leaders exhibit a high degree of honesty, have a deep sense of purpose, and are committed to their core values [10]. Authentic leaders who exemplify high morality and inner integrity create deep loyalty in the eyes of their followers, contribute to the employees’ awareness of what they can achieve in terms of performance, and encourage them to be more determined [3].

The basic descriptive characteristics of authentic leaders can be specified as follows [7, 17]:

- Authentic leaders do not imitate leadership. For example, once they’re appointed to a management position, they don’t act as leaders because they’re in a leadership position.
- Authentic leaders do not take on leadership roles or participate in leadership activities for status, honors or other personal rewards. They have a value-based motivation or mission that they want to encourage, and they carry out leadership to promote that motivation or mission.
- Authentic leaders are original, not copies. This does not mean that they are necessarily unique or different in their personality traits. Their values, beliefs, motives, or missions may be similar in content to those of other leaders and their followers.
- Authentic leaders are those whose actions are based on their values and beliefs. What they say is consistent with what they believe, and their actions are consistent with both their discourse and their beliefs. Authentic leaders can be characterized as having a high level of integrity because they act according to their values and beliefs rather than to please the audience, gain popularity, or advance some personal or narrow political interests.

- Authentic leaders show a passion for their cause, consistently practice their values, and lead with their minds and emotions. They build long-term, meaningful relationships and have the self-discipline to get results. They know who they are.

The basic processes in the authentic leadership model proposed by Luthans and Avolio [13] include the following: (1) positive psychological premises; (2) organizational context premises; (3) self-improvement; (4) the examination of positive psychological capacities within the broader life context of the leader; (5) the need to frame the organizational context through vision, strategy, and culture, and finally (6) identification of how planned and unplanned events shape the leader's development. The main theoretical premises will develop the positive psychological capacity and organizational context and change the self-concept of the leader to include the defined key structure variables underlying authentic leadership.

Authentic leaders are seen as individuals who act with a deep inner desire for change, know well the values shared by the community to achieve this, and can design how to integrate them to achieve common goals [8].

In the leadership literature, it is stated that the accompanying characteristics are as important as those of the leadership. With this regard, "leader-follower interaction" is emphasized in authentic leadership. Achieving authenticity in the followers by creating awareness of authentic leadership in them can yield positive outcomes.

## *Dimensions of Authentic Leadership*

The authentic leader creates trust and healthier working environments with four basic components: a balanced and unbiased evaluation of information, relational transparency, internalized moral understanding, and self-awareness [18]. Authentic leaders provide 'balanced processing of information' by requesting both positive and negative adequate input and perspective from the followers before making important decisions. They emphasize a level of openness and accuracy ('relational transparency') that encourages consideration of the opinions, difficulties, and views of others. The authentic leader sets a high standard of ethical and moral behavior ('internalized moral perspective) and creates role models and, finally, conveys 'self-awareness' by understanding not only their own strengths and limitations but also how they affect others [19: 948].

## **Self-awareness**

There are four elements of awareness that are believed to be related to the development of authentic leadership: values, acceptance about identity, emotions, and assumptions about motives/goals. Although the individual does not know exactly what all the



components of their identity are, self-awareness implies that people are aware of various aspects of their identity, their own perceptions are internally integrated, and that they are consistent with the perceptions of others [1].

Self-awareness refers to establishing insights into how a person makes inferences about the world, how they make sense of the world, and how this meaning-making process affects one's perspective on himself/herself over time. It also shows an understanding of one's strengths and weaknesses and the multifaceted nature of the self. Behaviors displayed towards others include gaining insight about the self and being aware of the person's influence on others (Kernis 2003, as cited in Walumbwa et al. [18]).

Self-awareness is more than knowing how others see you. It covers understanding some basic principles common to all people, such as how we all make sense of our life experiences, as well as being aware of aspects that others cannot see. It also involves allowing the possibility that others are wrong about you. Although the term self-awareness is often used for a particular state of "enlightenment" that some people achieve, in practice, it is a long-term learning process. This is because the true self is dynamic and changes over time [2: 155].

## **Balanced and Unbiased Processing of Information**

A balanced and unbiased evaluation of information, the second component of authentic leadership, means that all the available information is evaluated during the decision-making phase [12].

Adaptive conflict arises when a variety of opinions from people with different backgrounds are taken into account in decision-making. Healthy discussion and fair evaluation of competing ideas result in more creative, emerging, and adaptable solutions. If leaders are unaware of their own internal biases and those of their teams, they may not benefit from the diversity and innovative solutions that result from adaptive conflict in their organizations. At the other extreme, stereotyping, bias, and correctness have created conditions for incompatible conflict. Therefore, people need education about these internal cognitive biases and automatic sensory generation processes, so they can begin to decipher their implicit theories and learn how to interact constructively with other people working from their own personal filters and biases. Awareness of the occurrence of these processes is always a big step towards a more balanced processing of information [2: 160].

## **An Internalized Moral Perspective**

Authentic leaders listen to their inner conscience to guide their followers in decision-making and take a stand on controversial issues. That the leader and the group can agree on the basic principles and that the gain of one in the group and the leader

is not perceived as the loss of the other is a great form of sacrifice in achieving the goals [2: 148–150].

## **Relational Transparency**

Leadership is built on social interactions and influence. Therefore, one of the main components of authentic leadership is relational or interactional transparency, and this concept is defined as sharing relevant information, being open to supplying and receiving feedback, being frank about the rationale behind motives and decisions, and showing consistency between words and actions (Vogelgesang 2007, as cited in Avolio and Wernsing [2: 160–161]).

Transparency is crucial to building trust between people. Hiding information, saying one thing and doing something else, and unwillingness to give or receive feedback erodes transparency in relationships and reduces trust [2].

## **Materials and Methods**

This study was carried out to systematically examine studies about authentic leadership in healthcare professionals, to reveal the target groups in the studies, to determine the concepts associated with authentic leadership, and to reveal the relationship with these concepts.

In the study, publications on the subject were reviewed retrospectively. The Prisma method was used in the systematic analysis approach. Scopus and ISI Web of Science (WOS) databases were reviewed to access studies examining authentic leadership in healthcare professionals. While doing the review, publications including “authentic leadership AND health”, or “authentic leadership AND nurse” in their titles were selected. Duplicate publications were detected and necessary eliminations were made. During the review process, no year limitation was used, and studies on the subject carried out until October 2020 were evaluated.

### ***Inclusion Criteria***

1. The study should be about authentic leadership.
2. The sample should include healthcare workers (students in health-related departments are not included).The sample should include healthcare workers (students in health-related departments are not included).
3. The language of the study should be English.
4. The full text of the study should be available.

- The study should be a research article (theoretical studies, books/book chapters, papers, bulletins are not included).

Figure 2 shows the specification, reviewing, eligibility, and inclusion stages of the reviewing process carried out within the PRISMA method.

A total of 48 studies from the review carried out using the Scopus database and 53 studies from the review carried out using the WOS database were reached. As a

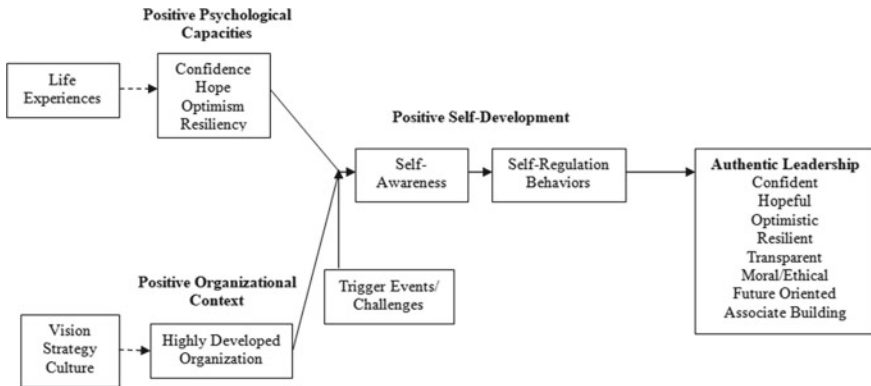


Fig. 1 Authentic leadership development model. Source Luthans and Avolio [13]

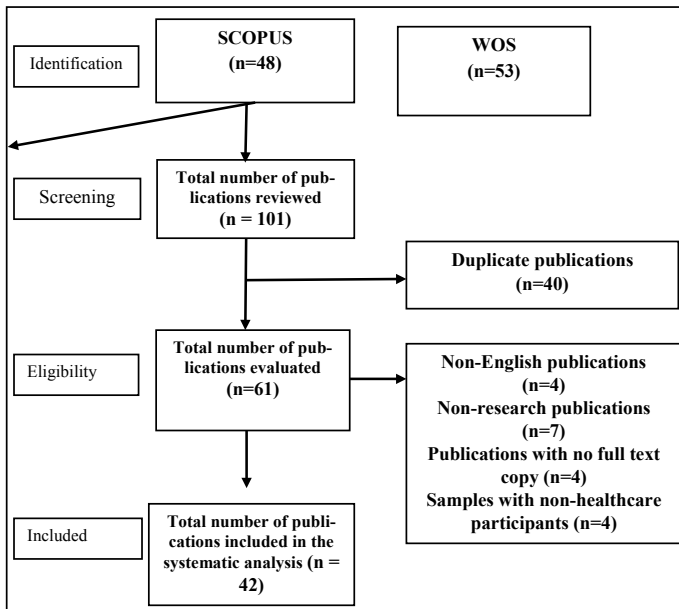


Fig. 2 Flow chart regarding the study selection process according to the PRISMA method

result of the reviews performed using two different databases, a total of 101 studies on the subject were obtained. However, some of these studies were excluded from the analysis because they were duplicates; accordingly, a total of 61 publications were included in the evaluation. Apart from this, 19 studies were excluded from the study because they were published in a different language other than English, they were not research articles, their full text was not accessible, or their samples did not include healthcare workers. As a result of this elimination, a total of 42 studies were included in the systematic analysis (Fig. 2).

The studies included in the study were analyzed in terms of publication year, sample group, research method, data collection tools, independent variables, other concepts related to authentic leadership, and methods of analysis.

### Results

The distribution of the 42 studies analyzed in the study by years is given in Fig. 3.

It was found that studies on authentic leadership in health employees started in 2009 and that the number of studies carried out especially after 2011 increased. There was an increase of approximately 10% between 2018 and 2019. Also, 7.1% of the 42 studies analyzed in the study were published between January 2020–October 2020 (Fig. 3).

Of the studies on authentic leadership in healthcare professionals, 90.48% were conducted only on nurses, and 9.52% were on health employees (physicians, nurses, other healthcare personnel) (Fig. 4).

It was determined that 92.86% of the research articles on authentic leadership in health employees used the quantitative research method (Fig. 5).

Thirty-nine quantitative studies analyzed in the study were found to use the survey method. Studies using a quantitative research method were found to use

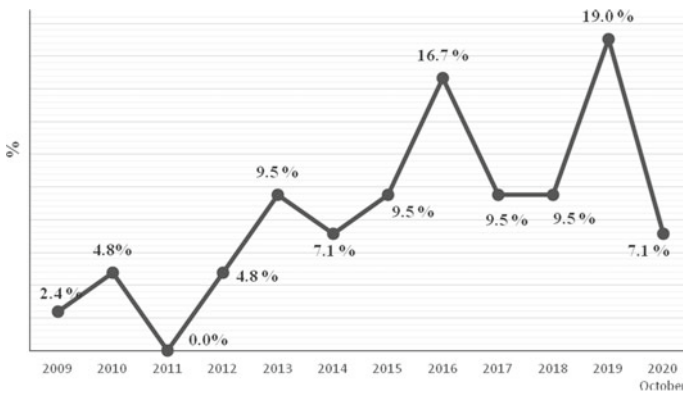
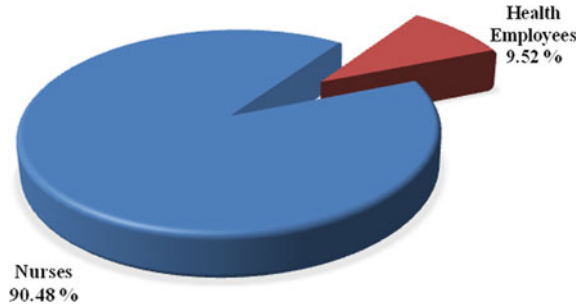
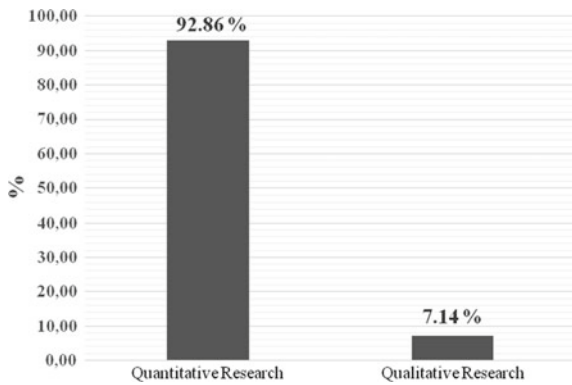


Fig. 3 The distribution of the 42 studies analyzed in the study by years (%)

**Fig. 4** Distribution of the studies analyzed in the study by sample groups (%)



**Fig. 5** Distribution of the studies analyzed in the study by research methods (%)



two commonly employed scales related to authentic leadership. One of them was the “Authentic Leadership Inventory” developed by Neider and Schriesheim [15]. The other scale that was used in more than half of the studies (approximately 76.9%) was “the Authentic Leadership Questionnaire”, developed by Walumbwa et al. [18]. This scale consists of 16 items and 4 dimensions, namely, “relational transparency” (5 items), “self-awareness” (4 items), “internalized moral perspective” (4 items), and “balanced processing” (3 items).

The examination of the statistical analysis methods used in qualitative studies indicated that almost all studies included descriptive statistics and reliability analyses. These methods were followed by correlation analysis. In addition, the use of regression analysis and structural equation model was also common based on the purpose of the study. There were 3 studies using the qualitative research method. The methods used in these studies included thematic analysis, narrative inquiry, and grounded theory (Table 1).

Variables used in studies on authentic leadership included socio-demographic variables, such as sex, age, educational status, marital status, mother tongue, place of residence, as well as variables related to profession and professional life, such as title, department, type of institution, mode of employment, weekly working time, and working years in the profession, institution, and department. Apart from these

**Table 1** The statistical analyses and methods employed in the studies analyzed within the scope of the study

Statistical analyses used in the quantitative studies	Statistical analyses used in the qualitative studies
Descriptive statistics	Thematic analysis
Reliability analysis	Narrative inquiry
Correlation analysis	Grounded theory
Structural equation model	
Regression analysis	
Confirmatory factor analysis	
Variance tests	
Exploratory factor analysis	
Chi-square analysis	
Principal component analysis	

variables, participants in a study were also asked about the level of satisfaction with the profession and wages (Table 2).

Table 3 presents other concepts discussed together with authentic leadership and their relationship with authentic leadership.

Although there were many different concepts related to authentic leadership in studies on authentic leadership, the most commonly used ones in studies analyzed in this study included working life/environment/climate, burnout, job satisfaction, empowerment, trust, turnover intention, passion to work, and psychological capital. In these studies, it was determined that there was a negative relationship between authentic leadership and burnout and turnover intention and a positive relationship with other concepts (Table 3).

**Table 2** The independent variables used in the studies on authentic leadership

<i>Independent variables</i>	
Sex	Type of institution (medical center, hospital, magnet hospital, etc.)
Age	Mode of the employment (full time, part time)
Level of education	Weekly working hours
Marital status	Working years (work experience)
Mother tongue	Seniority in the current institution
Place of residence	Seniority in the current department
Title	Level of satisfaction with the profession
Department	Level of satisfaction with the salary

**Table 3** Concepts related to authentic leadership

Concepts most associated with authentic leadership	Relationship
Worklife/work environment/work climate	Positive
Burnout	Negative
Job satisfaction	Positive
Empowerment	Positive
Workplace/Manager trust	Positive
Turnover intention	Negative
Work engagement	Positive
Psychological capital	Positive
Other concepts	
Commitment, change process, organizational citizenship behavior, social capital, factors associated with mental health, self-efficacy in professional coping, emotional exhaustion, resilience, job embeddedness, organizational identity, extra role behavior, autonomy, person-job fit, civility, employee creativity, information sharing behavior, thriving, use of information technology, empathy, supportive professional practices, inter-professional collaboration, patient care and quality of care, psychological/workplace well-being, workplace bullying, voice behavior, hope, job resources, optimism, safety climate	

## Conclusion and Recommendations

Since the health sector is in a constant process of change and development, new leadership approaches are necessary for effective management. With the enactment of new laws, regulations, care coordination, and payment models, it is of great importance for health employees to regulate not only how they treat patients but also how they work together (Dodson 2017, as cited in Gün and Aslan [8]). Leadership in health is a process in which healthcare managers affect health employees to achieve certain goals in providing care and treatment. It is the responsibility of health leaders to promote harmony and achieve coordination among the personnel in health institutions. It is predicted that both patients and health employees can reach better conditions through the integration of authentic leadership qualities into the work environment [5].

It was determined that studies on authentic leadership in the field of health started in 2009 and that the number of studies reached a peak in 2019. It is noteworthy that authentic leadership in health employees has been studied for the last decade and that there has been an increase in the number of studies conducted on this topic. During this period, there were few studies that sampled “health employees” and covered physicians, nurses, and other health personnel together. The majority of the studies were carried out specifically with nurses. While most of the studies were planned as quantitative research, only three of them used the qualitative research

method. Descriptive and inferential statistical methods were widely used in quantitative studies, and regression analysis, structural equation models, and confirmatory factor analysis were also widely used in addition to using descriptive characteristics. The independent variables addressed in the studies can be classified into two different groups: sociodemographic characteristics and variables related to work and professional life. While sex, age, and educational status are the most frequently used variables among sociodemographic characteristics, seniority in the profession/institution/department is the most used variable relating to the work and profession. The most commonly used concepts related to authentic leadership in the studies are working life/environment/climate, burnout, job satisfaction, empowerment, trust, turnover intention, passion for work, and psychological capital. Of these concepts, it was determined that there was a negative relationship between authentic leadership and burnout and turnover intention, and a positive relationship with other concepts, which supports the literature.

We present some suggestions for future studies on authentic leadership in the field of health. These are as follows:

- Future studies can be planned to have a sample that includes physicians, dentists, other health employees, and administrative staff or healthcare managers.
- It was determined that quantitative studies generally used descriptive and inferential statistical methods. Future studies on the topic can employ multi-criteria decision-making methods, such as AHP, Topsis, or Entropy.
- Although the studies analyzed in the current study involved concepts that are often associated with authentic leadership, such as working life/environment/climate, burnout, job satisfaction, empowerment, trust, turnover intention, passion for work, and psychological capital, analyses were done with many variables as presented in Table 3. Apart from these concepts, the relationship between authentic leadership and concepts, such as communication skills, personality traits, managerial characteristics, organizational learning, organizational justice, organizational climate, organizational culture, motivation, organizational cynicism, organizational stress, organizational prestige, organizational silence, perceived organizational support, organizational alienation, and the like, can be examined.
- Many of the studies were found to use quantitative research methods; therefore, it is recommended that future studies should focus on qualitative research methods more, which will help obtain in-depth knowledge of authentic leadership in the field of health. On the other hand, quantitative and qualitative research methods can be handled together. According to Molina-Azorin and Lopez-Gamero [14], the mixed method, which means including a combination of qualitative and quantitative methods in the same study, is a popular approach used in various fields. Similarly, according to Johnson and Onwuegbuzie [11], the mixed research method does not restrict the choices of researchers; it is inclusive, pluralist, and complementary.

In conclusion, this study aimed to provide information about studies on authentic leadership and to do a general evaluation of the results of these studies. Our study indicated that there was a quantitative increase in studies on authentic leadership



in the field of health; accordingly, we present suggestions about the occupational groups and statistical methods that have never been investigated and concepts that are thought to be related to the topic. Also, the most frequently used independent variables and the scale used as a data collection tool in studies on authentic leadership were determined, and information about this scale was presented. It is thought that this study has significance in terms of benefiting researchers who want to study authentic leadership in the future and providing some insights through the results obtained.

## References

1. Avolio, B. J., & Gardner, W. L. (2005). Authentic leadership development: Getting to the root of positive forms of leadership. *The Leadership Quarterly*, 16, 315–338.
2. Avolio, B. J., & Wernsing, T. S. (2008). Practicing authentic leadership. In S. J. Lopez (Ed.), *Positive psychology: Exploring the best in people*. Westport, CT: Greenwood Publishing Company.
3. Baykal, E. (2017). Otantik Liderlik ve Pozitif Çıktıları: Pozitif Örgütsel Bakış Açısı. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*, 3(3), 42–64.
4. Dinçer, H., Tabak, A., & Koçyiğit, Y. (2019). *Otantik Liderlik* (pp. 111–134). Psikolojik Sermaye ve Yarattıcılık: Çok Düzeyli Analiz, LAÜ Sosyal Bilimler Dergisi, X-II.
5. Dirik, H. F., & İntepeler, Ş. S. (2019). Geçmişten Günümüze Otantik Liderlik ve Sağlık Alanına Yansımaları. *Sağlık Ve Hemşirelik Yönetimi Dergisi*, 2(6), 164–170.
6. Ferrara, A. (1994). Authenticity and the project of modernity. *European Journal of Philosophy*, 2(3), 241–273.
7. George, B., Sims, P., McLean, A. N., & Mayer, D. (2007, February). Discovering your authentic leadership. *Harvard Business Review*, 1–9.
8. Gün, İ., & Aslan, Ö. (2018). Liderlik Kuramları ve Sağlık İşletmelerinde Liderlik. *Sağlık ve Hemşirelik Yönetimi Dergisi*, 5(3), 217–226.
9. Harter, J. K., Schmidt, F. L., & Hayes, T. L. (2002). Business-unit level relationship between employee satisfaction, employee engagement, and business outcomes: A meta-analysis. *Journal of Applied Psychology*, 87(2), 268–279.
10. Hassan, A., & Ahmed, F. (2011). Authentic leadership, trust and workengagement. *International Journal of Human and Social Sciences*, 6(3), 164–170.
11. Johnson, R. B., & Onwuegbuzie, A. J. (2014). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14–26.
12. Kılınç, U., & Akdemir, M. (2019). Otel İşletmelerinde Otantik Liderlik Algısı ve İşyeri Mutluluğu: Ankara İlinde Bir Uygulama. *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 24(4), 793–811.
13. Luthans, F., & Avolio, B. (2003). Authentic leadership development: A positive development approach. In K. S. Cameron, J. E. Dutton, & R. E. Quinn (Eds.), *Positive organizational scholarship* (pp. 241–258). San Francisco, CA: Berrett-Koehler.
14. Molina-Azorin, J. F., & Lopez-Gamero, M. D. (2014). Mixed methods studies in environmental management research: Prevalence, purposes and designs. *Business Strategy and the Environment*, 25, 134–148.
15. Neider, L. L., & Schriesheim, C. A. (2011). The Authentic Leadership Inventory (ALI): Development and empirical tests. *The Leadership Quarterly*, 22(6), 1146–1164. <https://doi.org/10.1016/j.leaqua.2011.09.008>.
16. Novicevic, M. M., Harvey, M. G., Buckley, M. R., Brown, J. A., & Evans, R. (2006). Authentic leadership: A historical perspective. *Journal of Leadership and Organizational Studies*, 13(1), 64–76.

17. Shamir, B., & Eilam, G. (2005). "What's your story?" A life-stories approach to authentic leadership development. *The Leadership Quarterly*, *16*(3), 395–417.
18. Walumbwa, F., Avolio, B., Gardner, W., Wernsing Tara, S., & Peterson Suzanne, J. (2008). Authentic leadership: Development and validation of a theory-based measure. *Journal of Management*, *34*(1).
19. Wong, C. A., & Laschinger, H. K. S. (2013). Authentic leadership, performance, and job satisfaction: The mediating role of empowerment. *Journal of Advanced Nursing*, *69*(4), 947–959.

# The Butterfly Effect of the March 1 Memorandum: The Hood Event



Ekrem Yaşar Akçay

**Abstract** Terrorist attacks in the United States on September 11, 2001, shook the entire world. These attacks in the United States, the superpower of the world, worried the world and were a harbinger of a new order. After attacks, states such as Iraq, Iran, Korea supported terrorism were considered devil states, and the US fought these states and global terrorism. In this context, Saddam Hussein has designated the axis of evil and the US wanted to make an operation. In this process, Turkey became a crucial ally for the United States. The US wanted to use Turkish territories. However, the Turkish government sent a memorandum to the Parliament, but it rejected this memorandum. Refusal of the memorandum was a harbinger of chaos and confusion. For example, the staff of the 11 Turkish Armed Forces, which established headquarters in Sulaymaniyah on July 4, 2003, was arrested and led away with hoods over their heads. This event, known as the Hood event in Turkey, has serious damage to relations between the US. As Edward N. Lorenz stated in the Butterfly Effect approach, everything in the universe could not be calculated and caused an insignificant event to occur unpredictable big events. In this framework, this study will be discussed with Lorenz's Butterfly Effect Approach, also known as Chaos Theory.

**Keywords** Memorandum · Butterfly effect · The hood event

## Introduction

9/11 attacks caused a series of events that would change the fate of the world. After the event, the US administration fought against global terrorism and tried to prevent the states that make terrorist action and support terrorism within the framework of the preventive war doctrine, before they take action [27]. In this framework, the US primarily operated on Al-Qaeda and Afghanistan. Then, the US administration planned to operate in Iraq led by Saddam Hussein and conducted lengthy interviews to cooperate with Turkey. Because of the negotiations, Turkey has tried to take a

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memorandum on March 1, 2003, to send troops to Iraq, to allow foreign troops in Turkey from the Turkish Parliament. But this memorandum did not enter force through the Parliament [11].

After this event, the strategic partnership which continued for a long time between Turkey and the US deteriorated. Thereafter the US cooperated with Kurds in Iraq and Turkey remained spectators' events in its region. However, the hood event on July 4, 2003, quashed to Turkey-US relations seriously after Johnson's letter in 1964. Refusal of the memorandum on March 1, 2003, left not only Turkey ineffective but also damaged Turkey-US relations [8].

That is to say, the Butterfly Effect, also known as the chaos theory put forward by Edward N. Lorenz, is that small changes in the initial data of a system can have large and unpredictable results [7]. This approach by Lorenz is famous with his example about weather conditions. Accordingly, a butterfly flapping wings in the Amazon Forests might lead to a storm breaking in the United States or the formation of a tornado that can travel half of the world. The butterfly effect approach dealt with different issues in international relations such as the global economic crisis, the Arabian spring [2], and China-US relations. For example, the wave of changes in the Arab world that emerged from the movements beginning in Tunisia in November 2010 is referred to as the Arab Spring. From this perspective, this process generally arose in the regimes governed by the republican mode and democracy. This interaction, which may well be called as power dissemination, can be used to explain the social media-supported radical changes in Arab spring countries. Nevertheless, this quantum mechanics developed in the opposite direction with butterfly effect and influenced culturally and economically hegemonic states as well. Açıkalin and Bölücek [1] Similarly, it is possible to explain the memorandum process and hood event with this approach. a vote that could not enter force the Parliament, as in the approach, led to unforeseen events. In this context, this study will examine the effects of the hood event on Turkish Foreign Policy within the framework of the Butterfly Effect approach. This study argued that the memorandum didn't enter force the Parliament caused the emergence of major events such as hood event and the termination of the strategic partnership between the US.

In the first part of the study, the effect of the 9/11 attacks will be examined. In the second part, the period and the process of motion before the Iraq intervention will be discussed. In the last section to be examined hood event and this event will be assessed its effects on Turkey's foreign policy and Turkey-US relations.

## **9/11 Attacks and Its Effects**

On September 11, 2001, terrorist attacks on some symbolic and strategic locations—Pentagon and Twin Towers—in the Washington and New York cities underscores the need to revisit the concept of security and security structures, given that everyone reacted. The United States has been impelled to make radical change in the security policy against this “asymmetric threat/war”, which implies that minor

actors such as terrorist groups in the international system lead to erosion of great powers. For example, terrorism has been ranked first according to the new threat perceptions of the US. Also, it has been emphasized that countries that support terrorism will be called out as “evil axis” [14]. The national security strategy created for this purpose referred to as the “Pre-emptive Strike Concept” or “Bush Doctrine” that aimed to eliminate potential threats before they become active, has got included in the country’s policies [3, 34]. The Bush administration defined this new security strategy as glorifying human dignity, securing the world against terrorism and weapons of mass destruction, and implemented it against Afghanistan, the headquarters of one of the leading suspects of the 9/11 attack: the Al-Qaeda [35]. This new cyclical situation has undergone significant evolution to find out the thesis of “Clash of Civilizations” published in “Foreign Affairs” journal in 1993 before being converted into a book in 1996. According to Huntington and his Clash of Civilizations, the new conflict point of world politics will not be ideological or economic; instead, the actual conflict will be culturally based. This will lead to the Clash of Civilizations [4]. Huntington opines that it is possible to talk about the existence of eight civilizations in the world, which include: Western, Confucius, Japanese, Islam, Hindu, Slavic-Orthodox, Latin American and African civilizations. In his opinion, the acceleration of globalization will make people aware of their identity, the civilization of others, with the superiority of Western civilization over other civilizations fueling the palpable discomfort. Huntington’s thesis has been in the spotlight, with developments such as the invasion of Afghanistan and later Iraq, after the US was exposed to the 9/11 terrorist attacks by terrorists with Islamic origins [24].

The 9/11 attacks caused the US to lose its advantage of military superiority, of which it was considered the leader of the world, to the economic field. The Cold War era was a period of stability, but a lack of security. In contrast, the 10 years after the 9/11 attacks was one with no security and no stability. Even the US, a world superpower with the world’s most advanced intelligence facilities and nuclear weapons, was shown to be vulnerable. As a result, the Bush Administration’s perspective on terrorism changed after these terrorist incidents and directed its defense strategy towards the fight against global terrorism. For this purpose, it made restrictions on human rights with the stated reason to provide better security and reshaped its internal security structure against the new threat perception. For example, a reform law passed through the American Congress and the CIA, which is traditionally dealt with external security events, and the FBI, which deals with internal security, are united within the established Ministry of National Security. After 9/11, the balance between freedom and security was broken in favor of security [33]. In the light of US’s exchanges and the new policy, firstly it was selected as target al-Qaeda, which is responsible for the 9/11 attacks and Afghanistan, which the state provides support to al-Qaeda and the US conducted a joint operation under Article 5 of NATO [4].

## A Process on the Way to Memorandum

US's cry for helping from Turkey for Iraq intervention dated back too far before the 9/11 attacks. After the Gulf Operation in 1991, this case was first delivered to Turkey by the US on November 6, 1998. However, Süleyman Demirel, who was President disagreed, saying the operation would be wrong. Later in the period, the US has reiterated its request for help from Turkey for military operations in Iraq [10]. The US administration wanted to use it as a trump card in the capture's event of Kurdistan Workers' Party's (PKK) leader Abdullah Ocalan and sending to Turkey in 1999. This situation had been reminded of the Democratic Left Party (DLP)-Nationalist Movement Party (NMP) and Motherland Party (MP) coalition, which was founded after the general elections in Turkey in 1999. The US promised Turkey, if Turkey helps the US about Iraq intervention, it will be more willing to accept Turkey's membership of the EU and will bring a solution to the PKK issue [37].

July 15, 1999, after a meeting between Prime Minister Bulent Ecevit and US Defense Secretary William Cohen, Cohen reiterated its request for help from Turkey. After the earthquake on August 17, 1999, in Turkey, Clinton visited Turkey and he even made economic aid from Turkey to provide support for operations in Iraq. The Democratic Party, which Clinton was in the US, has been replaced by the Republican Party led by Bush. In Turkey, it has been a presidential election. Süleyman Demirel replaced to Ahmet Necdet Sezer [38].

After the terrorist attacks, the US entered Afghanistan, where they received support to punish Osama Bin Laden as responsible for the incident. Turkey also not sent troops in this operation, has opened its airspace leads to ammunition and refueling aircraft. Because this operation was based on UN Decision 1368, 1373, and Article 5 of the NATO Treaty, which set new rules for the international fight against terrorism adopted by the UN Security Council right after the 9/11 attacks [36]. However, during the meeting with Bush in the US on January 16, 2002, with Ecevit's business executives who were members of TUSIAD, the principal topics were also discussed in Iraq, although it was seen as Cyprus, EU and Afghanistan. Turkey did not support the Iraqi regime, but he defended the territorial integrity of Iraq. If a military operation is carried out in Iraq, Iraq can face the risk of fragmentation and the establishment of a Kurdish state in the north. The Iraqi Kurds negotiated the Kurdish State, which includes Kirkuk and Mosul, in exchange for military support with the Pentagon officials in Iraq [39]. Ecevit sent a letter to Saddam Hussein on Bush's proclamation of "the axis of evil" in North Korea, Iran and Iraq and making Iraq his first target in the country on January 29, 2002. Saddam gave a leaden response to Ecevit on 7 February [30].

On February 20, 2002, US Vice President Dick Cheney visited Ankara and met with Prime Minister Ecevit. During the meeting, Ecevit said that the Iraqi administration could not harm its environment, they had been watching closely for 10 years since the Gulf War, that there would be no danger from Iraq easily, that it could not harm its neighbors, that they had already taken measures against the dangers that

might come from Iraq. He reiterated that a military operation in Iraq would have negative consequences by saying that they were not strong enough to give [16].

However, Cheney was asked to meet with Chief of General Staff Huseyin Kivrikoglu and has been detected in this case would be in the form of requests from Turkey, the US military operation in Iraq. February 27, 2002, to carry out the economic relations between Turkey and the United States established the Turkish-American Economic Cooperation Com-mission and the first meeting was held in Ankara. However, when the free trade zones planned to be established with the US did not pass through the American Congress, the actions did not yield any results [28]. The United States is to create a free trade zone with which Israel has included instead of Turkey. In this case, because Turkey didn't directly establish relations with the US, it has created indirectly disappointed. The US to make a joint response to terrorism against Turkey's possible to say that this case is economically important. This situation has led to instability and the Greek and Armenian lobbies in Turkey if they wanted from the policy of the US Congress because of the opposition of the President even sometimes may not get the results in favor of Turkey [5]. On July 16, 2002, Deputy Secretary of Defense Paul Wolfowitz and U.S. Secretary of State for Political Affairs Marc Grossman visited Ankara and said that President Bush had instructed Iraq to begin preparations, even though he did not fully decide on military action. 'or he said it sent to transmit and Turkey has expressed the great importance of cooperation in this operation [22]. Ecevit said that Turkey is a strategic ally of the US and the steps to be taken in this regard will be considered in the framework of a strategic partnership with the United States has expressed and left the door open for a possible operation. Ecevit also emphasized the anxiety about the regime of Iraq, that the Kurdish State could not be accepted and that the rights of the Turkmen would be secured in the new regime to be established. Wolfowitz assured the rights of Turkmen and the territorial integrity of Iraq. However, the has been granted two requests from Turkey. The first was that Central Intelligence Agency's (CIA) agents are allowed to pass through to the north of Iraq on Turkey's territory. The second was to allow the use of U-2 spy planes to use Turkish airspace to track Iraq from the air [32].

Prime Minister Ecevit immediately approved these requests, and the first CIA team began entering Iraq in October. On October 15, 2002, the following a comprehensive list of requests from this request was transmitted to Turkey. These requests;

- Approximately 80 thousand US troops to be stationed in Turkey were allowed to come and deployed 3500 personnel to Turkey for the construction work of staying in Turkey.
- Sabiha Gökçen, Balıkesir, Konya, Van, Erzurum, Erzincan and Çiğli airports, including Batman, Incirlik, Istanbul, Izmir, Antalya, Mus are allocated to the use of America and the distribution of 275 aircraft.
- Mersin, İskenderun, Samsun, Trabzon and İzmir ports were allowed to be opened and used in the American navy.
- Allocation of space will be made for distribution training.
- American personnel will provide security during the arrival of US forces in Turkey.

- In the first stage, approximately 10 million liters of fuel will be supplied to American forces [38].

Because of all this, Turkey faced two options. In the first option, the US would be discouraged from the operation, and in the second option, the US and the possible operation to be made in Iraq would have an active voice in the future of Iraq. In the second option, it was proposed to build a pile and increase the number of personnel in the north of Iraq [15].

The general elections in Turkey on November 3, 2002, the Justice and Development Party (JDP) government came to power alone in Parliament. Abdullah Gül became Prime Minister and it was also entered a new era in Turkey. US officials Wolfowitz and Grossman visited Turkey on December 3, 2002, when expectations of a further increase in operations in Iraq. Wolfowitz and Grossman said they would support Turkey's EU membership and about a solution that will satisfy Cyprus and Turkey if the survey supports military operations in Iraq. Because the US wanted to run the Iraq operation on two fronts, North and South. In this respect, the US wanted to Turkey as the primary supply base during the Iraq intervention [18].

At the National Security Council meeting on December 27, 2002, it was emphasized that a possible intervention in Iraq should be within the framework of international law rules, while Recep Tayyip Erdoğan said that on January 17, 2003, they would expect the UN Arms Inspectors Report and they were against the war. For the USA, it is an indisputable fact that the northern front was important in the Iraq operation [38]. However, Turkey opposed a possible invasion as it would be contrary to international law, the UN unanimously least some advocate unilateral intervention into the future of the US invasion. Also, where primarily the EU, including in Germany and France, have officially announced that they oppose the occupation of Turkey to support such an occupation, Iran and the future of the intense reactions from Russia, there are concerns that it might create problems in Turkish foreign policy application. However, Turkey will give support to the United States in Iraq, up to 75% because of the anti-war movement in Turkey, the JDP's vote could decrease. Due to the US economic and military dependence, the rejection of the demands by the US would remove major problems for Turkey [19].

Abdullah Gül stressed the Iraq problem has to resolve the peaceful settlement and stated that war was a last resort. Because peace was hoped to protect Iraq's territorial integrity. Then he met with Bashir As-sad, Syrian President and emphasized that Mosul and sensitive issue of Kirkuk. After this meeting, Gul went on a Middle East trip including Egypt, Jordan and Saudi Arabia and invited the foreign ministers of the countries to the "Regional Development on Iraq" summit in Istanbul. At the meeting in Istanbul on January 23, 2003, it was repeated once again that the problem in Iraq should be resolved peacefully. Also, Government Memorandum which was related to come to Turkey for training US military personnel has been accepted on February 6, 2003, in Parliament. With this agreement, it has been agreed to modernize the ports of İskenderun and Mersin, Incirlik, Diyarbakır, Afyon, Çorlu, Sabiha Gökçen and Batman and to open other bases and ports [31].



## March 1 Memorandum Process

After the motion adopted on February 6, 2003, the US plans to invade Iraq were completed using Turkey's border with Iraq and this has increased the pressure to start the occupation. Turkey sped up negotiations with the US behind their chief negotiator, Deniz Bölükbaşı. On the US side, this task was given to Marisa Lino. During the negotiations, the US made some requests such as trial in American courts if the crime of US troops to be deployed in Turkey. Giving a large number of weapons to the Kurds in the North of Iraq to fight with Saddam and exempt from any taxes of US soldiers [12].

However, in the negotiations with the US, several problems arose with the Turkish General Staff. The reason for this was the US insistence on delivering anti-aircraft weapons to Kurdish groups in Northern Iraq. The Turkish objection, according to the General Staff, was because there was a chance that Turkish aircraft would be shot at when Saddam's air force became dysfunctional and these anti-aircraft guns couldn't hit US planes [6]. This situation also disturbed the General Staff.

As a result of the ongoing negotiations;

- The number of military aircraft deployed to enter northern Iraq will be 31 thousand, and Turkey and Iraq will retain 31 thousand for logistics and vigilance along the border, making a total of 62 thousand Turkish military aircraft to be deployed and engaged in the operation.
- A total of 65 helicopters were determined.
- The government used a six-month -authority period, and it was decided that Major General Erdal Sipahi would command our troops. All the problems related to the government's permission dated February 23, 2003, were fixed. The roadmap regarding the transactions to be made after the positive decision of the Turkish Grand National Assembly was presented to Prime Minister, Abdullah Gül [4].

After all these evaluations, 533 deputies were present to vote for the memorandum on Saturday, March 1, 2003, at the Turkish Grand National Assembly. There were 264 votes in favor and 250 against the resolution; 19 voters abstained. Although the bill was initially accepted, Republican People's Party (RPP) deputies announced the cancellation of the billowing for failing to achieve the absolute majority by winning half of the votes in favor. Thereupon, by the 96th article of the Constitution titled "Meeting and Decision Quorum," and barring the presence of another provision in the Constitution, Parliament Speaker Bülent Arınç decreed that the Turkish Parliament meet with at least one-third of the total number of members and with the absolute majority of the participants. This decision was influenced by the rejection of the memorandum [26].

## Events After Memorandum and Hood Event

The refusal of the memorandum had a shocking effect in the US. Turkey, as an ally of the US in Iraq, has put forward some reasons in related to the refusal of the memorandum. According to one section of the memorandum, it could cause fruitless financial assistance bargaining between the United States and Turkey. While the US was offering \$20 million in loans and grants of over \$6 million (about \$26 million in total), Turkey wanted a grant of \$10 billion [11].

According to another section, the issues that Turkish and American sides could not agree upon were not military-based, but political and economic. Accordingly, the negotiations between the two sides focused on who would command the Turkish soldiers upon entering the north of Iraq. While Turkey insisted on commanding its soldiers, America, who was afraid of a potential conflict between the Peshmerga and Turkish soldiers, wanted to take the commanding role. As Kurdish extremist and separatist movements were Turkey's most important domestic issue, this internal conflict could provide an opportunity to allow media coverage to take advantage of the Iraq intervention. While the Turkish nation was already against the intervention of the United States in Iraq, this situation might have a heavy reaction on the public opinion if Turkish soldiers were included in the war. JDP deputies, who took these factors into account, refused a reaction to Prime Minister Erdogan's decision to reject the decision [19].

The US, which suffered great shock and disappointment because of the rejection of the bill, has maintained its hope that a new bill will pass through Parliament. Despite the rejection of the bill, the previous Modernization Treaty has continued. The US belief in the new motion was for this treaty. Turkey's last efforts to convince them of the US occurred on March 13, 2003. Erdogan made a private call with Cheney, who had not yet established whether to give the government's response to the status of the government established after Turkey. The US's response after Turkey's invasion plan, without which they would also enter part of the Turkish occupation, announced that they had officially conceded and enacted the Plan B. According to this Plan B, the US would mobilize its naval troops waiting in the eastern Mediterranean towards the Persian Gulf. Later, Powell dropped their demand by calling Gul and stating that they only needed Turkey's air corridors. If relationships are significantly strained, Turkey required to compensate for the permit denial and wanted to take part in the new order in Iraq [9].

When Powell came to Ankara and met with Ahmet Necdet Sezer and Recep Tayyip Erdoğan. However, no result could be reached. Permits were denied because of deteriorating U.S.–Turkey relations, and the US, aiming to fix the Erdogan government, sent another memorandum to Parliament on March 20, 2003. Accordingly, the Turkish airspace would be opened to American forces, and Turkish soldiers would be sent to Iraq if necessary. This draft was accepted in the Assembly with 322 votes [20]. On the same day, the U.S. started to bomb Baghdad. After the passage of the motion on March 20 and initiation of the bombing of Baghdad, Turkey pledged to support the United States. However, the rejection of the motion on March 1 was the

precursor of Turkey-US relations. The United States entered the war against Turkey. Patriotic Union for Kurdistan (PUK), Kurdistan Democratic Party (KDP) and Peshmerga were seen as alternatives to Turkey as America's ally. This issue disturbed the Turkish side. Especially considering Peshmerga, plenty of Turkmen will join, and Turkey's "red line" accepted Mosul and entered Kirkuk; cities were not destroyed to be negative for the Turkmen's looting, and the population's discomfort increased [25].

The event that made this troubled period even more troubling occurred on July 4, 2003, in the city of Sulaymaniyah in northern Iraq. The soldiers affiliated with the American 173rd Airborne Division raided the Turkmen Front building in Sulaymaniyah based on alleged intelligence and arrested them, led away with hoods over their heads. According to the American side, 11 Turkish soldiers in the building have a numerous explosives and ammunition to assassinate a local Kurt leader. According to some, this "Hood Event" was the biggest crisis between the two countries after the 1964 Johnson Letter. This event in Turkey has been described as the US's revenge due to the refusal of the memorandum. Turkey protesting the Habur incident, one of the leading centers through which ammunition from Iraq to Turkey and the Turkish border gate is closed Liaison Unit Base in Tampa in the US state of Florida was taken to Ankara. On July 5, 2003, after the meeting between the US Secretary of State Dick Cheney and Prime Minister Erdogan, the parties decided to establish a commission to investigate the incident. Our arrested soldiers were also taken to Baghdad for interrogation and released after about 60 hours [21].

In the joint statement published at the end of the talks between July 9–14, 2003, it was said that concerns about the US's Turkish military activity in Iraq were recorded. In other words, although the Turkish side refused, the Americans provided some disturbing evidence. On July 14, Prime Minister Erdogan, who wrote a letter on behalf of the President of the United States, US Defense Minister Donald Rumsfeld, said that the incident was out of Washington's knowledge and continued as "our soldiers prevented your soldiers based on the solid evidence they had" [17].

Although it was not something, the US government planned, this event was in line with the nation's policy. In a letter to Rumsfeld, the government explained that there were weapon systems that were not used by Turkish forces in Sulaymaniyah and that at least some detainees had time-sensitive information that they were plotting against coalition activities in northern Iraq. In response, Rumsfeld told Turkey, "there were soldiers in sabotage activities to destabilize what I want to build in northern Iraq". If we did not stop it, it would be desired [29]. Between July 22 and July 26, 2003, the Turkish foreign minister, Abdullah Gül went to the United States. During his visit, the US administration, because it is not something new to say Turkey cannot be worried because of some events with the Foreign Minister of Turkey, has been the subject of debate. However, there was also evidence that supported the belief that the trip would be beneficial for Turkey. Gül met with various key individuals in the US administration, including Powell, Rumsfeld, Rice and Cheney. All discussions that took place during the trip included the matter of Turkish troops being deployed to Iraq [13].

Gül's visit to Washington, and Turkey's promised involvement in sending US troops to Iraq, sped up the process to fix the damage that arose from a memorandum on March 1. However, due to the distrust the events caused that the US refused Turkish involvement. Regardless, Turkey prepared a new motion to send troops to Iraq the Parliament passed that on October 7, 2003. Resistance to the possibility of Turkish forces in Iraq came from the Wolf Brigade in northern Iraq. The Kurdistan Democratic Party (KDP) announced that should Turkish soldiers enter the region they would resign from the Iraqi Interim Administration. The Kurdish demands placed a great deal of pressure on the US and as a result; the US agreed that the move should be postponed, arguing that it would take time for the Turkish soldier to get to Iraq [22].

Some groups believed that Turkish forces in Iraq would contribute to the US guerrilla movement. Due to Turkey's struggle with the Kurdistan Workers' Party (PKK), military success in Bosnia, Kosovo and Afghanistan was similar to potential. However, the US considered the north of Iraq a problem-free zone, and the risk of Turkish soldiers coming to the region and clashing with the Peshmergas would be problematic for the US. These situations showed that a crisis of confidence still existed between Turkey and the US. Mark Paris, the US ambassador in Ankara between 1997–2000, and now an expert at the Brookings Institute, explains that the Iraq War worsened the trust and mutual understanding between the two countries. Indeed, the wound inflicted by the March 1 Memorandum was too deep to be corrected even in consideration of the October 7 memorandum. This situation emerges as a harbinger that the military cooperation between the two countries has been over for 50 years [23].

## Conclusion

Terrorist attacks in the US on 9/11 affected almost the universe and nobody felt that they were not safe. Besides, these events have been the harbinger of the new world order. After the events, the US which decided to fight global terrorism, firstly intervened in Afghanistan in this direction. The US administration which decided to Iraq under Saddam Hussein wanted to cooperate with Turkey, and Turkey was seen as an important ally in this process. After the negotiations between Turkey and the US, Turkey wanted to spend a memorandum from the Turkish Parliament on March 1, 2003, but has not accepted this memorandum.

The rejection of the memorandum caused some problems such as ending the strategic partnership which continued for a long time between Turkey and the US, remaining passive of Turkey during planning Iraq's future, Turkey's failure to take adequate economic assistance from the United States and increasing PKK's effect in the region. All these problems are the problems envisaged in Turkey-US relations. However, the event that occurred in Sulaymaniyah on July 4, 2003, known as the hood event, was unexpected. 11 Turkish soldiers on the grounds of illegal activities

and taken into custody by US soldiers and PUK Peshmergas and this event caused a backlash in Turkey.

Turkey was considered being the revenge of the refusal to memorandum this incident seriously damaging to relations between the US mowing. This incident has led to a negative image, such as a failure to protect the soldiers, even Turkey. Based on this, the negative result of a vote in the Turkish Parliament caused an unforeseen and unaccounted event. As Lorenz stated, the flapping of a butterfly in Turkish Parliament caused a great storm in Sulaymaniyah.

## References

1. Açıkalın, Ş. N., & Bölücek, C. A. (2014). Understanding of arab spring with chaos theory-uprising or revolution. In S. Banerjee, Ş. Ş. Erçetin, & A. Tekin (Eds.), *Chaos, complexity and leadership* (pp. 29–46). Switzerland: Springer International Publishing.
2. Açıkalın, Ş. N., & Artun, E. C. (2017). The concept of self-organized criticality: The case study of the arab uprising. In Ş. Ş. Erçetin, & N. Potas (Eds.), *Chaos, complexity and leadership* (pp. 73–85). Switzerland: Springer International Publishing.
3. Ağır, B. S. (2007). The bush doctrine: A search for global hegemonic stability? *International Relations*, 3(12), 71–100.
4. Akçay, E. Y. (2019). The Effectiveness of the European Union in the Iraq Crisis in 2003. In E. Y. Akçay, H. Demirhan, & S. Demez (Eds.), *Crisis as a political and economic concept: A multidisciplinary approach* (pp. 17–34). Berlin: Peter Lang.
5. Arbell, D. (2014). The US-Turkey-Israel triangle. *Brookings Center for Middle East Policy Policy Paper*, 34, 1–54.
6. Bağcı, H., & Kardas, S. (2004). Post-September 11 impact: The strategic importance of Turkey revisited. In İ. Bal (Ed.), *Turkish foreign policy in post-cold era*. Florida: Brown Walker Press.
7. Bağcı, H., & Açıkalın, Ş. N. (2013). From chaos to cosmos: Strategic depth and turkish foreing policy in syria. In Ş. Ş. Erçetin, & S. Banerjee (Eds.), *Chaos, complexity and leadership* (pp. 11–25). Switzerland: Springer International Publishing.
8. Barkey, H. J. (2010). Turkey's new engagement in iraq embracing iraqi kurdistan. *United States Institute of Peace Special Report*, 237, 1–20.
9. Birdsall, N. (2003). The real challenge for iraqi development. *The International Economy*, 17(8), 58–61.
10. Brown, C. S. (2007). Turkey in the gulf wars of 1991 and 2003. *Turkish Studies*, 8(1), 85–119.
11. Cagaptay, S., & Parris, M. (2003). Turkey after the Iraq war: Still a U.S. Ally?. <https://www.washingtoninstitute.org/policy-analysis/view/turkey-after-the-iraq-war-still-a-u.s.-ally>.
12. Copson, R. W. (2003). Iraq war: Background and issues overview. *Report for Congress*, 15, 1–50.
13. Cordesman, A. H. (2003). *The Iraq war: Strategy, tactics, and military lessons*. Westport: Praeger.
14. Cox, M. (2002). Paradigm shifts and 9/11: International relations after twin towers. *Security Dialogue*, 33(2), 247–251.
15. Dale, C. (2008). Operation Iraqı freedom: Strategies, approaches, results, and issues for congress. *CRS Report*, 28, 1–124.
16. Demir, M. (2008). US Vice President to visit Turkey in March. <https://www.hurriyet.com.tr/gundem/us-vice-president-to-visit-turkey-in-march-updated-8240009>.
17. Flanagan, S. J., & Wilson, P. A. (2020). Implications for the U.S.-Turkish partnership and the U.S. Army. In S. J. Flanagan (Ed.), *Turkish nationalist course: Implications for the U.S.-Turkish strategic partnership and the U.S. Army*. Santa Monica: RAND.

18. Foundation Robert Schuman. (2002). General elections in Turkey 3rd November 2002. <https://www.robert-schuman.eu/en/eem/0077-general-elections-in-turkey-3rd-november-2002>.
19. Foreign Affairs, Defense, and Trade Division. (2003). Iraq War: Background and Issues Overview. [https://www.everycrsreport.com/files/20030422\\_RL31715\\_423d9db6f13f3552cf646ac695f8021bcc84ef4e.pdf](https://www.everycrsreport.com/files/20030422_RL31715_423d9db6f13f3552cf646ac695f8021bcc84ef4e.pdf).
20. Gruen, G. E. (2004). Turkey's strategic mideast regional initiatives. *American Foreign Policy Interests*, 26(6), 435–456.
21. Hale, W. (2007). *Turkey, the US and Iraq*. London: Middle East Institute at SOAS.
22. Henke, M. E. (2017). The rotten carrot: US-Turkish bargaining failure over Iraq in 2003 and the pitfalls of social embeddedness. *Security Studies*, 27(1), 120–147.
23. Human Rights Watch. (2003). Turkey and War in Iraq: Avoiding Past Patterns of Violation. [https://www.hrw.org/legacy/backgrounder/eca/turkey/turkey\\_violations.pdf](https://www.hrw.org/legacy/backgrounder/eca/turkey/turkey_violations.pdf).
24. Huntington, S. P. (1993). The clash of civilizations? *Foreign Affairs*, 72(3), 22–49.
25. Kanat, K. B., Diptaş, S., Hannon, J., & Dudden, L. K. (2017). *US-Turkey Relations under the AK Party*. İstanbul: SETA Pub.
26. Kibaroğlu, M., & Sloane, M. (2005). Clash of interest over northern Iraq drives Turkish-Israeli alliance to a crossroads. *The Middle East Journal*, 59(2), 246–264.
27. Maria, L. (2007). The concept of preventive war and its consequences for international relations. <https://assembly.coe.int/nw/xml/XRef/X2H-Xref-ViewHTML.asp?FileID=11677&lang=en>.
28. Migdalovitz, C. (2002). Turkey: Issues for U.S. Policy. [https://www.everycrsreport.com/files/20020522\\_RL31429\\_9e7e7343894e9cae0833ae1ae7a86b877d8399c.pdf](https://www.everycrsreport.com/files/20020522_RL31429_9e7e7343894e9cae0833ae1ae7a86b877d8399c.pdf).
29. O'Hanion, M. (2005). Iraq Without a Plan. <https://www.brookings.edu/articles/iraq-without-a-plan/>.
30. Oktav, Ö. Z. (2004). Changing security perceptions in Turkish-Iranian relations. *Perceptions*, 9(2), 103–117.
31. Park, B. (2014). *Turkey-Kurdish regional government relations after The U.S. withdrawal from Iraq: putting the Kurds on the map?*. Carlisle: U.S. Army War College Press.
32. Peuch, J. C. (2002). Turkey: U.S. Deputy Defense Secretary Holds Iraq Talks. <https://www.rferl.org/a/1100273.html>.
33. Rosand, E. (2004). The security council as global legislator: ultra vires or ultra innovative. *Fordham International Law Journal*, 28(3), 542–590.
34. The White House. (2002). The National Security Strategy of the United States of America. <https://2009-2017.state.gov/documents/organization/63562.pdf>.
35. Thrall, A. T., & Goepfer, E. (2017). Step back: Lessons for US foreign policy from the failed war on terror. *CATO Institute Policy Paper*, 814, 1–42.
36. US Department of State. (2001). The United States and the Global Coalition against Terrorism, September 2001-December 2003. <https://2001-2009.state.gov/r/pa/ho/pubs/fs/5889.htm>.
37. Weiner, T. (1999). U.S. Helped Turkey Find and Capture Kurd Rebel. <https://www.nytimes.com/1999/02/20/world/us-helped-turkey-find-and-capture-kurd-rebel.html>.
38. Wilson Center. (2004). Turkey. <https://www.wilsoncenter.org/publication/turkey>.
39. Wilson Center. (2020). Regime Change in Iraq: Repercussions for Turkey. <https://www.wilsoncenter.org/publication/regime-change-iraq-repercussions-for-turkey>.

# A Research on the Effect of Covid-19 Pandemic on Primary School Students' Perceptions of Heroism



Deniz Görgülü

**Abstract** In this study, it was aimed to interpret the effect of the COVID-19 pandemic on primary school students' perceptions of heroism. 15 primary school students who have been studying in the 2nd and 3rd grade in Konya participated in the study in the 2019-2020 academic year. Metaphor analysis, which is a qualitative research method, was used to determine the students' perceptions of heroism. For this purpose, this open-ended question: "Hero is like..... . Because ....." was asked to primary school students before the COVID 19 pandemic and during the pandemic. According to the research results, it was seen that the students generated 14 metaphors and among these, they mostly used the teacher (2) metaphor before the COVID-19 Pandemic. It was noteworthy that these metaphors were mostly grouped in the category of "To Be Precious". For the period of the COVID-19 Pandemic, it was noticeable that students mostly used the father (8) metaphor. It was seen that most of these metaphors were in the category of "To Be Protective". Another result was that the metaphors which students used before and after the COVID-19 Pandemic differed. It was thought that the increase in the fear and anxiety levels of students during the pandemic period and their spending more time with their fathers were effective in the emergence of this result.

**Keywords** COVID-19 Pandemic · Hero · Metaphor · Student

## Introduction

In the twenty-first century, people exhibit attitudes and behaviors towards adapting to changing situations, perhaps the most, apart from their basic vital functions. The constant change in their attitude and behavior has caused people to approach the static nature of science with doubt. Consequently, the assumptions of traditional paradigms have been abandoned and it has been seen that the new science model has

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more meaningful explanations in explaining phenomena and cases. Daneke listed the main features of the new science model as follows [6]:

- Fluid, nonlinear, complex living systems,
- Complexity,
- The mathematics of chaos and complexity which is used to identify predictable and unpredictable situations,
- Focusing on processes, patterns, potentials and diversity,
- Interdisciplinary interaction.

When the properties of the new science model are scrutinized, an assumption about unpredictable minor situations which will be able to have enormous effects on systems draws attention. Indeed, even the slightest change that seems insignificant in this age has unpredictable consequences. This situation, which Edward Lorenz described as “butterfly effect”, is explained as flapping of the wings of a butterfly in the Amazons may cause a hurricane on the other side of the world [5].

The COVID-19 Pandemic, which emerged in Wuhan, China and affected the whole world, reveals the accuracy of the butterfly effect assumption. The COVID-19 Pandemic has caused the emergence of a chaotic climate in all communal processes with its still unpredictable effects [4]. It is no doubt that societies possessing the ability to “live on the brink of chaos” will emerge from this process even higher [3]. The important thing is to be able to provide all humanity with the knowledge, skills and thoughts that can struggle with this process. As for gaining these, there is an important effect of people who lead societies and become role models. Heroes fulfill similar functions in society, just as leaders inspire and influence the group they address. For this reason, it has been thought that it may be beneficial to investigate the characteristics of people who are accepted as heroes in the society and the source of this perception.

## **The Concept of Heroism**

According to the Dictionary of Turkish Language Association, the word hero is explained as follows: “One who demonstrates usefulness in a war or in a dangerous situation, alp, brave” [8]. Mankind, who has faced various difficulties throughout their life, has sought a savior at different times of their struggle, has identified with that savior and has glorified him as a hero with the values he has attributed to his savior. These heroes are frequently discussed in literary works such as fairy tales, legends, mythology and novels in folk culture [1]. Nevertheless, especially those that children see as heroes may be real or imaginary characters from close or distant surroundings. For instance, children may accept their teachers, friends, family members such as parents and people whom they watch on television or other mass media as their heroes. This relevant possibility reveals the importance of the basic assumption of Social Learning Theory especially in child education.



Bandura, who is one of the important proponents of Social Learning Theory, maintains that a person's learning and personality are largely influenced by observed behaviors and such behaviors form both one's learning and personality development. This theory, which we can call observational learning or social learning, treats the individual as a living being who builds his life through the socialization process and enculturation and continuously seeks role models for himself [2]. That is why; role models who are effective in individuals' learning and their developing certain behaviors are important components in the education process. On the basis of the aforementioned importance, this research is going to focus on the change in primary school students' perceptions of heroism during the COVID-19 Pandemic process.

## **Purpose of the Research**

The aim of the research is to interpret the effect of the COVID-19 Pandemic on primary school students' perceptions of heroism. For this purpose, answers were sought for the following sub-problems:

- (1) What are the metaphors that primary school students used to reveal their perceptions of heroism before the COVID-19 Pandemic?
- (2) Under which conceptual categories can these metaphors be grouped in terms of their common features?
- (3) What are the metaphors that primary school students used to reveal their perceptions of heroism during the COVID-19 Pandemic?
- (4) Under which conceptual categories can these metaphors be grouped in terms of their common features?
- (5) Is there any difference in the metaphors that primary school students used to reveal their perceptions of heroism before and after the COVID-19 Pandemic?

## **Method**

In the research, the opinions of 15 primary school students studying in the 2nd and 3rd grade in Konya Altunekin Cumhuriyet Primary School in the 2019–2020 academic year were included. 7 of these students (3 girls and 4 boys) were in the 2nd grade and 8 of them (2 girls and 6 boys) were in the 3rd grade. Metaphor analysis, which is a qualitative research method, was used to determine the students' perceptions of heroism. For this purpose, this open-ended question: "Hero is like..... . Because ....." was asked to primary school students before the COVID 19 pandemic and during the pandemic. The metaphors developed by the participants were analyzed in four stages: (1) the coding and sorting stage, (2) the compilation of sample metaphor image stage, (3) the category development stage, (4) the verification of validity and reliability stage and (5) transferring the data to the computer environment stage.

### ***The Coding and Sorting Stage***

The metaphor form created to determine the students' perceptions of heroism was examined for each student and the forms that did not involve in metaphors or were left blank were excluded from the scope of the research. As a result of this process, the forms of 5 students were not included in the research.

### ***The Compilation of Sample Metaphor Image Stage***

Fifteen metaphors written by students regarding their perceptions of heroism were analyzed and sample metaphor expressions that could represent each metaphor best were created. These expressions were used to determine the categories and to ensure the validity of the research.

### ***The Category Development Stage***

At this stage, each metaphor developed by the students regarding their perceptions of heroes was examined in terms of the relationship between subject, source and subject-source. At the end of the examination, the metaphors developed by the students before the COVID-19 Pandemic were grouped in 5 different categories whereas the metaphors developed after the COVID-19 Pandemic were grouped in 2 categories.

### ***The Verification of Validity and Reliability Stage***

In order to ensure the validity of the research, the process was explained in detail and the students' opinions were given by directly quoting. Additionally, triangulation method was used for the validity and reliability of the research. In this context, multiple data sources were used and the data were controlled by experts. In the course of these controls, each expert made their evaluations independently. For the reliability of the research, the data collection and analysis process was also supervised by an independent researcher.

### ***Transferring the Data to the Computer Environment Stage***

The data obtained at this stage were transferred to the Microsoft Excel program and the frequency (f) values for the students' opinions were calculated.

## **Findings**

In this part of the research, the findings obtained from the analysis of the data were presented under sub-headings.

### ***Findings Regarding the First Sub-problem***

In the first sub-problem of the study, an answer was sought to the question "What are the metaphors primary school students used to reveal their perceptions of heroism before the COVID-19 Pandemic?" The metaphors used by primary school students to reveal their perceptions of heroism before the COVID-19 Pandemic were given in Table 1.

**Table 1** The metaphors primary school students used to reveal their perceptions of heroism before the COVID-19 Pandemic

Metaphors	f
Mother	1
Friend	1
Tree	1
Lion	1
Atatürk	1
Father	1
Nature	1
Sun	1
Light	1
İsmet İnönü	1
Teacher	2
Water	1
Plane	1
Stars	1
Total	15

When Table 1 was examined, it was understood that students produced 14 metaphors and they used the metaphor teacher the most among them.

**Findings Obtained from the Second Sub-problem of the Research**

In the second sub-problem of the study, the question “(2) Under which conceptual categories can these metaphors be grouped in terms of their common features?” was answered. The metaphors that primary school students used to reveal their perceptions of heroism were grouped according to the conceptual categories listed in Table 2.

When Table 2 was examined, it was realized that the metaphors that primary school students used to reveal their perceptions of heroism were mostly in the category of “To be precious”. Apart from this, it drew attention that metaphors of heroism were grouped more in the categories of “To be strong” and “To be protective” in the second place. Primary school students’ opinions related to the metaphors they used were given below categorically.

**Table 2** Categories created for the metaphors primary school students used to reveal their perceptions of heroism

Categories	f	Metaphors
(1) To do the impossible	1	Plane
(2) To be precious	7	Teacher(2), sun, tree, friend, light, water
(3) To be strong	3	Lion, Atatürk, İsmet İnönü
(4) To be protective	3	Mother, father, nature
(5) To be loved by everyone	1	Stars

### ***The Category of “To Be Precious”***

- Hero is like a teacher. Because our teacher endeavors in order to make us a good person by giving us information (K-2)
- Hero is like a teacher. Because teachers train us and prepare us for the future. Without teachers, for example, there wouldn't be any police because they are also trained by teachers (E-3).
- Hero is like the sun. Because the sun warms the whole world and it is indispensable for life (E-2).
- Hero is like a tree. Because tree gives fruit, it gives us oxygen. If there were no trees, we would have to buy fruit from foreign countries (E-3).
- Hero is like a friend. Because our friends treat us very well (K-3).
- Hero is like light. Because light illuminates the environment. Like light, heroes also enlighten people and guide them (E-3).
- Hero is like water. Because it gives life to all living things (E-3).

### ***The Category of “To Be Strong”***

- Hero is like a lion. Because lion is the king of the forests. It is very powerful on its own. Even if all the animals are its enemies, it fights against them by itself. (K-2).
- Hero is like Atatürk. Because Atatürk founded the republic and gifted children a day. He gave us a beautiful future (E-2).
- Hero is like İsmet İnönü. Because İsmet İnönü fought for our country on the western front and won the war (E-3).

### ***The Category of “To Be Protective”***

- Hero is like a mother. Because mothers take their children under their wings. They protect them from harms (K-3).
- Hero is like my father. Because while chopping an apple he helps me in case I cut myself. He helps workers who work in heavy jobs(E-2).
- Hero is like nature. Because nature is a home for all living things(K-3).

### ***The Category of “To Do The Impossible”***

- Hero is like a plane. Because heroes can fly (E-2).

### ***The Category of “To Be Loved By Everyone”***

- Hero is like stars. Because stars are very beautiful and they are loved by everybody(K-2).

### Findings Obtained from the Third Sub-problem of the Research

In the third sub-problem of the study, the question “What are the metaphors primary school students used to reveal their perceptions of heroism during the COVID-19 Pandemic process?” was answered. The metaphors produced by primary school students during the COVID-19 Pandemic process were given in Table 3.

When Table 3 was scrutinized, it was detected that primary school students used 8 metaphors to determine their perceptions of heroism during the COVID-19 Pandemic process and they used the metaphor father mostly among these.

### Findings Obtained from the Fourth Sub-problem of the Research

In the fourth sub-problem of the study, the question “Under which conceptual categories can these metaphors be grouped in terms of their common features?” was answered. The metaphors used by primary school students to reveal their perceptions of heroism during the COVID-19 Pandemic process were grouped according to the conceptual categories listed in Table 4.

When Table 4 was examined, it was noticed that the metaphors that primary school students used to reveal their perceptions of heroism during the COVID-19 Pandemic process were mostly in the category of “To Be Protective”. The opinions of primary school students on the metaphors used during the COVID-19 Pandemic process were given below categorically.

**Table 3** The metaphors primary school students used to reveal their perceptions of heroism during the COVID-19 Pandemic process.

Metaphors	f
Mother	1
Moon	1
Father	8
Doctor	1
Pal	1
Teacher	1
Police	1
Turkish soldier	1
Total	15

**Table 4** Categories created for the metaphors used by primary school students to reveal their perceptions of heroism during the COVID-19 Pandemic process

Categories	f	Metaphors
(1) To be precious	5	Pal, police, teacher, moon
(2) To be protective	10	Father (8), mother, Turkish soldier

### *The Category of “To Be Protective”*

- Hero is like my father. Because he protects us (E-3).
- Hero is like my father. Because I become the happiest person when my father is with me. My father is both strong and merciful (K-3).
- Hero is like a father. Because he is always full of love towards us (K-2).
- Hero is like a mother. Because she is self-sacrificing (K-3).
- Hero is like my father. Because he protects us (K-2).
- Hero is like my father. He always protects us (E-2).
- Hero is like my father. Because he is the senior member of our family and he is the one who meets our needs and loves us (E-3).
- Hero is like father. Because he protects us from everything (E-2).
- Hero is like Turkish soldier because they defend our country (E-2).
- Hero is like my father. Because he protects us from bad things (E-3).

### *The Category of “To Be Precious”*

- Hero is like a pal. Because he/she helps people (E-3).
- Hero is like a police. Because he/she catches thieves (E-2).
- Hero is like a teacher. Because he/she teaches us everything (K-3).
- Hero is like the moon. Because it lights up at nights (K-2).
- Hero is like doctors. Because they cure us with medicines (E-3).

## **Conclusion, Discussion and Suggestions**

People express their opinions about many phenomena and events in their daily lives. Metaphors are important tools which people use to explain situations that they have difficulty in expressing in their daily lives [7]. In this context, analyzing students' perceptions of heroism through metaphors in the research provides an important convenience in understanding situations that are demanding to express.

In this research which aimed to interpret the effect of the COVID-19 Pandemic on primary school students' perceptions of heroism, it was observed that students' perceptions of heroism were different from each other before the COVID-19 Pandemic. In the analysis conducted after the process of categorizing these metaphors into conceptual categories, it attracted the attention that the metaphors used by students were mostly gathered in the category of “To Be Precious”. Based on this situation, it can be concluded that before the COVID-19 Pandemic, students accepted people who contributed to useful works as heroes.

According to the findings obtained from the research, it drew attention that after the COVID-19 Pandemic, more than half of the students used the metaphor of “father” as hero. Additionally, it was realized that the metaphors used after the pandemic were mostly gathered in the category of “To Be Protective”. This situation reveals that during the pandemic period, students needed the protection of those whom they accepted as heroes.

As a result of this research which interpreted the alteration in students' perceptions of heroism before and after the COVID-19 Pandemic, it can be stated that the participants' perceptions of heroism differed during the COVID-19 Pandemic. Whereas taking actions believed precious among students before COVID was the criterion of being a hero, hero was expected to be protective the after the pandemic. This situation may have resulted from the fear and uncertainty atmosphere created by the pandemic.

With the pandemic, it is an important finding that the students mostly accepted the "father" figure as hero. Fathers' spending more time at home during the pandemic process and strengthening family ties could be the source of this situation. In the research conducted by Erçetin [4], "the finding that men spend more time at home during the pandemic process and this situation strengthens family ties" supports this view. As a result of the research, the following suggestions can be put forth:

- The effects of the pandemic process on children should be investigated and the things to be done to reduce the fear and anxiety in children should be contemplated.
- Based on the fact that fathers are seen as heroes, studies should be done on "fatherhood education" that will strengthen the duties and responsibilities of fathers in the family.
- This research should be expanded with a larger working group at least to reveal the perceptions after the pandemic.
- People regarded as heroes by societies and their leadership characteristics should be investigated.

## References

1. Akarslan, T . (2014). Modern çağda kahramanın hazin değişimi. *Sosyal Bilimler Araştırmaları Dergisi*, 9(2), 156–170. Retrieved from <https://dergipark.org.tr/tr/pub/gopsbad/issue/48566/616713>.
2. Bandura, A. (1999). A social cognitive theory of personality. In L. Pervin, & O. John *Handbook of personality* (pp. 154–196). New York: Guildford Publications. *Psychological Review*, 106(4), 676.
3. Erçetin, Ş. Ş. (2001). *Yönetimde yeni yaklaşımlar*. Ankara: Nobel Yayın Dağıtım.
4. Erçetin, Ş. Ş., Potas, N., Ulaşlı, S. S., Çevik, S., Görgülü, D., Güngör, C., et al. (2020). *COVID-19 Pandemisi'nin yaşam kalitesine etkisi: 30 Mart -5 Nisan 2020 (İstanbul, Ankara, Konya İlleri örneği)*. Ankara: Uluslararası Bilim Derneği.
5. Erçetin, Ş. Ş., Tekin, A., & Açıkalın, Ş. N. (2014). Organized and disorganized chaos a new dynamics in peace intelligence. In S. Banerjee, Ş. Ş. Erçetin, & A. Tekin (Eds.), *Chaos theory in politics* (pp. 3–16). Dordrecht: Springer.
6. Erçetin, Ş. Ş. (2000). Örgütsel zeka. *Kuram ve Uygulamada Eğitim Yönetimi*, 24, 509–526.
7. Lakoff, G. & Johnson, M. (2015). *Metaforlar: Hayat, anlam ve dil*. Çev. Gökhan Yavuz Demir. İstanbul: İthaki Yayınları.
8. TDK. (2020). Güncel Türkçe sözlük. Erişim: <https://sozluk.gov.tr/> 20.Aralık 2020.

# Impact of Strong Leader Profile on National Energy Policies: Putin-Era Russian Energy Strategy



Hamit Berat Kaya

**Abstract** The 1998 Economic Crisis had negative consequences in the Russian economy, especially in the energy sector. However, as a result of oil prices and economic reforms that began to increase since 2000, it has made significant progress. In particular, Vladimir Putin's natural resources-heavy economic policy was particularly influential in the progress of this phase. In this study, energy policy will be discussed in line with the "Energy Strategy of the Russian Federation for 2020" document published during the Putin period by examining Putin's relationship between natural resources and the economy. In addition, the roles of institutions that have an impact on the shaping of energy policy will be addressed.

**Keywords** Energy policies · Putin-era · Russia

## Introduction

In 2000, by Yeltsin's transferee Putin strengthened the forward t-y. By dissolving the governorships of the region, it ended the influence of the regions on the country's policy. In this way, European states, fearing new instability in the region, have remained silent against this authoritarian structure. With Putin's victory in the country's 1990s struggle against Jewish oligarchs and controlling business people who avoided taxation, the conflicts between the centre-environment and state institutions in the country have stopped, economic and political stability has been achieved, and significant increases in the inflow of foreign capital have been recorded in the country. With Putin's rise to power, the indiscipline that emerged during the Yeltsin era disappeared and tied it to positive results in the economy. Putin's new National Security and Foreign Policy Doctrine states that economic interests will be the new priority in foreign policy. In other words, until 1999, the military circles that formed the basis of Russian foreign policy lost their influence.

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It has tried to reduce the effects of shock therapy applied during the transition to the free market. For this, it mobilized the military-industrial complex and mobilized natural resources. Russia has made long-term natural gas agreements with its close neighbours such as the EU and Turkey, ensuring energy trade. The increase in demand for natural gas in the world in recent years has made Russia more of a say in this regard in the world.

Significant increases in oil prices during the same period played a decisive role in the development of the Russian economy. Russia obtained 15% of its \$2 trillion gross domestic product in 2012, or \$310 billion, from oil. Over time, the Russian Federation has effectively used its energy card to continue its influence in a very wide area in Eurasia.

In order to keep Ukraine, Georgia, Armenia and Estonia under control in response to the US policy of encirclement, it will stop selling low-priced natural gas to these countries from time to time, sometimes by reducing gas supplies or cutting off the flow of gas, or by cutting off the flow of gas, as in the case of Georgia. Turkey and Iran has continued its monopoly position in natural gas by preventing the alternative pipeline projects that are wanted to be created. Despite the EU's search for alternative resources, Russia is still the EU's largest gas supplier. With these policies, Russia has become a state that must be taken into account in the Middle East and Africa.

### **General Energy Policy of the Russian Federation**

Before framing the recent energy policy, it is important to look at the reasons why Russian energy policy has not been effective in previous years. RF inherited the state-owned energy sector from the Soviet Union through vertically integrated monopoly structures. Throughout this process, the presence of powerful and influential private landlords and oligarchs, the inaction of a suitable legislative system, corruption in the bureaucracy and the undervalued banking sector resulted in the transfer of the country's assets to countries in the former Soviet and Eastern bloc. Therefore, this has led to the effective use of rich natural resources held by RF. However, after the financial crisis in 1998, the benefits of devaluing the ruble and the rise in oil prices began to use the oil and gas resources of the state in the medium and long term in the policy of "energy superpower".

The energy sector, which had a significant share in Russia's economic breakthrough over the past decade, was developed with the collapse of the Soviet Union. Accordingly, with the "Energy Policy Concept under New Economic Conditions" document published in 1992, policies aimed at seeing Russia as a reliable supplier, ensuring the independence and security of RF and increasing energy exports were determined. In addition to the document from 1992, the "Basic Provisions in the Energy Policy of the Russian Federation and the Structuring of the Fuel and Energy Industry for 2010", approved by Boris Yeltsin on 7 May 1995, are the first post-Soviet energy strategy. This document was followed by the document "Basic Provisions in Russian Energy Strategy" published on October 13, 1995. In addition to these two documents, the other documents issued during the Yeltsin period are the "Basic Provisions for Structural Reforms in the Field of Natural Monopoly" dated April 28,

1997 and the “Program for The Control of Structural Restructuring, Privatization and Incentive Tools in the Natural Monopoly Area” dated August 7, 1997.

At the same time, the State Energy Strategy Institute was established in 1998 in parallel with the document published in 1995. The Institute has been held responsible for the inspection of long-term fuel and energy facilities due to the country’s socio-economic development. During Putin’s presidency, “Energy Strategy of the Russian Federation for 2020” was published in 2003.

Within the framework of energy policy, the effective use of natural fuels and resources and the energy sector in improving economic growth and quality of life stands out. In addition, in the Russian energy strategy, improving the quality of fuel and energy plants and ensuring competition in production and services in the world market is stated as the main task. According to Bochkarev, Russian energy policy is built around four pillars. These:

1. The national energy sector is rapidly because the Kremlin is geopolitically intermediary and a source of ‘comparative advantage’ in global policy,
2. Strict control of the new legal framework of the sector and the decision-making of the Kremlin in the construction of energy policy,
3. The existence of the country’s basic energy assets and state control in companies such as Gazprom and Rosneft,
4. Government control of oil and gas pipelines,

The long-term state energy policy of the RF Federation is intended in two stages. “In the first phase: (i) the creation of an integrated normative legal structure, the removal of barriers to making the competitive energy market based on the principles of fair trade transparent, (ii) the completion of the transformation of close-to-each other sectors of the economy and placement at the level of energy efficiency, (iii) the export of oil and gas resources and the access of energy companies to the domestic and foreign fuel and energy markets, and the transition of fuel and energy companies in the Russian economy from a passive role to an effective role that meets the needs of the economy and the population for energy resources. In the second phase, the formation of RF’s fuel and energy industry was evaluated. At this stage; (i) to make the energy markets open and competitive within the framework of market infrastructure, (ii) to use the advantages of the nuclear and hydroenergy sectors, coal industry and petrochemical and gas chemistry, to establish the necessary basis for the execution of future projects, (iii) to increase scientific, technical and innovative contributions in the Russian energy sector and (iv) to increase the share of renewable resources in the upcoming process and transition to the energy of the future” should be given importance.

In addition to the aforementioned tasks, the objectives of RF’s state energy policy are a priority. Among the strategic objectives of long-term state energy policy; “(i) energy security, (ii) the effectiveness of energy in the economy, (iii) the budget effectiveness of the energy sector and (iv) the environmental security of the energy sector”. In addition, the following mechanisms are used in the implementation of state energy policy. These are: “(i) the creation of the new economic environment (co-ordinated tariff, tax, customs, anti-monopoly regulations and corporate structure in the energy

industry) required for the operation of the fuel and energy industry, (ii) the fulfillment of technical regulations, national standards and norms in the implementation of the priorities specified for energy development, (iii) supporting business environments in investment, innovation, energy savings and other priority areas, and (iv) effective management of public ownership in the fuel and energy industry”.

Another important goal of Russian energy policy is to ensure energy security. In the Russian energy strategy, energy security is indicated as the security of the country. In addition, threats are perceived as external threats that may occur from geopolitical, macroeconomic and market factors. In addition, problems in the field of energy security; “(i) attrition of assets in the fuel and energy industry (ii) decrease in investments in fuel and energy market development, (iii) the fact that the entire Russian economy and energy sector depend on natural gas, which accounts for 53% of the country’s consumption, (iv) The potential of the fuel and energy industry compared to the scientific and technical level in the world is small, and (v) the lack of energy infrastructure in Eastern Siberia and the Far East.”

Robert Pirog states that “the aging of oil and gas fields, the lack of modern western energy technology, the control of oil pipelines by transneft under state ownership and its reduction of export capacity, and the lack of investment in the development of oil and gas production and pipeline systems” are obstacles to Russian energy security.

### **Vladimir Putin’s View of Energy Resources and Economic Relationship**

With Vladimir Putin as president, the Russian government has again begun to emphasize RF’s control over energy resources, especially oil and gas. The Kremlin decided to nationalize the previously privatized oil extraction and production industry and the distribution systems of these industries by stating that the country is the property of the country. In addition, Putin’s administration states that energy resources are very important for the national security of the country and will be the basis for the economic and social recovery of the RF, freed from the negative effects of the wave of privatization during the Boris Yeltsin era after the fall of communism.

Putin’s interest in RF’s economic problems and lost super-power prestige began before he was appointed prime minister. In June 1997, he emphasized the development and economic and political return of RF in his thesis “Mineral Natural Resources in the Development Strategy of the Russian Economy” at the St. Petersburg Mining Institute. In his thesis, Putin emphasized the need to create effective and competitive companies in both domestic and world markets in the process of restructuring the national economy. In addition, Putin emphasized the restructuring of the state as the energy superpower of the best way to rebuild RF’s superpower status. At the same time, Putin proposed that RF seize energy companies and configure them to compete with Western companies such as Exxon-Mobil v Shell by enabling them to be vertically integrated.

In addition to the importance Putin attaches to energy resources, he has also made a connection between energy sources and the economy. Putin’s government has given importance to the soft “*dirigism*”, in other words, the policy of statehood, in which the market infrastructure and structural economic reforms created in the state administration in the field of economic policy stand out. At the Economic Forum

in St. Petersburg in June 2005, Putin stated that his government interfered in the country’s economic business in order to protect rf’s sovereignty and ensure national security. With this strategy implemented, it is seen that individual business activities under the control of the state will affect traditional economic thinking in RF for the “common interest” of the whole society. In addition, Putin drew attention to the need to develop the “national champion” industries, which will guarantee the general well-being of society rather than *the interests of private individuals by using rf’s most profitable resources and industries.*

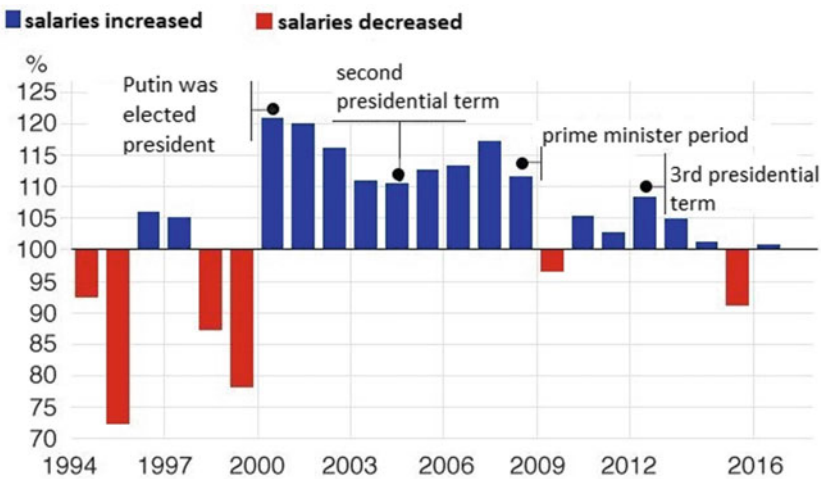
In short, until 2005, there were divisions within the Russian government among those who advocated liberal opinion and economic nationalism in economic management, but economic nationalism gained importance in the middle of the second term of Putin’s presidency. The energy policy that Putin is trying to implement should not be perceived as reviving the planned Soviet-era economy. Putin’s energy policy is neither public nor private property in energy companies, but is expected to have state control over them.

As a result of the energy policies implemented, the devastating post-Soviet picture was replaced by another picture. In particular, international treaties and the forefront of prosperity have re-e-founded some delicate balances. It is possible to see the results of this in both the consumption and production sectors (Tables 1 and 2).

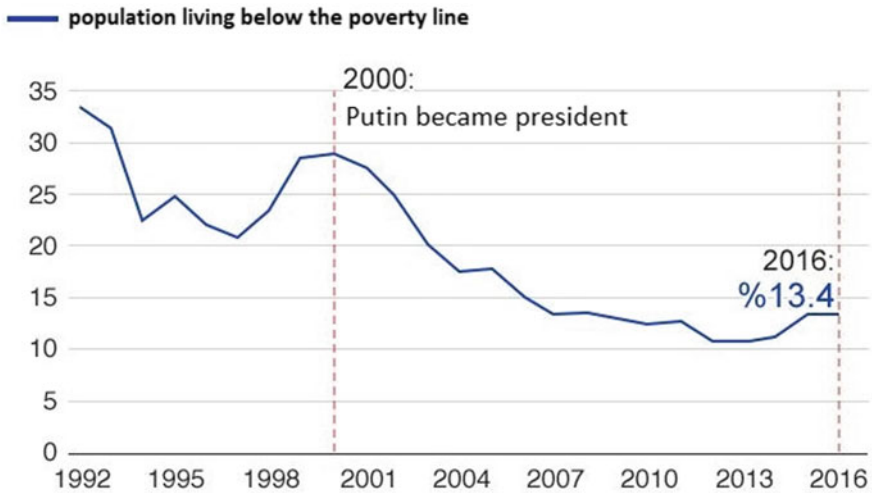
**Actors in Russian Energy Policy**

At the end of the evaluation of Russian energy policy, the effects of government and non-governmental actors actively involved in the more effective implementation of the policy laid down by the energy vision document published in 2003 will be examined.

**Table 1** Percentage increases and decreases in the average monthly income



Source Russian Federal State Statistics Authority

**Table 2** Population living below poverty line (%)

Source Russian Federal State Statistics Authority

### *Presidential Administration*

As the presidential administration, the steps taken in the field of energy under Vladimir Putin, which made your energy important in domestic and foreign policy, will be evaluated. During his first presidency, Putin also changed the taxation system to expand the government's shares and improve the state budget in order to increase the role of the state in energy companies. During the second term of his presidency, which began in May 2005, he attempted to create a public company in order to fight private companies in the field of energy.

In addition, during his post, Putin created a well-harmonious central control system that could more effectively govern regional rulers in Russian politics. With this system, RF has increased the income of conventional money in the oil and gas industry. In addition, energy exports accounted for 67% of the export revenues in the Russian budget during the Putin period, and energy exports were also used as a political tool internationally.

In summary, Vladimir Putin predicted that RF's worsening Russian industry and infrastructure could not be built without "money from the sale of oil and gas" and that modernization would not happen. Accordingly, establishing strict controls in the field of energy can be considered as the main objectives of Putin.

### *Ministries*

Three ministries stand out in the creation and implementation of Russian energy policy. Of these, the Ministry of Industry and Energy stands out as the most important institution in the national energy sector, especially in the protection of the interests of energy companies abroad. In addition, the ministry contributes technologically

and economically to investment projects in the field of energy and follows policies to accelerate developments in sectors such as oil pipelines, petroleum products and electricity networks. It includes the Federal Energy Agency, which uses and oversees the state budget to carry out strategic energy projects. Secondly, it is responsible for researching mineral resources, evaluating them economically and financially through the Federal Agency, one of the important structures within the Ministry of Natural Resources responsible for the exploration, util use, production and protection of RF's natural resources, and tendering rf's mineral wealth. The Federal Inspection Service, another institution within the Ministry, licensethe research of mineral resources and the construction of pipelines in rf's territorialwaters and in the field. Finally, the Ministry of Foreign Affairs, which is accused of failing to protect Russian energy interests in the Caspian region, the Persian Gulf and Central Asia, will be discussed. As a rule, Russian embassies and consulates are responsible for the increase in the activities of rf's important companies around the world. However, in Gazprom's activities in Germany and Lukoil in the United States, these two companies attach importance to the president's support rather than the support of the ministry. In this context, the Ministry of Foreign Affairs paints a more passive image than the first two ministers. Behind the scenes of this passivity, Putin's actively involved in foreign policy and the use of companies' economic interests to protect the interests of the state have an impact.

### ***Parliament***

The RF Federation assembly consists of the upper cabin known as the 198-member Federation Council and the lower cabin known as the 450-member Duma. If it is necessary to evaluate the assembly in the context of energy; There are committees operating in the field of energy in both the upper and lower cabins. These committees, five of which are located in the upper cabin and three in the lower cabin, are responsible for energy-related areas such as regulation, economic, industrial and transportation. In addition, they can communicate with the board members of oil and natural gas companies as they have a lean relationship with the officials of energy companies in both cabins.

### ***Gazprom***

Gazprom has an important role in the Russian economy and politics, and the importance of the company has gradually increased after the Ministry of Gas Industry, which was divided as a result of the collapse of the Soviet Union. It has an average of 60% of Russian reserves and almost 94% of gas production. It also provides gas to all regions of rf, but exports gas to 28 countries, accounting for about 25% of Europe's gas imports. In addition, the company is carried out direct ownership within the country and partial or full ownership in post-production transportation, refining, storage and distribution activities internationally. Geological research, well digging, natural gas and oil production, gas coasing process and oil treatment, natural gas transportation, natural gas storage, marketing, research and scientific studies and energy saving and environmental protection on the continental and continental field are among Gazprom's "core activities".

Between 2004 and 2005, the government took control of 51 % of Gazprom's shares, while the remaining shares were opened to foreign investors. In addition, Gazprom works with European energy companies (BASF and E.ON and Italy's ENI from Germany) in projects such as Blue Stream and North Stream. In addition, Gazprom is RF's company with the most convertible money, and the taxes it pays make up a quarter of federal revenue. Gazprom also prevents the development of the natural gas industry by playing a monopoly role in the exploration and transportation of natural gas. For example, if you want to use limited access to the pipeline system by independent gas producers causes oil companies to sell their own gases to this company at a cheap price.

Apart from the aforementioned Gazprom activities, the company continues to increase its influence in the Russian energy sector and is carried out to become the most important actor. Accordingly, the company has taken over part of United Energy Systems, one of Russia's leading power companies. Gazprom also bought a majority stake in Atomstroieksport in 2004. In addition, the company is lying in partnership with TNK-BP at the Kovytko site to form a gas consortium. Thus, he wants to have a say in important projects in Russia. Finally, Gazprom has stepped into the media sector and purchased companies such as Media Most and NTV.

In addition to Gazprom's activities within the country, it is also an important investor abroad. While most of its investments are located in former communist countries, it is also increasing its investments in Western Europe. Gazprom directly and indirectly sells gas to Central and Eastern European countries, the Baltic states, the Balkans and Western Europe (Germany, France, the Netherlands). In addition to selling gas, it also spends significant efforts in delivering, distributing and storing gas in transit countries.

Looking at Gazprom's relations with the government to understand its influence in politics, eight members of the management committee, including the company's president, Aleksey Miller, have a close relationship with Petersburg and President Putin. Under Gazprom Miller, known as the "state within the state", he been an important part of the state by establishing close relations with the president and assumed the role of the intermediary of government policy both inside and internationally.

### ***Oil Companies***

In the 1990s, oil companies run by businessmen and oligarchs with political links to Russian oil production had a say over the Russian government. Since 2003, significant changes have been observed in the oil sector with the rise in oil prices and the policies of the Russian state, which wants to have a say again. This exchange first began with the arrest of Yukos under state control and the arrest of Yukos' boss, Mikhail Khodorkovsky, for tax evasion. In fact, the main reason for Khodorkovsky's arrest is related to his disobeying Putin's instructions. For example, Khodorkovsky was mentioned as financially supporting opposition parties and some members of parliament in the possible presidential race in 2008. In August 2007, when his company Yukos announced its bankruptcy, the state's effort to become a "key player in the national oil industry" was successful. The institutionalization of the energy sector,

which the Kremlin cares about, is one of the main foreign and internal initiatives of the state.

Similar to the Yukos incident, Sibneft under Roman Abramovich was purchased by Gazprom and named Gazprom Neft. Thus, the Russian government dominated 30% of Russian oil production. In addition, the government oversees RF's oil pipelines through Transneft. The Russian government is using this institution as a means of pressure on private Russian companies, foreign investors and foreign countries.

Shareholders of Lukoil, RF's largest company, include the government, corporate management, Russian banks and Conoco Phillips. Lukoil follows an effective policy in European countries and the Caspian region. Vagit Alekperov, a board member of the company, has a significant influence on the Russian-American energy dialogue implemented by Putin and Bush in 2002. In addition, Lukoil strengthens its relations by investing in refineries and pipelines at the same time as European markets that are buyers of petroleum products produced in RF in European markets. In this context, Lukoil has a political say with its investments such as Gazprom. The influence of these two companies in the Russian economy is that the Russian government is using these two companies in foreign policy to put pressure on Western European countries and neighboring countries (Table 3).

**Table 3** Leading Russian energy companies in the energy sector between 2008 and 2009

Company	CEO	BoD chairman	State stake (%)	Oil production (in million ton, 2008)	Gas production (in billion cubic meters, 2008)	Market value (in \$ billion according to Forbes, 2009)
Gazprom	Alexei Miller	Victor Zubkov <sup>a</sup>	50.002%	12.7	550.5	74.55
LUKOIL	Vagit Alekperov	Valery Grayfer	0% <sup>c</sup>	90.2	14.2	26.62
Rosneft	Sergey Bogdanchikov	Igor Sechin <sup>b</sup>	75.16%	113.8	13.0	34.07
Surgutneftegas	Vladimir Gogdanou	Vladimir Erokhin	0%	61.6	14.1	19.65
TNK-BP	Mikhail Fridman	Mikhail Fridman	0% <sup>d</sup>	68.7	10.1	9.45
Gazpromneft	Alexander Dyukov	Alexei Miller	0% <sup>e</sup>	30.7	2.1	n/a

<sup>a</sup>former prime minister of Russia

<sup>b</sup>deputy prime minister of Russia

<sup>c</sup>20% owned by ConocoPhillips

<sup>d</sup>50% owned by BR

<sup>e</sup>55.9% owned by Gazprom, 16.9 percent owned by Gazprom Finance BV

Source Nina Poussenkova, "The Global Expansion of Russia's Energy Giants", Journal of International Affairs, Volume: 63, Issue: 2, p. 103



### ***Other Actors***

There are three key influence groups that enable Putin to succeed in controlling political instruments. They're like, "I' St. Petersburg lawyers are liste das Siloviki and family. St. Petersburg lawyers believe that the state's role in the economy, foreign policy and human rights should be liberal. Siloviki is made up of former KGB current FSB officials. While this group is pro-war, it considers the state to be the most important support of society. The last group, the family, is a community of businessmen who have a close relationship with former President Boris Yeltsin.

The St. Petersburg group is effective in strategic planning the entire energy industry in areas such as export and investment issues. In addition to re-maintaining control over Gazprom, Putin and this group have used their political power to control the assets of independent producers and increase Gazprom's effectiveness.

The Siloviki group, which is influential in the energy sector, is those who want to create a strong state that reflects Moscow's security interests, especially in the region where the former Soviet Union was active. In addition, this group considers energy policy to be an extension of foreign policy and is the most important group influencing Russian energy policy. In addition, the Siloviki group opposes the weakening of the state as a result of the growth of the independent private sector. This group states that Western companies that exist in the Russian energy sector can jeopardize Russian national security.

The last group, the family, has a strategic influence on Putin. This pressure group, for example, was active in selecting Medvedev as Putin's successor. Although the energy sector is an area that the family does not care about, the family's recommendation was taken into account in the appointed names close to Medvedev.

### **Conclusion**

After the 1998 economic crisis, the increase in demand and energy prices of countries such as China and India had positive consequences for the Russian economy. These developments have slowed the privatization process in the energy sector and increased government oversight of foreign investment activities and acquisitions. These developments in the field of energy have resulted in economic and political stability, an increase in foreign investments and a decrease in capital escape from the country. Vladimir Putin, who became president in 2000, has a lot of influence in the increasing importance of energy resources in the economy. In his thesis "Mineral Natural Resources in the Development Strategy of the Russian Economy", Putin emphasized the restructuring of the state as an energy superpower the best way to rebuild RF's superpower status. In addition, Putin emphasized in his thesis that the "national champion" industries should be developed that will guarantee the general well-being of society rather than the interests of private persons by using rf's most profitable resources and industries.

During Putin's presidency, the "Energy Strategy of the Russian Federation for 2020" document on the energy sector was prepared in 2003. The document, published in 2003, set the main objective for the effective use of the energy sector in improving economic growth and quality of life, improving quality of fuel and energy plants and ensuring competition in production and services in the world market. Influential actors such as the presidential administration, the ministry of industry and energy, the ministry of foreign affairs, parliament, energy companies, Gazprom and other leading energy companies, the St. Petersburg Group, Siloviki and The Family were mentioned in the development of the Russian energy sector.

The energy-based economy causes the long-term search for profits, the development of the concept of property and a poor management approach. In this case, it is defined as "Dutch disease" in the economic literature. Generally speaking, the Developing Russian economy in line with energy resources contributes to the transformation of RF into an energy superpower, while the Kremlin is using this situation to achieve its foreign policy objectives.

The increase in energy prices and production strengthens the cash positions of companies, allowing them to borrow more easily, increase investments and consolidate in the sector. Despite claims that no foreign capital would come to RF after the YUKOS incident, Gazprom was able to get a loan of USD 13.1 Billion from a consortium of western banks to finance the acquisition of Sibneft. On the other hand, it has been observed that the newly established conglomerate Rosneftegaz, which is fully owned by the public, can easily carry out borrowings of USD 7.5 billion.

What makes the energy sector as important economically as it is politically is the RF's reserve status, especially natural gas, its annual production and ownership of oil and natural gas pipelines owned by the state. As of the end of 14, RF 20 has 9.1% of the world's total oil reserves and 36.7% of the world's natural gas reserves. On the other hand, proven reserves are increasing day by day with new discoveries, and the general consensus is that the exploration efforts, which are expected to increase after the licensing process is streamlined, will further increase the reserves.

All these developments have caused RF to grow faster in the manufacturing sector and gain strength in the arms industry. As a result, while balancing production and domestic politics, it has taken more precise and clear steps in foreign politics. Putin, who has re-established a country especially with his infrastructure investments, has used the state more effectively to meet the basic needs of his people.

## Bibliography

1. Breslauer, G. W. (2009). Observations on Russia's Foreign Relations Under Putin. *Post-Soviet Affairs*, 25(4), 370-376. (October/December 2009, p. 372).
2. Robert F. (2007). Price, Energy reform in Russia and the implications for European energy security. *Demokratizatsiya: The Journal of Post-Soviet Democratization*, 15(4), 391-407. (Fall 2007, p. 393).
3. Goldman, a.g.e., p. 97.

4. Heinrich, A. (2008). Under the Kremlin's Thumb: does increased state control in the Russian gas sector endangered european energy security?. *Europe-Asia Studies*, 60(9), 1539–1574. (November 2008, p. 1542).
5. Price, a.g.e., p.493.
6. Energy Dialogue and the Future of Russia: Politics and Economics in the Struggle for Europe, says Viatcheslav Morozov. Pami Aalto, The EU-Russian Energy Dialogue: Europe's Future Energy Security, Ashgate, Hampshire, 2008, in ss. 43–61, p. 51.
7. Russia as an Energy Great Power: Consequences for EU Energy Security, says Javier Morales. Antonio Marquina, Energy Security: Visions From Asia and Europe, Palgrave Macmillan Publications, New York, 2008, in, p.m. 24–33, p. 28.
8. Vilemas, a.g.e., p. 46.
9. Lelli, a.g.e., p. 747.
10. Fredholm, M. (2005). "The Russian energy strategy & energy policy: Pipeline diplomacy or mutual dependence?". Conflict Studies Research Center, September 2005, p. 2, [http://www.defac.ac.uk/colleges/csrc/document-listings/russian/05-\(41\)-MF.pdf](http://www.defac.ac.uk/colleges/csrc/document-listings/russian/05-(41)-MF.pdf).
11. Ibid, p. 3.
12. The Summary of the Energy Strategy of Russia..., a.g.e., p.1.
13. Bochkarev, a.g.e., p. 2.
14. Russia Energy Sector Handbook Volume 1:..., a.g.e., p. 96.
15. The Summary of the Energy Strategy of Russia..., a.g.e., p.3–4. <sup>62</sup> Russia Energy Sector Handbook Volume 1:..., a.g.e., p.107–108. <sup>63</sup> Ibid., p.108.
16. Ibid., p. 110.
17. Ibid, p.111.
18. Pirog R. (2007). Russian Oil and Gas Challenges, CRS Report for Congress (p. 1).
19. <http://www.fas.org/sgp/crs/row/RL33212.pdf>.
20. Tkachenko, a.g.e., p. 171.
21. Kroutikhin, M. (2008). Energy Policymaking in Russia: From Putin to Medvedev, NBR Analysis: Russian Energy Policy and Strategy. *National Bureau of Asian Reserach*, 19(2), July 2008, ss. 23–40, p. 25.
22. Tkachenko, a.g.e., p. 173–174.
23. Ibid., p. 174.
24. Ibid., p. 184.
25. "Gazprom and the Russian State," says Kevin Rosner. Kevin Rosner, Russian Foreign Energy Policy: An Analytical Compendium (Vol. 1), GMB Publishing, London, in, p. 265–347, p. 278.
26. Ibid., p. 288.
27. Tkachenko, a.g.e., p. 185.
28. Larsson, R. L. (2006). "Russia's energy policy: security dimensions and russia's reliability as an energy supplier", FOI- Swedish Defense Research Agency, March 2006: 142, <http://www2.foi.se/rapp/foir1934.pdf>.
29. Ibid., p. 143.
30. Agata Loskot-Strachota, "The Russian Gas For Europe", Centre for Eastern Studies, Warsaw, October 2006, p. 7, [http://pdc.ceu.hu/archive/00003361/01/russian\\_gas\\_for\\_europe.pdf](http://pdc.ceu.hu/archive/00003361/01/russian_gas_for_europe.pdf).
31. Stern, a.g.e., p.172.
32. Donaldson, R. H., & Noguee, J. L. (2005). *The foreign policy of russia: changing systems, enduring interests* (p. 177). New York: M.E. Sharpe Press.
33. Lelli, a.g.e., p. 749.
34. Bochkarev, a.g.e., p.13.
35. Woehrel, S. (2009). Russian energy policy toward neighboring countries, CRS Report for Congress, September 2009, p. 3. <http://www.fas.org/sgp/crs/row/RL34261.pdf>.
36. Tkachenko, a.g.e., p. 186.
37. Kroutikhin, a.g.e., p. 25–26.
38. Ibid., p. 26.
39. Rosner, a.g.e., p. 315.

40. Smith, K. C. (2007). Russian energy pressure fails to unite Europe CSIS Euro-Focus, Vol. 13(1), January 2007, ss. 1–8, p. 5, [http://csis.org/files/media/csis/pubs/eurofocus\\_v13n01.pdf](http://csis.org/files/media/csis/pubs/eurofocus_v13n01.pdf).
41. Kroutikhin, a.g.e., p. 27.

# Complexity in World Affairs and the Ways to Cope with It



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**Abstract** As experts of International Relations (IR) began to embrace alternative theoretical approaches in recent decades, complexity thinking has also found itself a place within the boundaries of the discipline. Complexity-oriented approaches derive their appeal from the analytical and conceptual originality they bring to the discipline, as they help make sense of emergent phenomena such as geopolitical shocks, pandemics and financial crisis, for which monocausal models often fail to provide adequate explanations. This article seeks to outline the process during which complexity thinking has made its way into IR and address the question of how this approach contributes to broadening our understanding of world affairs. Europe's migration problem and the security threats posed by two radical groups, al-Qaeda and ISIS, have been chosen as two case studies to demonstrate the relevance of complex systems for IR. This article also offers ways to cope with the uncertain and complex features of global life, emphasizing that policymaking approaches require the internalization of traits such as resilience and adaptability.

**Keywords** Complexity · Complexity thinking · Uncertainty · International Relations · World affairs

## Introduction

The realm of world affairs in its present form is increasingly characterized by growing interconnectedness. Developments taking place in certain parts of the world are capable of exerting greater influence over different parts due significantly to the techno-scientific advances, which enable rapid spread and movement of tangible and intangible assets such as norms, ideas, beliefs and goods and services. Human movement has also reached astonishing levels, creating consequences in a wide range of ways including the facilitation of cross-cultural interactions, inter-societal

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dialogues, cross-border terror threats and intense migration processes. Such interactive dynamics have made it implausible to separate issue-areas when analysing international developments. The speed with which international events and processes arise and reverberate across the international landscape has made it imperative for scholars and experts of world affairs to upgrade their intellectual tools so as to obtain the necessary means to comprehend the intricate and complex nature of world affairs. Overall, the growing intensity of international interactions demonstrates that complexity is becoming the hallmark of world politics. Despite this factual reality, the discipline of International Relations (IR) has been slow to comprehend the implications of this development.

At least since the end of the Cold War, IR scholars have gradually come to the awareness of the necessity of acquiring more sophisticated conceptual and analytical instruments to fashion a better understanding of world affairs. In response to this obvious need, complexity thinking has been embraced as an innovative approach, which has enabled experts to make sense of international phenomena that are marked by surprise, uncertainty as well as complexity. Complexity thinking's main utility lies in that it offers a viable alternative to the structure and agency-oriented perspectives in IR, thanks to the emphasis this theory places on the importance of interactions among various actors and factors. Therefore, this theory provides a useful prism in comprehending the dynamic and complex feature of international life, showing how developments taking place in the international realm may generate cross-border impacts. Thanks to viewing the realm of world affairs as a network, complexity-oriented approaches illustrate in particular how factors/elements and actors/entities intermingle and co-evolve in a dynamic manner. This approach is well tailored to the need for developing fresh conceptual tools to grasp the underlying dynamics that highlight our complex world.

It is in this context that the main purpose of this article lies in contributing to efforts that aim to raise awareness about the need to view an appraise international events and interactions through the lens of complexity. The fulfilment of this purpose requires illustrating complexity thinking's significance for IR discipline, along with offering an insight into the ways to cope with complexity in the international realm. To demonstrate how complexity-oriented approaches help broaden our understanding of world affairs, I develop my arguments in three parts. Firstly, I outline the process during which complexity thinking has found its way into the IR with a reference to the insufficiency of mainstream approaches. This section also lays out the basic parameters underlying complexity thinking and their implications for the IR discipline. Secondly, with the aim of demonstrating how the international realm has increasingly come to be marked by complexity, I examine the notion of issue linkage by choosing Europe's migration problem as my case study. This section illustrates how international phenomena may involve multidirectional causal interplays. Lastly, I assess the implications of complexity for international security by focusing on the radical groups of Al-Qaeda and ISIS. The discussion advanced in this part aims to show that complex threats require correspondingly complex security approaches.

## Complexity in World Politics

Theoretical approaches based on positivist epistemology and utilitarian perspectives have long marked their imprint on IR discipline. Due to the commanding position of rationalist theories in particular, a historical and/or teleological conceptions have exerted a strong influence on the discipline [15, 46]. Such perspectives presume that social occurrences follow foreseeable paths and display predictable patterns, thus linear causality serving as the ultimate method to make sense of world politics. Explanations that put forward unidimensional cause-effect relationships rely upon mechanical analytical instruments, which highlight the international political realm as a closed system. This way of framing world politics gives way to a sub-discipline that can be defined as “Newtonian IR” [32: 139]. Newtonian IR enables IR scholars to simplify social reality so that clear-cut cause and effect relationships can be established in the international realm.

The Newtonian understanding of physical reality is predicated on three laws: unless it is met with a counterforce, an object’s speed of movement will remain constant (or if it is motionless, it will remain motionless); “the time rate of change of the momentum of a body is equal in both magnitude and direction to the force imposed on it”; and “when two bodies interact, they apply forces to one another that are equal in magnitude and opposite in direction.” The last law pertains to equilibrium conditions, “where all forces are balanced” [48]. In sum, Newtonian causality is closely associated with notions such as proportionality, linearity and orderliness, which emphasize that action-reaction exchanges between objects produce predictable and foreseeable outcomes.

The impact of the Newtonian understanding on IR discipline is manifest in concepts such as the balance of power [32: 138]. Perceiving reality as a regular interplay between rival actors that behave in a mechanical manner, balance of power theory presumes that if an actor increases its material power capabilities, it provokes a balancing act from others. This would occur because too much power in the hands of any one state would be threatening to other states, which would strive to bring the system back to its steady state by increasing their own power capabilities [52: 625]. The mechanical logic upon which the balance of power theory is built should not lead one to dismiss this theory as a blunt instrument, for it provides a useful prism in explaining certain international interactions, especially those between great powers. The attempts by the U.S to balance against the growing Chinese power would be a pertinent example in demonstrating the functionality of the balance of power as a theoretical tool [40].

Despite the utility of orthodox IR approaches in explaining certain international phenomena, global politics presents a much more complicated landscape, the understanding of which necessitates new conceptual and analytical instruments. Additionally, mainstream perspectives often prove to be inadequate in addressing key questions and issues concerning world affairs, as discussed below. Indeed, in recent decades, alternative IR approaches challenging mainstream views have started to emerge, offering more rigorous accounts as to how to analyse and make sense of

international events and processes. It has been posited by various IR experts since the early years of the post-Cold War that the realm of world affairs was beginning to look increasingly like a complicated landscape, where old approaches tailored for the bipolar structure were becoming defunct [44]. In a related vein, the failure of rationalist theories to give a convincing account of the factors that led to the end of the Cold War has also encouraged IR scholars to embrace new theoretical approaches [16, 35: 202–203, 49: 4–5]. Counted among these approaches is the complexity thinking, which emphasizes the necessity of viewing and evaluating world affairs through the prism of randomness, unpredictability or surprise.

Those emphasizing the necessity of applying complexity thinking to IR take their point of departure from the belief that, as natural and social systems operate by following complex trajectories, international phenomena cannot be explained through reductionist lenses [28: 11–15]. Such approaches are not only ill-suited to comprehend social reality *per se*, this view holds, but are also misleading as far as the necessity of developing methods and mechanisms to deal with policy issues is concerned [23]. Seen in this light, failing to account for the complex features of international interactions generates the risk of foreign policy mishaps, with the resultant political, economic or security costs. Taken together, complexity thinking, then, provides a prism to make both descriptive and prescriptive evaluations about world affairs.

The obvious utility of complexity thinking for IR is evident in the epistemological and methodological freshness it injects into the discipline, which is why a growing number of theoreticians are subscribing to this approach (See, for example; [5, 10, 16]). The process of complexity thinking's entrance into IR rests on a background that is characterized by a dialogue between different fields of science. This dialogue has come about through collaborative works conducted by experts specializing in fields such as mathematics, physics, biology, computer science, economics and political science [44: 34–35]. As complexity theory began to be employed in various fields of science such as physics and mathematics, a growing interest emerged to utilize this approach to explain social phenomena as well [30: 437]. When the social phenomenon in question moves beyond national borders, it falls into the IR discipline's area of interest.

As the following discussion will illustrate, international arena is pregnant with irregularities, unpredictable developments and randomness. This realm owes its contingent nature to the fact that it is often not the units themselves that determine the course of events, but rather the interplay between them, which is a key characteristic of complex systems. It bears stressing in this context that “[t]he main idea behind complex systems is that the ensemble behaves in ways not predicted by its components. The interactions matter more than the nature of the units” [47: 1200–1201]. In the international system also, interactions between components may be more determinative than agents or structures with regards to the way international events or processes unfurl.

In systems defined by complexity, collectivities tend to display different modalities than their constituent parts. This calls for new epistemological perspectives through which to attain the knowledge that is required to comprehend the unfolding



of international processes featuring multiplicities. Taleb states, for example, that “[s]tudying individual ants will almost never give us a clear indication of how the ant colony operates. For that, one needs to understand an ant colony as an ant colony, no less, no more, not a collection of ants. This is called an ‘emergent’ property of the whole” [47: 1201–1203]. The essence of the notion of emergence is nicely captured by Ablowitz, who emphasizes that “[i]f I play two notes together on the piano, there is an aspect of quality of this sound which is not the property of either of the notes taken separately” [1: 2]. Quoted in Geller [26: 65].

In addition to emergence, other underlying properties of complex systems can be summed up as the open system feature, non-linearity and self-organization [12]. As opposed to closed systems, where the unit lacks the ability to interact with its environment, open systems allow the unit to engage in an input-output relationship with its environment. In this setting, deductive methodologies are ill-suited to conduct thought and research experiments, because the unit is unable to provide feedbacks outside of its environment—hence unfit for analysis. Wight [53: 58–59]. Obviously, the feedbacks that occur in open systems are positive in the sense of signifying an interactive relationship as opposed to negative feedbacks, which characterize linear models [10: 165–166].

Non-linearity, another feature of complex systems, refers to systems “which do not display proportionality between input and output, and in which small influences can result in large effects” [12: 46]. This property indicates the possibility that systems may exist and function in far-from-equilibrium conditions. In such situations, a prevailing order begins to lose its functionality in “a thermodynamically equilibrium system” and moves into a stage that is defined by disorderliness, in order to maintain its existence [45: 1]. To exemplify the existence of non-linear dynamics, one may recall the well-known butterfly effect metaphor [12: 46].

Lastly, in complex systems, natural or social organisms acquire an ability to self-organize, provided that they are able “to change their internal structure and/or their function in response to external circumstances” [8: 8040]. Oscillations in the external environment are absorbed in a way that does not adversely affect the self-organizing unit’s functioning, since the unit, in order to adapt to new conditions, is able to modify its structural properties. The principle of self-organization has been employed to describe a wide range of phenomena including cells, ecosystems, cities and galaxies [8: 8041].

Taken together, the implications of complexity thinking for IR are significant. By taking state-centric approaches as its main guide, orthodox IR ignores how international entities interact with their environment [31: 4–6]. What is required is to place less emphasis on actor or structure-oriented approaches, which are prevalent in mainstream IR, and utilize interaction-oriented approaches. This assertion is predicated on the main idea that the international system operates as a network, in which constituent parts in the form of individuals, firms, organizations, institutions, states and so on are in constant interaction with one another. This has significant methodological implications for IR in particular, and social science in general, such that predicting the way a system will operate in a complex or chaotic environment requires moving away from quantitative approaches and embracing instead qualitative methods. More to the

point, evaluations focusing on particular events or situations that occur at certain junctures are insufficient to extrapolate as to how the system itself is likely to operate [10: 173]. This calls for a holistic methodological and epistemological perspective, which takes as its referent system-wide interactive dynamics. It is also important to stress that complexity thinking does not disregard the significance of causal reasoning; it simply urges one to look beyond “monocausal paradigm[s]” [16: 20] and draws attention to the possibility that the way international events and interactions unfold may be the result of “complex causation” [36: 10]. Quoted in Kavalski [32: 143].

## Issue Linkage in a Complex World

The allure of complexity-oriented approaches for IR discipline is especially noteworthy in contexts that are characterized by systemic or sub-systemic shocks such as the end of the Cold War, the Arab Spring and the so-called New Cold War (triggered by the Ukraine Crisis). In addition to these cases, other notable developments that fall into the same category are the global financial crisis of 2008, the Tunisian popular unrest of 2010, the European refugee crisis and the latest Covid-19 pandemic. These cases provide a basis for the assertion that the events that are triggered in one corner of the world are capable of spreading rapidly into different corners and lead to unforeseeable consequences internationally. This evokes the abovementioned basic proposition of complex systems, that interaction among units is the driver of various natural or social systems. The dynamic essence of natural or social systems is best captured by the oft-cited assertion that the whole is greater than the sum of its parts. Although, simplifying international political realities through a methodology based on isolation, deduction or abstraction may be essential for theoretical parsimony [51], one often comes across cases where more novel approaches are required to identify underlying causalities.

The European migration crisis offers a useful case in exemplifying the point. Although Europe has long been concerned with irregular migration from regions such as North Africa, the Syrian crisis added another layer of stress to the already-sensitive issue. The number of asylum seekers to the EU began to climb considerably from 2013 onwards due mostly to the impact of the Syrian Civil War. The number peaked in 2015, with a total number of almost 1.25 million people seeking refuge in Europe [21]. According to the information given by the EU, the Syrians topped the list in 2015 with 362,775 applications [20]. The impact of human flow from Syria to Europe and the internal problems this caused for member states were so considerable that even the scenario of EU’s disintegration has been voiced [42]. Although the Merkel government’s decision to open up Germany’s doors to Syrian refugees in 2015 served to alleviate Greece’s refugee burden, other member states such as Hungary and Sweden were distressed by the German plan [19: 7–8]. The disgruntled members of the EU, who proved unwilling to host the Syrian refugees, expressed uneasiness at what they saw as a unilateral German plan and began to level accusations regarding the division of refugee burden [13].

A more important consequence of the refugee problem for Europe was that it gave boost to far-right political parties. Countries such as Sweden, Australia and Germany have witnessed a surge in the popularity of populist and extreme-right wing political actors [33: 121–125]. This created the risk of upending the established political landscape in EU member countries, which in turn posed the threat of jeopardizing the cohesion of the EU itself. In the face of the rapid human inflow and the populist backlash it occasioned, EU states adopted controversial oversight and control strategies, which amounted to the objectification of refugees [4]. The way in which the refugee problem was dealt with in some member countries undermined the normative basis of the EU, with some even urging European nations to act in accordance with the Universal Declaration of Human Rights [3].

An assessment of the factors that have led to the worsening of the EU's refugee problem calls into focus the geopolitical landscape that has formed in the Middle East and North Africa region (MENA) with the beginning of the Arab Spring (See for a detailed account [6]). Even a cursory reading of the relationship between the Arab Spring and Europe's migration problem would demonstrate strong evidence for the existence of complex emergencies. In seeking to discover the initial cause that triggered Europe's refugee problem in the last decade, one would tend towards the self-immolation of the Tunisian street vendor Mohamed Bouazizi. This act occurred due to the undignifying treatment given to Bouazizi by the Tunisian local officials. This event set off a wave of protests in Tunisia, which eventually resulted in the removal of the Tunisian President Zine al-Abidine Ben Ali. Encouraged by the success of Tunisians in unseating the Ben Ali administration, protestors in Egypt, Yemen, Bahrain, Libya and Syria took to the streets with the same goal of bringing down their governments.

As decades-long authoritarian governments were overthrown in countries such as Egypt and Libya, the contagious effect of the Tunisian uprisings known as the Jasmine Revolution starkly demonstrates that minimal stress in one setting have the potential to cause widespread shocks. In this respect, the Arab Spring defies the principle of proportionality given that the initial cause that led to the event's occurrence far outweighs the effect that was generated, thus indicating the existence of far-from-equilibrium conditions. Occasioned by factors such as surprise, uncertainty and unpredictability, the emergent behaviour of the Arab Spring showcases the insufficiency of linear reasoning, since the events followed a chaotic trajectory, whose clearest manifestation is the civil war in Syria. Over the course of nine years, close to four hundred thousand people have lost their lives in that country, which is an outcome that could hardly be predicted at the outset of the protests in the MENA region [24].

The unpredictable path the Arab Spring followed provides strong evidence for the existence of complex dynamics, which gradually produced a refugee problem in Europe. But through the prism provided by some complexity theorists, we can take this analysis one step further and illustrate another crucial underlying cause that contributed to the geopolitical earthquake in the MENA region and a migration problem in Europe. Lagi, Bertrand and Bar-Yam contend that the failure of governments to provide basic needs such as food, water and other critical requirements

constitute the root causes of many social unrests. Importantly, they highlight the notion of “sudden perceived failure”, which suggests that governments, regardless of their performance, may not be directly responsible for the problem associated with the social unrest, but if the public keeps them accountable for their circumstances, they face the risk of a popular upheaval [34: 2].

It is through this prism that these three theorists explain the occurrence of the Arab Spring. As they outline, in 2008 alone, two years before the beginning of the Arab Spring, more than 60 riots—related to food price increases—had taken place in 30 different countries. Although, calm was restored following a fall in food prices, a greater surge in price level between late 2010 and early 2011 brought back social protests. The aforementioned time interval coincides with the start of the uprisings in the MENA region. The three complexity theorists demonstrate with reference to the United Nations Food and Agriculture Price Index that above the level of “210 ( $p < 10^{-7}$ , binomial test)”, populations feel the impact of higher prices caused by food shortages and this threshold was crossed in the case of the MENA region, which, from this view, triggered Arab uprisings [34: 4–5]. Although, Lagi, Bertrand and Bar-Yam highlight investor speculation and ethanol production as the main reasons for the jump in food prices, drought also played a vital role, as will be shown below.

The governments in the MENA region have not been inattentive to the issue of food security. Indeed, given publics’ sensitivity towards food prices, MENA governments have long made food subsidy programs a top policy priority. For example, in Egypt, one of the countries where the Arab Spring brought about a government change, the existence of food subsidy programs dates back to the time of the World War 1, in the aftermath of which the government sought to dampen the ongoing price increase in bread by importing large quantities wheat and flour. As government subsidization of food products has become an integral part of Egypt’s social policy, failure to rein in price increases has created the risk of social unrest, as witnessed during the 1977 riots [2: 5–7]. As for the period leading up to the Arab Spring, the unfavourable weather conditions in 2007–2008 had a negative impact on the food production capacity of exporting nations, which created challenges in addressing the global demand. As countries such as Egypt, which are highly dependent on food imports, were unable to obtain the required level of imported food quotas, this led to an increase in food prices, thus degradation of the living standards of ordinary citizens.

As noted above, although the problem subsided for a while, another surge in food prices from 2010 onwards occurred following a supply cut. The main reason for this cut was that major wheat producing countries—such as Ukraine, Russia and China, which had been hit by a drought—were unable to meet the global wheat demand [17]. Focusing on Egypt again, food prices in this country went up by almost % 150 between 2004 and 2014, during which two large scale social and political shocks occurred: the social upheaval of 2011, which brought down President Hosni Mubarak and a military coup, which toppled the Mohammed Moursi administration in 2013. A country where millions of households are dependent on food subsidies, the governments’ failure to meet people’s basic needs acted as a catalyst for the occurrence of political instabilities in Egypt.

The emphasis social scientists place on the role played by food security in Arab uprisings cast a valuable light on the factors caused the social unrests in the MENA region [37]. This is not to argue that factors such as authoritarianism, corruption and human rights violations played negligible roles. But food security has evidently served as a key contributing factor to the occurrence of a geopolitical turmoil in the region. Piecing together the actors and factors discussed so far, the overall argument demonstrates the difficulty of making sense of international issues in isolation. Relatedly, it also demonstrates the necessity of focusing on interactions rather than individual actors or events. As described, in the case of the Arab Spring, factors such as climate conditions, food security, internal political developments, geopolitical dynamics, civil wars and human movements interacted on a plane that transcends the internal boundaries of issue areas.

It is thus incumbent upon policymakers to take account of the possibility that events that they face may be the result of non-linear dynamics. This demands an awareness that situations may be following chaotic trajectories and the stress that accumulates over time may lead to unanticipated shocks [7: 79–80]. As Jervis remarks, “when variables interact in a nonlinear manner, changes may not be gradual. Instead, for a prolonged period there may be no apparent deterioration, followed by sudden collapse or transformation” [28: 39]. Such contingencies may come in the form of natural disasters (such as earthquakes and floods) or man-made events (such as wars and revolutions). It is also imperative to recognize the possibility for knock-on effects, the actualization of which generates new surprises with potentially unforeseeable consequences. The complex nature of international life calls upon policy makers to recognize that in issue areas there are usually “multiple parties and stages [which] permit many paths to unanticipated consequences” [28: 18].

## How to Deal with Threats in a Complex World

Within the discipline of IR, scholars—even those that are situated in the mainstream—are not inattentive to factors such as complexity, unknowability or unpredictability. For example, although employing state-centric lenses, the notion of uncertainty features prominently in the works of mainstream IR experts [18, 27]. Especially works in the realist canon emphasize the existence of prevalent uncertainty in the international system due to the lack of an overarching authority that could impose order [39]. Although Realists give a convincing account about state-to-state relations—especially when they are defined by military competition—international political realm is littered with interactions among numerous actors and factors, most of which escape the lens of mainstream approaches. These can be summed up as “other key levels of cross-border relations—from individuals and states to transnational movements and the all-encompassing biosphere” [16: 15].

It also bears emphasizing that complexity thinking in IR “does not argue that international life is marked by the absence of regularities; rather that order (linear patterns), complexity (nonlinear patterns) and disorder (alinear patterns) coexist”

[30: 443]. Viewed through this prism, the insights offered by complexity thinking help fill in the epistemological and conceptual gap that exists within the IR discipline. Conceptual tools such as network-oriented approaches, which underlie complex systems, provide a useful window into the interactive dynamics of international life. “To understand human societies and their interactions”, as Clemens points out, “we must examine the complex interactions of actors on many levels—individuals, clans, regions, classes, societies, governments, states, civilizations, the international system of states, international organizations, and transnational organizations and movements (from IBM and Greenpeace to al-Qaeda)” [16: 21].

Given the fact that international life increasingly revolves around emergent phenomena in the post-Cold War period, it behoves policymakers to update their analytical lenses. The need for adjustment hinges upon the basic understanding that “in order for a system to survive in a complex environment, its control mechanism must be correspondingly complex” [25: 284]. A case study may help clarify the point. The complex organizational and operational characteristics of criminal groups or terror networks had a confounding impact on those that sought to neutralize or eliminate them [12: 55]. After the 9/11 attacks in particular, Al Qaeda acted through the basic premise of providing operational freedom to its militants so that frightening terror acts could be carried out by local cells. Burke describes the cell that perpetrated the Madrid bombings by noting that, “[t]hrough the web of connections around the group was vastly complex, touching London, Casablanca and Italy, no clear connection to south-west Asia and the al-Qaeda hardcore has ever emerged” [14: 5010–5012]. It would be apt to assert that Al Qaeda owed its operational effectiveness to its deterritorialized and decentralized character, and through its network of militants, it was able to undertake acts on a global scale [11]. Given the difficulty of governments to identify the operational brain behind terror acts, the loose and fluid structure around which Al Qaeda operated provided it with added strength.

The complex operational character of Al Qaeda ultimately made it imperative for the U.S to develop the necessary skills and mechanisms, with the aim that the operational capability of the terror group could be degraded and its militant base could be neutralized. Since 1990s, the U.S in particular, knowing that bipolar world order had given way to a more complex international landscape in which non-state terror groups found a fertile environment to thrive, invested in capabilities to conduct “complex contingency operations” in a wide range of conflict theatres such as Somalia and Iraq [41: 39]. The U.S took this one step further after the 9/11 attacks by embracing tougher measures tailored for asymmetric threats. As stipulated in the 2004 Global Defense Posture, the “complex strategic environment” forced the U.S “to develop a flexible forward presence that would enable it to project power wherever threats might emerge” [43: 87]. The newly adopted security paradigm showed that the U.S sought to address emergent threats that possessed complex features by forging units that could operate with speed, resilience and adaptability. In other words, complex risks necessitated complex security assemblages.

The existence of complex risks does not mean that governments should focus their attention merely on unconventional threats that operate through fluid and decentralized structures. On the contrary, complexity thinking maintains the view that international actors must be prepared for various contingencies, be them in the form of conventional or unconventional threats. Referring back to the aforementioned discussion, new groups that thrive on the same ideological ground as Al Qaeda emerged in the following years, but importantly, not all of them chose to follow in Al Qaeda's footsteps. This rendered them more of a conventional threat than Al Qaeda was. ISIS provides the most pertinent example in this regard. Although ISIS has proved itself a serious threat on account of its ability to destabilize the Middle East and broader international security environment, its downfall occurred fairly quickly compared to Al Qaeda. The degradation of its operational capability by actors that sought its demise constituted a significant setback for the group to pursue its agenda. This occurred in a few years' time, as the international coalition, which was formed after ISIS's seizure of a large swath of land in Iraq and Syria, leaned on the group with overwhelming military force. The U.S.-led international military coalition not only rooted ISIS out of its strongholds, but also conducted insistent air operations against the hideouts of ISIS remnants so that the group could never reform [38].

The fate that befell ISIS is to a great extent the consequence of the way it operated: rather than assuming a complex, flexible and decentralized operational and organizational structure modelled on Al Qaeda, the group possessed a rigid, hierarchical and territorial character under the banner of a caliphate. This rendered ISIS an entity that was similar to that of a territorial nation-state. The self-defeating aspect of this strategy was that the international coalition found a convenient enemy to deal with, since ISIS lay on a huge stretch of territory, making itself an easy target for airstrikes. Tripp aptly summarizes ISIS's strategic blunder by noting that "[t]he murderous obsession with territory as a symbol of political prowess has been the downfall of military campaigns in history and seems now to have gripped the IS leadership as well" [50].

The territorial character of ISIS was clearly a significant handicap for this organization. On the other hand, since the underlying "cement" that binds ISIS-like groups is an all-encompassing cause (such as achieving a vision of puritanical Islam), it would be premature to assert their total demise. As long as the ideological belief system around which individuals and groups coalesce maintains its appeal, radical movements preserve their ability to regain their strength and therefore revitalize their militant network to continue to pursue their goals [29]. This assertion corroborates the view propounded by complexity-oriented approaches in IR: the course of world affairs may be determined by "the interactions of both material and intangible forces" [16: 22]. Also acknowledged by social constructivists, intangible factors such as beliefs, norms and ideas are crucial motives in individual and group behaviour [22].

It is also worth remarking in this context that, as humans and human systems such as states possess the habit of imitation and socialization [9, 51], there is no reason to assume that militant groups lack the ability to update and modify themselves through learning and observation. Relatedly, through a process of "selective learning", they can assimilate and avoid their counterparts' successes and failures. This calls for the



necessity on the part of governments to remain vigilant against threats that possess attributes such as adaptability and self-organization. Units that act through such attributes are best described as complex adaptive systems, which are systems “that are capable of changing and learning from experience” [10: 175]. Given the fact that ISIS prosecuted shattering terror attacks through its sympathizers in a wide range of countries including Indonesia, France and Turkey, the possibility that this group may switch to a non-linear organisational and operational model to resuscitate itself requires close monitoring.

Taken together, the existence of emergencies and contingencies in international life makes it imperative for governments to have the necessary practical and intellectual instruments to deal with various eventualities. This remark is not intended to imply that actors should possess clear-cut pre-existing plans for contingencies, with the aim that they can operate on the international landscape without encountering undesired surprises. In a complex world, such a prescription is ill-suited. What is required is to flesh out an understanding so that complexity is internalized as an inherent feature of world affairs. To make the point, Kavalski gives an intriguing example from the practice of surfing:

Surfers go out into the ocean expecting to ride a wave whose size, speed, strength and timing is completely unknown to them. In the ocean, they spend significant time [...] dancing with the rhythm of the water. In this dance, the surfers learn to distinguish between the different ripples of the water and read which one is likely to be an ‘ankle buster’ (a small wave), an ‘awesome’ (a nearly perfect wave), a ‘cruncher’ (an impossible to ride wave) and so on. [...]. Their fitness, in terms of adaptation to the movements of the water, allows surfers to make decisions which are crucial to their ability to catch and ride the wave [32: 146].

As can be inferred from this quote, policymaking in a complex world necessitates an intuitive understanding about the intricacies of international events, coupled with skills such as resilience, adaptability and flexibility. Just like surfers’ inability to foreknow how the waves will pan out, international actors are equally helpless in the face of the dynamic flow of world affairs. But this should not be understood as implying despair. It is important to note in this regard that, rather than seeking to bring things under control, policymakers should assimilate the basic understanding that complexity cannot be controlled and can only be “managed”. To be able to ride the wave of complexity, it is imperative for leaders and policymakers to gain the ability to operate with strategic foresight. As Kavalski’s quote implies, developing one’s intuitive and analytical skills is the key to making optimum decisions in a complex world.

## Conclusion

This article has aimed to provide an overview of the implications of complexity thinking’s incorporation into IR discipline. To sum up the main arguments, complexity-oriented approaches offer fresh epistemological and methodological perspectives in analyses of world affairs. When it became clear that orthodox IR



approaches proved insufficient to predict and explain international phenomena such as the end of the Cold War, IR experts began to turn increasingly towards alternative approaches, which also include the complexity thinking. As this article aimed to show, although theoretical perspectives that precede complexity theory within IR do not disregard the fact that international arena possesses complex features, they fail to provide an insight into the essence of complexity as such and how it bears upon international processes.

With the emphasis it places on factors such as contingency, surprise and unpredictability, complexity thinking provides a useful prism to comprehend a wide range of international phenomena such as systemic or sub-systemic shocks. This was illustrated in this article by discussing the reasons that led to the occurrence of a migration crisis in Europe. As shown in this article, this phenomenon offers a perfect example that demonstrates the necessity of employing multidimensional causal models. For, factors as diverse as climate conditions, food security, internal political shocks and geopolitical instabilities interacted with each other in the lead up to and during Europe's migration crisis. This case offers a useful context within which to understand how complexity's basic parameters such as far-from equilibrium conditions and disproportionality may come to characterize international events and processes.

In this next section, I have assessed complexity thinking's implications for international security by taking radical groups al-Qaeda and ISIS as my second case study. The discussion advanced in this section demonstrated that risks and dangers in the international realm increasingly take the form of emergent threats. Al-Qaeda with its organizational and operational model provides a perfect example of how an entity behaves in a network-oriented fashion. As for ISIS, despite its ideological similarity with Al-Qaeda, as described in this work, this group chose to adopt a relatively rigid operational and organizational model, thus differentiating itself from Al-Qaeda which operated in a complex adaptive manner. However, ISIS's decision to adopt a hierarchical and, more importantly, territorial character caused it to become a conventional threat for its enemies, which could easily pin down and target the group. A comparative analysis of the cases of al-Qaeda and ISIS through the prism of complexity thinking indicates the need for policymakers to be vigilant against emergent threats, which may come in different forms—conventional or unconventional.

The policy advice put forward in this article emphasizes the necessity of modifying policymakers' mental and analytical instruments so that international problems that display non-linear characteristics can be more effectively dealt with. The main requirement for devising effective policy responses lies in internalizing the inevitability of the complexity of world affairs. Rather than trying to fit facts into pre-existing policymaking mechanisms, such mechanisms must be modified and updated in accordance with the complex features of international life. By embracing this understanding, one would be able to gain skills such as resilience, adaptability and self-organization and therefore be better equipped to respond to unanticipated shocks such as the end of the Cold War or the Arab Spring.

Mainstream approaches have not lost their relevance in explaining certain international phenomena such as military competition between states or great power rivalry. Thus, Newtonian IR still maintains its relevance in certain respects. This implies that

IR discipline requires a holistic approach, one that takes account of the possibility that international events may entail both linear and non-linear modalities. But given the fast pace with which the world evolves, complexity thinking is likely to acquire more prominence within the IR discipline in the time to come.

## References

1. Ablowitz, R. (1939). The theory of emergence. *Philosophy of Science*, 6(1), 1–16.
2. Ahmed, A. U., Bouis, H. E., Gutner, T., & Löfgren, H. (2011). The Egyptian food subsidy system structure, performance, and options for reform. *International Food Policy Research Institute. Research Report*, 119. <https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/125318/filename/125319.pdf>. Accessed 01 Nov 2020.
3. Anadolu Ajansı. (2020). Erdoğan: Tüm AB ülkelerini insan hakları evrensel beyanname-sine uygun şekilde davranmaya davet ediyoruz. <https://www.aa.com.tr/tr/bahar-kalkani-har-ekati/erdogan-tum-ab-ulkelerini-insan-haklari-evrensel-beyanname-sine-uygun-sekilde-dav-ranmaya-davet-ediyoruz/1753942>. Accessed 18 Oct 2020.
4. Aradau, C., & Tazzioli, M. (2020). Biopolitics multiple: Migration, extraction, subtraction. *Millennium: Journal of International Studies*, 48(2), 198–220. <https://doi.org/10.1177/0305829819889139>.
5. Astrada, M. L., & Martín, F. E. (2013). *Russia and latin america: from nation-state to society of states*. Basingstoke: Palgrave Macmillan.
6. Açıkalın, Ş. N., & Bölücek, C. A. (2014). Understanding of arab spring with chaos theory-uprising or revolution. In S. Banerjee, Ş. Ş. Erçetin, & A. Tekin (Eds.), *Chaos theory in politics* (pp. 29–47). New York: Springer Understanding Complex Systems Series.
7. Açıkalın, Ş. N., & Artun, E. C. (2019). The concept of self-organized criticality: The case study of the Arab uprising. In S. Erçetin, & N. Potas (Eds.), *Chaos, complexity and leadership 2017* (pp. 73–85). Cham: Springer.
8. Banzhaf, W. (2009). Self-organizing systems. In E. A. Meyers (Ed.), *Encyclopedia of complexity and systems science*. (pp. 8040–8049). New York: Springer.
9. Bargh, J. (2017). *Before you know it: The unconscious reasons we do what we do*. New York: Touchstone (Kindle Edition).
10. Bousquet, A. (2009). *The scientific way of warfare: Order and chaos on the battlefields of modernity*. New York: Columbia University Press.
11. Bousquet, A. (2012). Complexity theory and the War on Terror: Understanding the self-organising dynamics of leaderless jihad. *Journal of International Relations and Development*, 15, 345–369. <https://doi.org/10.1057/jird.2011.24>.
12. Bousquet, A., & Curtis, S. (2011). Beyond models and metaphors: Complexity theory, systems thinking and international relations. *Cambridge Review of International Affairs*, 24(01), 43–62. <https://doi.org/10.1080/09557571.2011.558054>.
13. Burchard, H. V. (2016). Sweden challenges Germany on refugees. *Politico*. <https://www.politico.eu/article/sweden-challenges-germany-on-refugees/>. Accessed 18 Oct 2020.
14. Burke, J. (2007). *Al-Qaeda: The true story of radical Islam*. London: Penguin Books (Kindle Edition).
15. Buzan, B., & Little, R. (2001). Why International Relations has failed as an intellectual project and what to do about it. *Millennium: Journal of International Studies*, 30(1), 19–39. <https://doi.org/10.1177/03058298010300010401>.
16. Clemens, W. C., Jr. (2013). *Complexity science and world politics*. Albany: State University of New York Press.
17. ECC Platform. Food Price Shocks in Egypt. [https://library.ecc-platform.org/fop/pdf/export?nid\[\]=23281](https://library.ecc-platform.org/fop/pdf/export?nid[]=23281). Accessed 19 Oct 2020.

18. Edelstein, D. M. (2017). *Over the horizon: Time, uncertainty, and the rise of great powers*. Ithaca: Cornell University Press.
19. EuroMemo Group. (2017). The European Union: The Threat of Disintegration. [https://www2.euromemorandum.eu/uploads/euromemorandum\\_2017.pdf](https://www2.euromemorandum.eu/uploads/euromemorandum_2017.pdf). Accessed 17 Oct 2020.
20. Eurostat. (2016). Asylum applicants in the EU. <https://ec.europa.eu/eurostat/news/themes-in-the-spotlight/asylum2015>. Accessed 17 Oct 2020.
21. Eurostat. (2020). Asylum statistics. [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Asylum\\_statistics#Citizenship\\_of\\_first-time\\_applicants:\\_largest\\_numbers\\_from\\_Syria.2C\\_Afghanistan\\_and\\_Venezuela](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Asylum_statistics#Citizenship_of_first-time_applicants:_largest_numbers_from_Syria.2C_Afghanistan_and_Venezuela). Accessed 18 Oct 2020.
22. Finnemore, M., & Sikkink, K. (1998). International norm dynamics and political change. *International Organization*, 52(4), 887–917. <https://doi.org/10.1162/002081898550789>.
23. Ford, C. A. (2015). Musings on complexity, policy, and ideology. In E. Kavalski (Ed.), *World politics at the edge of chaos: Reflections on complexity and global life* (pp. 79–109). Albany: State University of New York Press.
24. France 24. (2020). Syria death toll tops 380,000 in almost nine-year war: monitor. *France 24*. <https://www.france24.com/en/20200104-syria-death-toll-tops-380-000-in-almost-nine-year-war-monitor>. Accessed 18 Oct 2020.
25. Gard-Murray, A. S., & Bar-Yam, Y. (2015). Complexity and the limits of revolution: What will happen to the Arab Spring? In P. V. Fellman, Y. Bar-Yam, & A. A. Minai (Eds.), *Conflict and complexity: Countering terrorism, insurgency, ethnic and regional violence* (pp. 281–292). New York: Springer.
26. Geller, A. (2011). The use of complexity-based models in International Relations: A technical overview and discussion of prospects and challenges. *Cambridge Review of International Affairs*, 24(01), 63–80. <https://doi.org/10.1080/09557571.2011.559191>.
27. Goddard, S. E. (2018). *When right makes might: Rising powers and world order*. Ithaca: Cornell University Press.
28. Jervis, R. (1997). *System effects: Complexity in political and social life*. Princeton: Princeton University Press.
29. Jordan, J. (2014). Attacking the leader, missing the mark: Why terrorist groups survive decapitation strikes. *International Security*, 38(4), 7–38.
30. Kavalski, E. (2007). The fifth debate and the emergence of complex International Relations theory: Notes on the application of complexity theory to the study of international life. *Cambridge Review of International Affairs*, 20(3), 435–454. <https://doi.org/10.1080/09557570701574154>.
31. Kavalski, E. (2015). Inside/Outside and around observing the complexity of global life. In E. Kavalski (Ed.), *World politics at the edge of chaos: Reflections on complexity and global life* (pp. 1–27). Albany: State University of New York Press.
32. Kavalski, E. (2012). Waking IR up from its Deep Newtonian Slumber. *Millennium: Journal of International Studies*, 41(1), 137–150. <https://doi.org/10.1177/0305829812451717>.
33. Kirchick, J. (2017). *The end of Europe: Dictators, demagogues, and the coming dark age*. New Haven: Yale University Press.
34. Lagi, M., Bertrand, K. Z., & Bar-Yam, Y. (2011). The food crises and political instability in North Africa and the Middle East. <https://ssrn.com/abstract=1910031>. Accessed 05 Nov 2020.
35. Lebow, R. N. (1994). The long peace, the end of the Cold War, and the failure of Realism. *International Organization*, 48(2), 249–277.
36. Lebow, R. N. (2010). *Forbidden fruit: Counterfactuals and international relations*. Princeton: Princeton University Press.
37. Maystadt, J., Tan, J. T., & Breisinger, C. (2014). Does food security matter for transition in Arab countries? *Food Policy*, 46, 106–115.
38. McLaughlin, E. (2019). US-led coalition hits ISIS ‘infested’ island in Iraq with 80,000 pounds of munitions. *ABC News*. <https://abcnews.go.com/Politics/us-led-coalition-hits-isis-infested-island-iraq/story?id=65510568>. Accessed 23 Oct 2020.
39. Mearsheimer, J. J. (2014a). *The tragedy of great power politics*. New York: W. W Norton & Company.

40. Mearsheimer, J. J. (2014b). Can China Rise Peacefully?. *The National Interest*. <https://nationalinterest.org/commentary/can-china-rise-peacefully-10204>. Accessed 20 Oct 2020.
41. Murdock, C. A., & Weitz, R. (2004). Beyond Goldwater-Nichols: New proposals for defense reform. <https://apps.dtic.mil/dtic/tr/fulltext/u2/a522000.pdf>. Accessed 02 Nov 2020.
42. Münchau, W. (2016). Europe enters the age of disintegration. *Financial Times*. <https://www.ft.com/content/f9c8bb52-dcac-11e5-8541-00fb33bdf038>. Accessed 17 Oct. 2016.
43. Pettyjohn, S. L. (2012). *U.S. global defense posture, 1783–2011*. Santa Monica, CA: RAND Corporation.
44. Rosenau, J. N. (1997). Many damn things simultaneously: Complexity theory and world affairs. In D. S. Alberts & T. J. Czerwinski (Eds.), *Complexity, global politics, and national security* (pp. 32–43). Washington, D.C.: National Defense University.
45. Selvarajoo, K. (2015). Can the second law of thermodynamics hold in cell cultures? *Frontiers in Genetics*, 6(262), 1–3.
46. Smith, S. (2000). The discipline of International Relations: Still an American social science? *The British Journal of Politics and International Relations*, 2(3), 374–402. <https://doi.org/10.1111/1467-856X.00042>.
47. Taleb, N. N. (2018). *Skin in the game: Hidden asymmetries in daily life*. New York: Random House (Kindle Edition).
48. The Editors of Encyclopaedia Britannica. (2020). Newton's laws of motion. *Encyclopaedia Britannica*. <https://www.britannica.com/science/Newtons-laws-of-motion>, ACCESS DATE. Accessed 23 Oct 2020.
49. Tomé, L., & Açıklan, S. N. (2017). Complexity theory as a new Lens in IR: System and change. In Ş. Ş. Erçetin, & N. Potas (Eds.), *Chaos, complexity and leadership 2017* (pp. 621–646). Cham: Springer.
50. Tripp, C. (2015). IS: The rentier caliphate with no new ideas. <https://english.alaraby.co.uk/english/politics/2015/2/8/is-the-rentier-caliphate-with-no-new-ideas>. Accessed 20 Oct 2020.
51. Waltz, K. N. (1979). *Theory of international politics*. Massachusetts: Addison-Wesley Publishing Company.
52. Waltz, K. N. (1988). The origins of war in Neorealist Theory. *The Journal of Interdisciplinary History*, 18(4), 615–628.
53. Wight, C. (2015). Theorizing international relations: Emergence, organized complexity, and Integrative pluralism. In E. Kavalski (Ed.), *World politics at the edge of chaos: Reflections on complexity and global life* (pp. 53–77). Albany: State University of New York Press.

# Co-adaptation in Context with Iranian, Russian and Turkish Policies on Syrian Complexity: The Emergence of the Astana Process



M. İlbey Çoban

**Abstract** This research is based on explaining the dynamics that led the Iran, Russia and Turkey to initiate Astana Process within the framework of the Syrian Civil War's changing dynamics. The article intends to combine power politics with the "complexity" paradigm. Linear ontology is problematic in explaining the changing dynamics. On the other hand, the complexity paradigm explains non-linear processes derived from its ontological foundation. Especially the variety and diversity of actors, their interconnection, interdependence, and co-adaptation to the situation can be a solution against the reductionism of this phenomenon. Actors in the Syrian crisis are very diverse, and it can be observed that actors like ISIS can profoundly affect the policies in this process, and the Syrian issue can affect varied actors' security and foreign policies that are also based on power competition. Complexity paradigm assumes system as complex, more dynamic and living that many actors (which are not exogenous as closed units) interact with many feedback loops; thus the outcome of the events may not be predicted. IR is also impacted by many various parameters and variables which are interconnected and interdependent, indeed, also the main actors in the system cannot be limited by only states which are socializing and affected by the structure in their interactions considering the critical impact of the substate factors, transnational terrorist groups, and many other variable causes as well as their interactions in the international changing and co-evolutionary dynamics. Russia, Turkey, and Iran (the guarantors of the Astana Process) have followed different policies and demonstrated divergent outlooks regarding the crisis. Indeed the priorities and set agendas differed from one another as well as objectives to pursue in the disorder occurred by fragmented and diversified dynamics in Syria. However "unpredictable" events of changing dynamics resulted in diversification of states' agendas. The prolongation of the civil war led to the introduction of new actors along with it, and especially the states sharing the border with Syria were also exposed to new threats. It can be seen that with the emergence of ISIS and Russian activism in the Syrian complexity, especially her intervention in Syria as well as other actors' policies on this complexity, the regional and global powers have also co-adapted their policies

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on the changing dynamics. This co-adaptation also derives from the intertwined causalities in the complexity which is between the order and disorder. The Astana process is also an expression of this co-adaptation in Iranian, Russian and Turkish policies in Syrian Complexity. The complexity paradigm offers an alternative framework in order to understand the process-oriented interconnected power struggle in disorder. The characteristics of the “processes” in the Syrian disorder symbolizes the fracturing component in the power struggle that brings non-linear orientation. The power struggle shaped by the non-linear dynamics by the time and processes in the changing dynamics brings about flexibility in the behaviors of the actors in order to maintain their initial priorities in their foreign policies or their main objectives in the changing dynamics. That results in the co-evolutionary dynamics in the interactions between the relative power distributed actors restrained or allowed activism in structure, and between the actors and structure that co-shaped each other in the area.

**Keywords** Complexity · Power politics · Syrian complexity · Astana process · International relations

## Introduction

This part is derived from the Master of Science Thesis (Astana Process in Context with Iranian, Russian and Turkish Foreign Policies on Syrian Complexity) by the same author.<sup>1</sup> The Syrian Civil War brought us numerous discussions and many dilemmas and one of the great breaking points in the contemporary world system. While expecting the development of democracy as part of the “Arab Spring” in the MENA region, the demonstrations against Syrian President Bashar Al-Assad converted into a bloody civil war in Syria as well as increased instability in the region. In March 2011, the demonstrations against the (Syrian) Baath regime began in Daraa, shortly after it spread to the other cities due to the regime’s repressive response to the demonstrations. The regime’s response to the protests, diverse ethnic composition, sectarian dynamics, as well as foreign funding and support to the different sides have enhanced the polarization of the social and political dynamics which later caused the civil war in the country [16].

The dynamics in the area have been determined by regional power competition and local disorder intertwined with the global power struggle in the three-layered complex system. These interwoven layers lead to complexity and uncertainties in the Syrian Civil War. Local dynamics in the civil war, especially transboundary armed groups such as ISIS, bring about spilling over insecurities and mass migration across the region and the world that has made borders more penetrable [35]. The global power struggle is mainly between the US along with the EU and Russia, the regional

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<sup>1</sup> This research is based on and derived from: Çoban, M.İ. (2020). *Astana Process in Context with Iranian, Russian and Turkish Foreign Policies on Syrian Complexity*. Master of Science Thesis. Middle East Technical University. Available at: <http://etd.lib.metu.edu.tr/upload/12625609/index.pdf> (Accessed: 15 October 2020).

power struggle in Syrian complexity is mainly composed of Iran vs Israel or Saudi Arabia and Turkey. While the local disorder is emanated from the struggle among opposition, Assad regime, Kurdish groups and radical jihadists. However these three layers are not separated from each other, but interconnected and interrelated in which the interactions among them more diverse and varied that cause many feedback loops in the interactions. Disorder in Syria is not only subject to fill the power vacuum by state actors, but also local factors and foreign fighters change the course of the war. The causes of the crisis in the global power struggle emanated from multi-factors that regime changes in the post-Cold War era connected to power competition and norm contestation. The prolongation of the civil war has been also caused by power competition, the power vacuum in the region, local armed groups, and foreign fighters. However, the causes have resulted in various and nonproportional effects. What shaped the crisis and determined its characteristics would be found in its dimension of power competition and explain better with the help of the complexity paradigm to describe the non-linear characteristics of the developments in the area.

The global, regional, and local dynamics based on power struggle enhanced the fire in the country while the peace initiatives organized firstly by the Arab League, then via the UN, and because of this power competition, ceasefire efforts remained temporary. Nevertheless, the declaration of nationwide ceasefire (excluding radical jihadists and YPG) in December 2016, Syria, under the guarantors of opposition (Turkey), and the regime (Russia) which are also rivals that support conflicting sides has led the new phase in the conflict management measures in the country [23]. That ceasefire led the Astana Process—that aims to manage the conflict between conflicting sides and enable ground for the coordination between Iran, Russia and Turkey—under the guarantee of (rival powers) Iran, Russia, and Turkey since January 2017. Surely Astana Process has been another causation and the Parties' request of changing dynamics in the crisis. How can we describe and explain the emergence of Astana process based on the exploration of the changing dynamics in Syria? The research question seeks to describe and explain the emergence of the Astana process based on the exploration of the changing dynamics in Syria in context with Russian, Turkish, and Iranian foreign policies on the civil war with the help of complexity paradigm. This research does not ignore power dynamics but broadening the horizon of power politics and based on power dynamics while it is averted to question “world order”, on the other hand, the research is pertaining to “disorder” in Syria between the order in the global politics. Nevertheless, complex systems are between the order and chaos in context with its ontology. The non-linear characteristics derive from this disorder while pursue of self-interest and its limits demonstrate the continuity in the system. The literature is poor on the Astana Process due to its up-to-date characteristics; at the same time, the complexity paradigm is currently developing in IR. These features pose both disadvantages and advantages to the research. Because of poor literature and current dynamics of the event in context with the newly developing paradigm in IR (International Relations), the data and theoretical framework is minimal. Nevertheless, that is also an advantage for the research given the contributions of exploratory research of the complexity paradigm in IR in context with one of the initial researches on the Astana Process.

## Power Competition in the Syrian Complexity

The Civil War in Syria has established a suitable ground for the power struggle; both regional and global powers are struggling to create or promote their influence, secure their area and strengthen their position on global and regional issues, trying to turn the Syrian crisis into an opportunity and minimize the adverse effects of the crisis; indeed, this power competition also constitutes one dimension of the prolongation of the civil war [57]. Although power politics can be understood through the lens of the realist approach, realism *per se* is not able to explain or predict the changing dynamics in the Syrian complexity because of its foundation on the linear static ontology. On the other hand the complexity paradigm benefit and complement in the understanding of power politics, competition, and cooperation dynamics in the Syrian complex and Astana process. The complexity paradigm is not necessarily to replace other theories; however, the complexity may complement other IR theories in order to reach a better framework as well as regarding uncertainties in the changing dynamics [54]. This article will also benefit from the paradigm of complexity for better understanding and description in applying given assumptions that states pursue their interests and they are willing to maintain their security as well as increase their power in the dynamics of the Syrian case which demonstrates itself as a disorder in the system. Indeed, *a priori* assumptions of “order” and stability in the dynamics oversimplifies the kaleidoscopic events, on the other hand, the complexity paradigm offers the fractals in the order emanated from disorder and focused on change and co-evolution in the dynamics. The system illustrating simple, static in which few actors (closed units) interact with few feedback loops that may foresee predictable results in the outcome of the activities; on the contrary, complexity approach assumes system as complex, more dynamic and living that many actors (which are not exogenous as closed units) interact with many feedback loops; thus the outcome of the events may not be predicted [44, 52]. IR is impacted by many various parameters and variables which are interconnected and interdependent, indeed, also the main actors in the system cannot be limited by only states which are socializing and affected by the structure in their interactions considering the critical impact of the substate factors, transnational terrorist groups, and many other variable causes as well as their interactions in the international changing and co-evolutionary dynamics [53]. Complexity paradigm offers alternative approach in order to describe and explain Astana Process which have realized in the environment in which the non-linear changing dynamics emerged with diversified actors (not only states but also armed groups included) interacting in the Syrian complexity with many feedback loops. Also, the actors in the case of Syrian complexity are not exogenously closed to the environment as it can be observed from the spilling over of the insecurities (such as radical terrorism) and massive flow of the refugees, which have an enormous impact on some actors’ changing foreign policies in the disorder.



## *Complexity in IR*

Complexity paradigm originally occurred in natural sciences to challenge Newtonian linear causation in the natural phenomena; then, exploratory applications have emerged in social sciences, including IR [50]. The paradigm represents that many and diversified interconnected elements, variables, and agents interact each other in which total pattern of the dynamics change over time; because there are uncountable interdependent variables, even minor changes may alter the dynamics in unpredicted flows, in contrast to the paradigms predicted and calculated events as linear flows. “Grains of sand falling under gravity do not act differently from a single grain under gravity. However, allow these grains to interact with each other by piling them up on a flat disc, and they will begin to exhibit complex, unpredictable behavior” [41]. As earlier research which applied this sandpile model to the Arab Spring indicates that; if economic hardships, unemployment, oppressed self-organization and freedom tendencies, political corruption, social inequalities, and many more intertwined causalities analogically represent themselves as sand particles, resulting in an avalanche from this sandpile [1]. This analogy also remarks the self-organized criticality on the edge of chaos. Nevertheless, a young Tunisian’s burning himself in 2010 resulted in the ‘butterfly effect’ and triggered the mass demonstrations and uprising in the interconnected and interdependent Arab region which initiated a chain of causalities and unpredictability in the events [2].

Complexity is a system that is between the linear flow of determination of the order and non-linear chaotic systems; the chaotic systems represent non-linear and unproportionate characteristics that are reiterated, random, indeterminate and very sensitive as well as interdependent while unpredicted on the origin of the emergent events in which famously signified metaphorically as the “butterfly effect” developed first in meteorology and mathematics: butterfly’s flapping wings may cause horrific storms on the other side of the world [27, 74]. While the chaotic systems are beyond this article, it is essential to remark that chaos and complexity are different approaches, and non-linear foundations of the complexity aspect should not be understood as totally random, disproportionate, and unpredicted; however, the complex systems still demonstrate those mentioned characteristics but not totally. The linear causation founded on the assumptions that the agents (units) in the system are self-enclosed to each agent, on the other hand, in the complex systems it is essential to presume that agents are not enclosed *billiard balls* that interact each other in the system, but their internal dynamics along with interactions with other agents in the system also matter and may also have an impact on the other agent; thus the cause may have differentiated effects in the context of diversified factors considering the features of the complexity that are *diversity*, *connection*, *interdependence*, and *adaptation*; this leads to non-linear causation in the problematic of emerging phenomena and uncertainty in the dynamics; indeed, a cause might result in different and disproportionate effects in various timelines [33, 84].

The interconnectedness of the diversified actors, their actions and interactions are not enough to describe the system; however indirect effects and unintended

consequences is also possible from the interactions of the other actors; relations between states are beyond their bilateral interactions and totality is not the sum of their parts or interactions, variables are diversified in the relations between states that also prevents the interactions between them from following linear progress; in fact, diversified variables may have a significant impact on the nongradual effects; “in relations between two states affect each states stance toward third parties, and the distribution of bargaining power between two states is strongly influenced by existing and possible relations with others” [49].

The relations between the two states are not only determined by their respective, collective and contrasting agendas in the changing dynamics because of interconnected and interdependent patterns in the areas of interests; for instance, some major external threats might also cause consistency in the conflicting agendas even though this may not lead complete cooperation in the relations which is consistent with each actor’s separate interests and power calculations [49]. In these calculations, security is prominent to dominate the states’ agendas and to reorient their interactions with the other actors since the concern of maintaining security causes significant patterns in their connection and behaviors of the states [83].

Complexity indicates the vivid and dynamic structure and due to the flow of time dynamics are not able to totally reversed back the same in this system; in this structure states are not only actors interacting in the system but sub-state actors and mobile networks across local landscapes with global connections (such as transnational terrorist groups which self-organize themselves consistent to changing dynamics in the system as well) may have major implications in the global events that make them actors in the global system [30]; indeed the complex structure contains disorder and order at the same time enhanced by varying degree of fluctuant “global fractals” in the system [90]. The international system, as emphasized, is not totally structured as order organizing the interactions and actions of states arranged by the system; nevertheless, fractals in the “order” comprising non-state and sub-state actors as well as their interactions in the system may possess a considerable impact in global politics as observed in the terrorist events of 9/11. Indeed, the changing dynamics in the Syrian complexity is not bounded only by the two sides of the civil war (the regime and opposition) nor the external states involved in the area; but non-state actors such as YPG, ISIS, and Al-Nusra had a significant effect in the changing dynamics; in addition, the actors like ISIS cannot be regulated via rules by state actors as in international institutions.

In order to describe connected interactions between agents in the complex system, emergent behaviors, and co-evolution of agent-structure and agent-agent relationships, the concept of “Complex Adaptive Systems” (CAS) has been developed from the biological experiment on the co-evolution of slime mold cells and their environment; based on this experiment as a model, the CAS was conceptualized in mathematics to natural sciences, and then it was also adapted in social sciences [28]. In the mentioned experiment, it was observed that slime-mold cells affected each other by self-organizing themselves, adapting and co-evolving with the changing environment via *feedback* mechanisms; indeed, the threshold change in the adaption of the cells emerged from non-linear dynamics [28]. CAS contradicts simple causality based on

linear equations, whereas, the approach ascribes processes as dynamic and nonlinear characteristics in which relationships and interactions of different, interconnected and many agents impact the system or environment (structure) while the agents are also self-organized and shaped by the system itself [51, 82].

The “co-evolutionary dance of competition and cooperation” between interacting states enables each actor to adapt in the international processes while the objective of maintaining their interests is still on the agenda to a degree of their capabilities; nevertheless, relatively weak power would avoid any conflict alone with relatively more powerful state and modify its activism in order to adapt changing dynamics in response to feedback loops in the complex system while the great power would also adapt its policies accordingly to a degree of its limited capabilities in the dynamic processes [45, 69]. Interdependent roles that are pursued accordingly to each actor’s interests and maintenance of their survival and their security in the changing environment result in adaptation and then co-evolution in the foreign policies of the actors sharing landscapes; each alteration in the area whether deriving from the actor’s activism or from internal dynamics bring about adaptation in the other actors’ polities by self-organizing their attitudes which also causes chaining impact on the different actors’ polities involving in the area; indeed this synergic adaptation indicates co-evolution in the polities of the varying actors accordingly non-linear dynamics [65]. Co-evolution may provide cooperation, coordination, or further competition between interrelated agents pertaining to the changing dynamics, which also serve the foundation of emergent properties and interaction with that emergent phenomena through feedback loops in the structure [31] that can be observed in the Syrian Civil War.

### *Co-adaptation in the Syrian Complexity*

It is evident that there are varied and diversified actors who come into play in the Syrian complexity. The CAS into Syrian complexity would help to describe and explain the interrelated, connected and adaptive interactions and polities of the actors. In the Syrian case, two watersheds directed the change and adaptation of the polities and priorities on the state’s agendas: the rise of the ISIS and the Russian military intervention in Syria by Assad’s request on 30 September 2015. In those events, diversity of actors included, while the actors adapt to the transforming events and modifying interactions. The core interests, concerns, and policies have been maintained; however, the actors re-organizes their polities to adapt to the new environment while contributing to change dynamics. The agents are not enclosed but penetrable and adaptive to the changing dynamics; nevertheless, diversity and variety of the actors, interconnected events, and interdependence to the changing dynamics on the foreign policies of the actors constitutes the complex structure in Syria. Because of the complexity in area, dynamics do not orient in a linear process, but in a non-linear formation, indeed, due to the non-linear change dynamics in the area, actors are inclined to more flexible to adapt for maintaining their core interests in the Syrian complexity. Due to the connected, multiple, unproportionate and varied

causes; emergent properties carry the characteristics stemmed from the interactions of the many actors which self-organize themselves in the emergence of the new events or phenomena, and because of this adaptation, the system is not complicated but complex which offers a better explanation that the totality is not the sum of the interactions or parts but transcending from the sum of interactions in the system. The actors do not only compete to each other but also co-adapt to each other's interactions, the emergent events caused by unproportionate causality, and their environment over time.

As famous physicist Albert Einstein pointed out in natural sciences; the events are shaped in the four dimensions of the matter in space which are demonstrated as; the vertical and horizontal co-ordinates constitute the first and second dimensions, the third dimension that gives the matter a volume, and the time as another co-ordinate in the shaping of the matter that generates the fourth dimension in the relations between matter and space [37]. Similarly, in international relations, it could be argued that there are also four dimensions in the events between interrelated interactions in the complex international system. The first and second dimensions constitute the main actors and the interactions between them in the international system. The third dimension, which gives a volume to international events, is formed by the power competition and cooperation in the system. The fourth dimension as "time" or processes in the international dynamics directs the power competition in the non-linear form of the changing dynamics. In the complex international system, in addition to power struggle guiding by the conflicting or overlapping interests and the interactions between the states constituting per se three dimensions of the system guided by linear processes; the fourth dimension of the international complexity in the vivid structure shaped by the course of the processes and events dynamizes in a non-linear form. This non-linear characteristics of the power struggle emerge from the structural changes and the continuity in global politics realized in the specific "time" period. In the course of time, power dynamics, the changing dynamics in the area, actors' position, and their interactions co-evolve and co-shape with the events and environments in which the events emerged. However, this co-evolution and co-adaptation, by the course of time, also symbolizes the continuity of the foreign policies of the actors on changing dynamics; the process shaped by the actors also determines the actors' adaptation in their environment. The complexity paradigm considers that both the structure and the actors have been subjected to a change arising from interactions over time when analyzing over processes instead of parts in which totality does not derive from the sum of these parts [95]. Indeed, by the course of time, the changing dynamics in the area and interconnected relational factors with the varied and diversified actors remodel the power struggle among the actors held conflicting or overlapping interests. The complex co-adaptation also considers the "time" parameter, which establishes the power struggle in a dynamic, vivid structure that occurs in a non-linear form and contributes to the self-organization of the new circumstances by the interrelated and interdependent actors. Following this, Syrian complexity will have a better understanding of the description of the actors' roles in the area and then the Astana process in context with CAS.

## **Policies of Russia, Turkey and Iran on Syrian Complexity**

The Astana Process (2017 to today) as a conflict management method (under the guarantee of Moscow, Ankara, and Tehran) that is parallel with the Geneva Process via the UN mediation efforts has aimed to manage the conflict between the Baath regime and opposition forces and to enable coordination among Russia, Iran, and Turkey which hold different agendas and contrasting interests in the Syrian Complexity. In this part of the article, the different and varied interests of the guarantor states will be analyzed.

### ***Russian Foreign Policy on Syria***

Russian foreign policy on the issue of Syrian Civil War has a variety of dimensions including Russian outlook of the world affairs and her place in the global politics basing her view on the international system as multipolar and placing herself as an equal partner with the Western states in this system, norm contestation between non-interference in domestic politics and concerns of regime change policies, the threat of jihadist terrorism to her mainland as well as to her Near Abroad and also geopolitical concerns.

*Global Calculations:* Russian MENA policies are part of her global objectives as being a power center and pursuing her interests in her Near Abroad and status enhancing in the international system. Russia under Vladimir Putin's rule has augmented its presence in the Middle East politics benefiting from the reluctance of the US under the Barack Obama Administration (2008–2016) to involve actively in the MENA region; Putin has established pragmatic relations with the regional powers while abstaining from taking sides of the regional rivalries to enhance Moscow's leverage on the MENA and global issues and to break US monopoly on the global politics in order to demonstrate itself as an equal partner in the global agenda [78]. Russia applied for military interventions, aiming to increase its status and maintain its influence in global politics [40]. Russia, which aims to be an equal dialogue partner with the US, has been trying to stand out as an indispensable actor in the order to be established in the region with her intervention in Syria on 30 September 2015. Putin manifests Russia as an indispensable global power and attempts to play a decisive role in the region by active military engagement in Syria [89]. Entering in the region, Russia has also affected the policies of the regional powers to coordinate and be in good relations with herself. Although good relations have been developed and airstrikes have been coordinated with Iran; Kremlin also attaches great importance to her relations with Israel and Saudi Arabia considering balances in the regional competition, and intends to prevent Iran from gaining a great influence in Syria [67].

*Syria-Ukraine Nexus:* Although some sanctions were imposed on Russia because of the Ukrainian crisis in 2014, this crisis also motivated Russia to demonstrate herself as an indispensable actor in the Middle East (ME) by pushing a more active

policy in the region, and increased the power of Russia at the negotiations of the problems arising from the Ukraine problem. By intervening in Syria in 2015, Russia not only assured Assad's salvation, but also managed to draw attention to Syria from the Ukrainian crisis and was able to put Syria as a trump card against Ukraine in the negotiations with the West [59, 76] and also to attempt to alleviate her isolation from the Ukraine crisis and reengage with the West but having more powerful position on the negotiations [92]. Nevertheless, the possible compromise deal would be determined by a variety of interests and may be hard to achieve, because the Syrian case is not only connected to the Ukraine crisis but the outcome of power competition and many factors that are not agreed upon regional and world policy.

*Tartus Port and Beyond:* In addition to being the only base of Russia in the Mediterranean, Tartus Port, which also provides access to the Eastern Mediterranean for Russia, the developments in Syria have enabled this base to be more functional, and Russia's largest electronic eavesdropping facility outside her borders has been established in Latakia in 2012 which is very close to Tartus, furthermore, Russia has consolidated its strategic position in Syria by temporarily taking control over Syrian bases (Hmeymim Air Base in Latakia and extended the duration leasing of Tartus Port) with Assad's agreements [12, 36]. Also the importance of Syria could be seen from Russian intelligence establishment in the state as well; intelligence cooperation continued on the Moscow-Damascus line after the USSR collapsed even it was the years when the FSB was following the invasion of Iraq through Syria and that Syria was Russia's eye in the Middle East [68]. When it is evaluated with the development of military opportunities, it can be seen that securing this intelligence network facility also has a geopolitical anxiety in Russia's strategic and security establishment, as its interests in the Middle East cannot be evaluated solely through bilateral relations. In this sense, the protection of existing institutions in Syria means the protection of geopolitical interests, and at the same, these developments enable Moscow to secure its security architecture in the ME, and to expand its strategic achievements and pursue a more active policy in the future of the region.

*The Problematique of Regime Change:* Before the Arab uprisings, Kremlin has suspected color revolutions by the initiatives of the West (primarily the US) [26] to engage regime change in the post-Soviet states, seen it as an intervention in her primary domain of influence, isolated and even feared of the possibility to the extension to Russia itself [93]. In this framework, the "Arab Spring" was seen as the continuation of regime change policies by discerning as Western activity to promote democracy. Russia fears long-term and unilateral implementation of regime change policies by the West, and does not support the overthrow of authoritarian regimes through foreign intervention, arguing that these policies will give rise to hopes of the overthrowing regimes through external intervention and will lead to civil wars [8]. Russia perceived that she was alienated from the formation of a new multilateral Contact Group to provide political guidance on operations in Libya, and criticized regime change by the intervention that NATO is no right authority to implement Resolution 1973 [8]. NATO's implementation of Resolution 1973 under the banner of the R2P norm, and subsequently the fact that this norm used to led to a regime

change in Libya, caused Russian already doubts have grown in the implementation of the R2P and policies and have begun more cautious towards the Western policies [29].

*Jihadist Terrorism Threat:* Considering that there are about 20 million Muslims living in Russia, the majority of which are Sunni, and that there are jihadist Chechen organizations where Moscow is struggling for over decades to fight Chechen jihadist organizations [29]; it is another concern for Moscow that radical Islamic ideas and armed groups in the Middle East can penetrate the post-Soviet territory, the Russian North Caucasus, the central Russian republics of Tatarstan and Bashkortostan due to the region's proximity and poses a threat for Central Asian countries and Russian southern border [85, 97]. Russian foreign and internal politics affected by radicalism and separation issues in the North Caucasus, as well as the region's proximity with the ME and post-Soviet states, attach area to the geopolitical sense [98]. Kremlin's motivations also concerned that possible returning fighters would act terrorist deeds in Russia, thus Putin aims to neutralize jihadists at their location in Syria to preempt this spilling over insecurities [59].

### ***Turkish Foreign Policy on Syria***

At the start of the "Arab Spring", Turkey supported and welcomed the developments of political transformations against authoritarian regimes in the MENA region. However, when uprisings spilled over to Syria in which reconciliation and enhancement policies applied by Turkey during the JDP (Justice and Development Party) term in office, Turkey has become alarmed due to the concerning events in its neighbor [18]. Especially wrong estimations on Assad's departure; led Ankara to follow a much stricter policy as well as paving the way to conceive of more security problems. Apart from Ankara's own concerns and policy agenda, Turkey, via America's "leading from behind" policy, has been the prominent actor in the crisis in Syria; however, miscalculations on Assad's fall and not receiving *de facto* adequate support from the US; dragged Ankara to a deadlock where Assad's departure would be the only way out [19]. Apart from that situation, "unpredictability" in political events displayed that Ankara had limited capabilities in Syria.

*3.2 Activism in TFP:* Since 9/11, Turkey discovered her trump card in the Middle East as a global stakeholder and boosted her soft power capabilities as an interlocutor for the Muslim world, reorienting her foreign policy towards as an influencing regional actor in the ME in addition to following objectives to being part of the Western club [17]. New TFP has been founded on Davutoğlu's (former Minister of Foreign Affairs and former PM of Turkey) views on the international system and status of Turkey in this system. The geopolitical worldview of Davutoğlu based on the assumption that the decline of the West and thus Turkey could lead the shaping of regional and global events by the instruments of mediation efforts, economic engagement and exploiting her soft power capabilities to demonstrate itself as a power center [86]. According to Davutoğlu; Turkey's strategic depth formed by its



historical, geographical (in which its nearby land, sea, and continental basins interacting but they are different from each other), cultural assets and its power capacity should be mobilized to realize its real power and in terms of enhancing the regional and global position of Turkey; its geopolitical, geo-economic and geo-cultural integration tool should be utilized, and Ankara should pursue strategic consistency and flexibility in the uncertainties of the dynamic transition derived from the new parameters of the order that not entirely determined after the Cold War [34]. During the Arab uprisings, Turkey assessed those events as an opportunity to realize and promote her liberal policies such as economic interdependence, political transformation, democratization in the region under her influence [11]. Based on the predictions that the old order in the MENA would change and authoritarian leaders would leave their seats, and new regimes would be established in the region; Turkey was enthusiastic about playing a constructive role during the change that occurred from the “Arab Spring” and to involve in shaping the transformation in this region [11]. Nonetheless, this policy orientation based on soft power evolved into hard power due to the failure of the “Arab Spring” to bring democracy in the MENA region, as seen from the 2013 Egyptian military coup d’etat and prolongation of the Syrian Civil War [96]. Also, the strengthened terrorist groups in the area benefiting from the prolongation of the disorder, as well as the Western support to PYD concurrently neglected Turkish security concerns by the West resulted in the revision in the agenda by seeking new ad hoc collaborations with other actors and enhancement of hard power measures in order to deal with disorder in its security environment [96].

Indeed, the post-2011 events and the failure of the soft-power measures in the MENA transformed the TFP into a more security-oriented; especially the events in 2016 which were the announcement of “federal democratic system” by PYD in March 2016, Western support to PYD/YPG despite Turkish sensitiveness on this subject, departure of Davutoğlu from the Premiership and his disagreements with the ruling elites in May 2016, failed coup attempt in July 2016 and the reluctance of Western support to Erdoğan after the coup attempt resulted in the doctrinal shift in TFP by increasing its hard-power measures and its unilateral acts in the area as well as distrust to traditional allies while engaging more with Russia (Moscow also seized the opportunity to the enhancement of disagreements in the NATO alliance) despite reciprocal mistrust and conflicting interests in the region [9].

*Syrian Refugees:* Refugees may pose the risks and threats to the receiving countries concerning social order, economic development, and political stability [55]. Having regard to fact that there are approximately 3,6 million Syrian refugees in Turkey [88], the massive influx of refugees has been forcing Ankara’s economic capacity, thereby disrupting the social composition and have been taken into account in the future of the refugees’ situation in the country remains in the process of integration will constitute a major problem is clear. However, the influx of refugees and gives an ethical responsibility to Turkey regarding ensuring humane conditions for “the guests”. Ankara, which initially implemented an “open door policy”, was considering that the Assad regime would fall in a short time; nonetheless, its capacity against such a large influx was not suitable. The “unpredictability” of dynamics caused by a



disorder in the neighboring country has posed risks and threats to the internal order of the receiving country.

*Border Security:* Although Turkey has perceived a threat from ISIS to its border and internal security, the other dynamics in the area alarmed Ankara and led to dilemmas due to the events that in Ayn el-Arab; Kurds would strengthen their position to establish an autonomous structure in Syria, because PKK linked organization YPG's fight against ISIS would boost Kurdish identity, as well as the US support to this organization, would legitimate Kurds as a political actor [22]. In parallel with the threats emanating from YPG and ISIS to the Turkish territory, Ankara has prioritized to eliminate these groups' presence and build a wall along the border to secure its territory; besides these prevention measures would also help Ankara to maintain its domestic security from the PKK which emboldened to pursue and increase terror activities due to the wins of YPG in northern Syria [62]. Based on self-defense to establish safe zones, Turkish military operations in Syria met on common ground; all activities conducted with the help of FSA (later named as Syrian National Army) which was trained and equipped by Turkey; nonetheless, declarations were also made to ensuring Syrian refugees to return in those safe zones. The US administration has attempted to prevent conflicts between Turkey and YPG at every turn which demonstrates that in order to implement the policies, Turkey should have engaged with the great powers in the region. Because of the involvement of other actors, including great powers, Ankara has limits of capabilities in the area; accordingly, to maintain her priorities, Ankara has coordinated with notably the US and Russia. This compulsory situation demonstrated itself on the Astana process with Russia and Kurds with the US.

### ***Iranian Foreign Policy on Syria***

Removal of Assad regime has defined as "red-line" for Iran, nevertheless; the other objectives in Syria demonstrate themselves as restoring the *status quo ante*, as far as possible to keep Assad in power concerning that probable government change would not result in carrying out vis a vis strategic relations like before [10]; and also preventing "Lebanonization" of Syria in case of autonomous Kurdish zone would also pose a threat to Iranian territorial integrity, while maintained tactical relations with PYD to counter ISIS in coordination with Assad [71]. According to Sinkaya, Iran's firm position on Syria stems from several reasons. Firstly exclusion from international and regional initiatives meant to the establishment of the new regional order without considering Iran's expectations and apprehensions on the subject, secondly; security elites come to the fore in the decision-making process that results in the perception of the events as a zero-sum game, and thirdly Russian intervention in 2015 greatly relieved Iran militarily and economically, eliminated the need to change of its position; nonetheless, Tehran had to follow the leadership of Russia on Syria because of the Russian engagement [73].

*Axis Of Resistance:* As a “semi-alliance”, “the axis of resistance” has been shaped around coalition-building among the group of states and armed groups aiming to “resisting dominance” and mutual solidarity against the Western and regional measures to isolate Iran and Syria; accordingly, the axis establishes the backbone of Iranian regional strategy as well as relations with the great powers [75]. The common understanding of Syria and Iran against Israel, countering Iraqi ambitions (before 2003), and isolation by the US caused to pursue a pragmatic way in bilateral relations; however, the axis has been defined as “marriage of convenience” in the bilateral relations [72]. Moreover, the assassination of Lebanese former PM Rafic Hariri, alleged to be by Syria in 2005 and the nuclear ambitions of Iran, resulted in the boosting alienation of these actors in the regional order, which resulted in further rapprochement in the bilateral relations [75]. Although the Syrian crisis interpreted as an “existential threat” to Iran (because of the fact that possible regime change in Syria would boost the encirclement of Iran, in which case the Islamic regime would become a more brittle structure), Iranian Supreme Leader Khamenei considers accord priority treatment that preserving the weapon and goods corridor to Lebanese Hezbollah and securing the Shia holy shrines in Syria [46]. Accelerating Iranian network with state and non-state actors across the Levant brings about the strategic depth which reckons for deterrent capabilities against Israel and also serves Tehran as a departure point against Western isolation for the IRI [91]. In this context; Iranian security architecture consists of preventing elements that pose a threat to its borders and maintaining the spheres of its regional influence that extends to Syria, Iraq, and Lebanon to be capable of averting its security structure from regional and global threats [47]. This architecture attaches great importance to establishing a connection between proxies and maintaining strategic “alliances” in order to serve its influence in the region and departure from isolation. Since Iran provides financial, military, and logistical support to Hezbollah over Syria, as the primary connection point between Iran and Hezbollah, it has been seen as critical for breaking Syria from this “axis”, ensuring that Hezbollah is besieged and breaking the influence of Iran in Lebanon [72].

*ISIS And Beyond:* Developing events in Syria and Iraq forced Iran (reluctantly) to perpetuate sectarian lines, at the expense of decreasing the impact of the proclamation of the unity of Muslim *umma* and avoidance of sectarian discourses, to defend Shia shrines and attract Shia fighters against ISIS which was also aiming Shia holy sites and communities [3]. Besides IRGC’s fight against ISIS together with its Syrian origin and other proxies, Tehran also mobilized multifaceted paramilitary groups, including “shrine defenders” in order to guard Shia holy sites, that also served Iran to get a foothold in Syrian regime’s vital zones. Stretched out to 80 km remoteness to the Iranian border in 2014, ISIS was assaulting Shia communities in its captured zones as well as posing a threat to Iranian domestic security as attracting Sunni minority to recruit them or challenge to Iranian internal order [91]. Although ISIS propaganda in Persian had limited appeal of its ideology within the country’s Sunni minority, still ISIS managed to recruit Iranians [38]. Following terrorist attacks by five Iranian citizens on behalf of ISIS against the symbols of the post-revolutionary values; the mausoleum of Ruhollah Khomeini and parliament building, indicated as an attack on the Islamic regime rather than an assault on civilians [56]. The terrorist

attacks inside Iran displayed that the dimension of the threat may extend to domestic security from external dynamics. Although both the US and Iran sought a solution in order to fight against the advances of the terrorist organization, Tehran has been alienated in the course of the coalition against ISIS led by the US [39]. Therefore Tehran's counter-terrorism efforts were not in coordination with the West, namely, tensions with the US prevented cooperation even in vital operations.

## **Ground Dynamics for Tripartite Talks**

Prolongation of the Civil War and therefore enhancing insecurities spilling over from Syria and the interconnected events in the course of time co-shaped the actors' positions, which resulted in co-adaptation. Astana process is an output of the developing but structurally limited rapprochement among Russia, Iran, and Turkey as well as deriving from parties' objective of maintaining their foreign policies as far as possible in Syria by utilizing the platform and ensuring the acceptance of their interests by the other actors. In doing so, the Astana platform also helped parties in providing ground for coordination to prevent any possible clashes between them [14].

### ***Impartiality Status***

In mediation efforts, mediators should have influence over the disputants in order to maintain leverage and effectiveness over the conflicting parties [66]. Neither Turkey, Russia, nor Iran possess influence over both of the disputants because of the active involvement in the civil war and their support to particular conflicting sides. In the meantime, as a part of the civil war that also extended by hard power means in area, Ankara, Moscow, and Tehran exerted their intention to determine the direction of conflict. However, mediation efforts, which is one of the appropriate tools in this context, could not be carried out solitarily due to the lack of the specific disputants' consent and entry in mentioned states' mediation efforts. Before militarily intervening in the civil war, Russia demonstrated its intentions to maintain mediation in parallel with the Geneva talks with the Moscow talks, however; the Moscow talks (hosted by Russia delegates of Syria's permanent representative to the UN, Bashar Jaafari and mainly "moderate" opposition attended) did not achieve any success, even SNC, which was recognized as a legitimate representative of the Syrian people by the West, and also the UN special envoy to Syria Staffan de Mistura declined to join further meetings in Moscow, early of 2015 [15]. As a proponent of the Assad regime, Russia could not establish an impartial platform for enabling negotiation and discussing the events in Syria.

Turkey's previous mediation efforts in global affairs has diverted to be preserving influence in its backyard during the Arab uprisings [4]; however, the continuation of the civil war minimized the effectiveness of its mediation efforts. Although Ankara

made attempts to persuade Assad in order to appease the incidents before growing momentum in the early stages of the disorder, this stance has turned into hostility with Assad and full support to rebels in response to the continuation of harsh actions by Assad [4]. These factors enabled Ankara to gain influence over rebels but also harmed its impartiality in the further mediation efforts in Syria because of visible hostilities with Assad. Iran also offered mediation between the conflicting sides in Syria in 2013, however, because of its vigorous stance on Assad's side, opposition strongly rejected its offer [4]. Tehran was unable to mediate between the parties despite its intentions to boost leverage by mediation along with its military support in Syria.

### *Tripartite Relational Dynamics*

In order to have a “greater stake and higher status” in the MENA region, Russia implements a multi-vector policy in the region, which also necessitates developing ties with regional actors such as Israel, Saudi Arabia, Turkey, and Iran together and restoring stability and security in the area [58]. Astana would be another instrument of broader Russian multi-vector policy in which helps to boost Russian status in the region as well as might have compelled other regional actors to accept its presence in the area and hence may result in developing closer ties with Moscow.

Stressing political solutions for the peace whereas, gaining ground which also might serve to acquire a position in the negotiations, Tehran endeavored to gain a seat in Syria talks, notwithstanding, Iran was isolated from Geneva I and II talks, and other diplomatic processes [43]. Similarly, discord in Syria between Turkey and the US, especially over Kurds' position, led to expressing the “precious loneliness” paradigm in the Turkish lexicon [20]. Whereas Tehran was isolated from diplomatic events, Ankara was alienated from political events in Syria, on the other hand, Russia assessed to take advantage of these situations.

Turkey and Iran, despite their proxies in Syria clashing each other, avoided worsening the relations and Iran maintain engagement with Turkey, which is also a specific gas market considering its isolation by the West [60]. In this context, Turkey and Iran had already demonstrated co-mediation efforts, for instance, by implementing temporary truce between Hezbollah and rebels in Zabadani and Idlib in August 2015 [4]. Another factor that enabled the Turkish-Iranian rapprochement in Syria was in their complex relations in the Kurdish issue. While Turkey supported Iraqi KDP backed Kurdish National Council which is also the main rival of the PYD, Iran maintained pragmatic and tactical relations with YPG against ISIS; besides, Tehran did not consider YPG/PYD as a terrorist group; however, Ankara has perceived threat to its border security from this organization as well as mentioned repeatedly this organization's links to PKK [10, 71]. But at the same time, it should be also mentioned that Tehran's relations with the PYD remained solely pragmatic in context with preserving Syrian territorial integrity; because of the fact that PKK-linked Iranian organization PJAK also poses threat to Iranian security and its territorial integrity,

especially when PJAK started operating in the 2000s, developing dynamics also led to creating conditions for cooperation on Kurdish issue between Turkey and Iran [94]. American support for the YPG is another factor that also worries Iran for the post-ISIS environment [25]. However, due to the proximity, PYD has been posed a fundamental threat to the Turkish border, on the other hand, the Kurdish problem occurring from Syria found a place as a secondary threat on Tehran's agenda.

In the 2000s under the JDP rule, TFP added dimensions to its relations with Russia more than economic rapprochement, Moscow and Ankara attempted to include their global and regional interests in their common agenda despite their conflicting interests in Central Asia and the Caucasus; their mutual interests such as diplomatic, energy and economic relations led these actors to cooperate in such sectors; however, the relations strained due to the explicit conflicting interests in Syria while the mentioned actors still attempted to pursue good relations in other areas; nevertheless, the shootdown incident of Russian Su-24m bomber aircraft by a Turkish F-16 fighter jet on 24 November 2015 brought about Russian harsh sanctions against Turkey and almost rupture in bilateral relations while Turkey endeavored to maintain relations via diplomatic channels after the Russian sanctions; on the other hand, this rupture in the relations harmed both sides in many areas; for instance notably both states' economy followed negative trend [21].

Kurdish separatism and PKK linked groups defined as "Achilles heel" of Turkey had been more played as a trump card by Russia, which has sustained historical ties with Kurdish actors, after the shootdown incident by Turkey in November 2015; on the other hand, there was no capability of Ankara to hold a Chechen card against Russia as in the 1990s given that Kremlin's control over Chechens has been augmented since the second Chechen war (1999–2009) [63]. In the short period of strained relations with Turkey, Russia protected political representatives of YPG, and enable PYD to run the first overseas office in Moscow, inasmuch as did not oppose federal solution in Syria and even tried to persuade Assad to cooperate with the Kurds, however, it did not officially recognize self-proclaimed administration in "Autonomous Administration of North and East Syria" (Al Jazeera English [7]. Nevertheless, this "Kurdish card" would be played by Russia in order to negotiate and persuade Turkey to side with Moscow and make concessions in favor of Assad, by reassuring Ankara to acknowledging its security concerns and enabling its military operations against YPG in some areas where Russian presence located.

To restore harmed relations, Kazakhstan took a constructive role in mediation with Turkey and Russia in 2016 and implemented intense efforts to repair the Ankara-Moscow line, which greatly harmed after the incident of Russian Sukhoi Su-24 shootdown by Turkey in 2015; as a matter of fact, Putin had defined this shootdown incident as "stab in the back" and imposed harsh sanctions to Turkey, and for that reason, bilateral relations had not seemed to recover in a short term period [61]. The abrupt change in Ankara-Moscow bilateral relations developed following by concurrent tensions over Turkey and the US. Ankara-Washington relations came through tensions over the threat of FETÖ as well; nevertheless, after the Gülenist failed coup attempt in 2016 the US did not want to support Turkey, and despite Ankara's repeated requests to handing over the FETÖ's leader Fethullah Gülen from

the US, the demands were declined. However, on the issue of FETÖ Russia declared to support to Turkey fully; that was also one of the reasons motivated Erdoğan to approach to Moscow [5]. Mutual perception of rejection by the West was another factor that enabled pragmatically developing relations and ad hoc cooperation, which also seeking modus vivendi in the issue of Syria [80].

As “strategic singles” (in Suchkov’s term) Russia and Iran have shared the proximate views on Syrian future and sought to cooperate in Syria; however, this cooperation also based on “delicate balance” which would be jeopardized if either party would probably harm the other’s interests and opportunities in the area [79]. Although different policies and interests determined the particular implications, because of their overlapping agendas on Assad’s fate, as seen from Soleimani’s visits to Moscow in July 2015, Russia and Iran have already been maintaining tactical and operational coordination in Syria [64]. Before the Astana process, Moscow sought for establishing platform (as in Astana) in coordination with Tehran. For instance; Putin had already visited Iran in November 2015, to confer on Russian proposal on Syria in which prescribes establishing a forum consisting of representatives of both opposition and Assad to forming a new constitution, excluding to refer Assad’s fate [13].

### *Dynamics in the Area*

An agreement between Turkish intelligence and Russian military in December 2016 (before the declaration of nationwide ceasefire in Syria by Russia and Turkey), foresaw the ceasefire in Aleppo and relocation of opposition forces to Idlib from Aleppo, that enabled regime forces to recapture of the city [70]. The ceasefire agreement on Aleppo was the preliminary step for the nationwide ceasefire in Syria and the Astana Process; nevertheless, initiation of this deal enabled Moscow and Ankara to take further steps and build confidence in the interactions between them in the area. After recapture of Aleppo in December 2016 by Assad, and with the initiation of Astana talks, Moscow estimated that enforcing rebels to conform with diplomatic pressures, and assessed the possibility to convince Turkey to sideline with Russia as well as sought Turkish persuasion over opposition forces, in order to return Geneva as a triumphant of the peace process and strengthening the position of the Syrian regime by enabling Assad to retake the west and south of the country [81]. In contrast to a partnership with the US in a diplomatic means on Syria, Turkey was assessed to be relatively easier to negotiate on Moscow’s terms, due to the impact of possible coercive economic, militarily and political measures applying in a regional power would be more effective than a superpower in a possible conflict.

The Russian presence in the west of the Euphrates, and the US presence in the east, located in northern Syria compelled Ankara to cooperate with the other external powers in order to conduct operations against YPG [77]. At the time Operation Euphrates Shield (OES) commenced in August 2016, Turkey had already agreed with Washington; nevertheless, Washington support was limited in addition to having been aiming to prevent escalations between Ankara and YPG, Syrian government

denounced the military operation; Iran in coordination with Assad also expressed its concern over the incursion [42]. However, Tehran and Ankara hold disagreements over dealing with the YPG; Turkey has focused on coordination with Moscow (notably during the Astana Process) and Washington, whereas Iran, in tandem with Assad, has indicated negative stance on the Turkish operations and urge Turkey to stop military operations and to respect for the territorial integrity of Syria [24, 42]. Just before the first round of the Astana talks took place and during the OES, Ankara and Moscow jointly airstrike against ISIS' compound in Al-Bab due to the signed a memorandum to coordinate airstrikes which also provides communication when it comes to the aviation airspace [6, 48].

As a result of Russian-Turkish rapprochement, a country-wide ceasefire declared (except for terrorist groups) under the guarantors of Moscow and Ankara on 29 December 2016; the declaration also envisaged meetings would commence in Astana in order to revitalize the process under the UN auspices [87]. As seen from these intertwined causalities, the "emergence" of the Astana Process is derived from the interconnected and interrelated interactions between varied and diversified actors that co-adapt in their interrelated interactions and the environment. Iran, Russia, and Turkey in context with their interrelated and interconnected interactions with the other actors and the changing dynamics in the area led these Parties to co-adapt with each other and the dynamics in the area in order to maintain their core interests in Syria, that resulted in the initiation of the Astana Process.

## Conclusion

In order to have a better understanding, the Astana process cannot be solely reduced into the relational dynamics among Iran, Russia, and Turkey; nevertheless, this process' underlying factors also derive from the interconnected relational interactions between varied and diversified actors and their interactions with those abovementioned states on the changing dynamics and on the emergence of the newly founded phenomena in the course of time in which actors co-adapt to changing dynamics to pursue their divergent core interests as far as possible. The essentials of the Astana Process' guarantor states' policies in Syria are based on various causes and interests, in which their separate but interconnected and interdependent relational interactions with various and different actors are also effective.

The international system is not directed by the linear static orientation; nevertheless, due to the vivid characteristics of the system, the dynamics are inclined to change and form other causalities (whether slowly or abrupt change by the emergence of other factors) that many calls "unpredicted" in the changing dynamics of international events. Indeed, changing dynamics would be unpredicted when the linear *ceteris paribus* assumptions are made to explain and describe international events; however non-linear assumptions ontologically based on complexity paradigm offers a

better understanding of the analyzes and predictions of “unpredictability” and “uncertainty” in order to include more varied and diverse actors and their interconnected role in the shaping of events in the area.

The complexity paradigm offers an alternative framework in order to understand the process-oriented interconnected power struggle in disorder. The changing dynamics in disorder in Syria have not reached any equilibrium, but attractors of the reiterated as well as emergent events which would establish the new circumstances far from the equilibrium that variety and diversity of actors have to co-adapt in the changing environment in the process of time. The characteristics of the “processes” in the Syrian disorder symbolizes the fracturing component in the power struggle that brings non-linear orientation. The Astana Process demonstrates itself as one of the emergent events in the Syrian Civil War that depend on the co-adaptation of the three states in the area and with the environment of the disorder, compartmentalization on the conflicting and overlapping interests in Syria, the diversity and variety of the actors’ action in Syria and their relations with Iran, Russia, and Turkey. The power struggle shaped by the non-linear dynamics by the time and processes in the changing dynamics brings about flexibility in the behaviors of the actors in order to maintain their initial priorities in their foreign policies or their main objectives in the changing dynamics. That results in the co-evolutionary dynamics in the interactions between the relative power distributed actors restrained or allowed activism in structure, and between the actors and structure that co-shaped each other in the area. Because there are diverse, connected, interdependent, adapt, and non-linear characteristics in the events, the Syrian case’s ontological structure is compatible with the complexity paradigm. The power struggle between the actors has not only determined by the interactions, overlapping, and conflicting interests in the area; but also changing dynamics in the area, interrelated interactions between the third parties, and the emergence of diverse actors pose as prominent intertwined cause and effect on the Astana Process. This initiative also demonstrates flexibility in the foreign policies of the guarantor states in accordance with the non-linear changing dynamics and also possess considerable impact on the Syrian complexity. The relations between other actors (for instance, the relations between the US-YPG and the US-Israel) and interactions with those actors in the relations between separately Iran, Russia, and Turkey had a significant impact on the interrelational dynamics between those three states that formed the Astana process. Indeed the role of the other actors cannot be excluded in order to understand the ground dynamics in the Astana process. On the other hand, neither state has the capability to alter the events in accordance with their core objectives totally. For this reason, to pursue the main interests in the area, Ankara, Moscow, and Tehran co-adapted their foreign policies in the changing dynamics and self-organized their positions without excluding their core priorities in the area.



## References

1. Açıkalm, Ş. N., Artun, E. C. (2019). The concept of self-organized criticality: The case study of the arab uprising. In: Ş. Erçetin, & N. Potas (Eds.), *Chaos, complexity and leadership 2017. ICCLS 2017. Springer Proceedings in Complexity*. Cham: Springer. [https://doi.org/10.1007/978-3-319-89875-9\\_7](https://doi.org/10.1007/978-3-319-89875-9_7).
2. Açıkalm, Ş. N., Bölücek, C. A. (2014). Understanding of arab spring with chaos theory—uprising or revolution. In: S. Banerjee, Ş. Erçetin, & A. Tekin (Eds.), *Chaos Theory in politics. Understanding complex systems*. Dordrecht: Springer. [http://doi-org-443.webvpn.fjmu.edu.cn/10.1007/978-94-017-8691-1\\_3](http://doi-org-443.webvpn.fjmu.edu.cn/10.1007/978-94-017-8691-1_3).
3. Akbarzadeh, S. (2015). Iran and Daesh: The case of a reluctant shia power. *Middle East Policy*, 22(3), 44–54.
4. Akpınar, P. (2015). Mediation as a foreign policy tool in the arab spring: Turkey, Qatar and Iran. *Journal of Balkan & Near Eastern Studies*, 17(3), 252–268.
5. Aktürk, Ş. (2019). Relations between Russia and Turkey before, during, and after the failed coup of 2016. *Insight Turkey*, 21(4), 97–113.
6. Al Jazeera. (2017). Russian and Turkish jets ‘bomb ISIL’ in Syria’s Al Bab [online]. *Al Jazeera*. [Viewed 14 April 2020]. <https://www.aljazeera.com/news/2017/01/russian-turkish-jets-bomb-isil-syria-al-bab-170118130233894.html>.
7. Al Jazeera English. (2016). Why is Russia courting Syrian Kurds? [online]. *Al Jazeera*. [Viewed 15 April 2020]. <https://www.youtube.com/watch?v=N2m86rPNSPQ&list=WL&index=41>.
8. Allison, R. (2013). Russia and Syria: Explaining alignment with a regime in crisis. *International Affairs*, 89(4), 795–823.
9. Altunışık, M. B. (2020). The New Turn in Turkey’s Foreign Policy in the Middle East: Regional and Domestic Insecurities [online]. *Istituto Affari Internazionali*. [Viewed 01 August 2020]. <https://www.iai.it/sites/default/files/iaip2017.pdf>.
10. Ansari, A., & Tabrizi, A. B. (2016). The view from tehran. In A. B. Tabrizi & R. Pantucci (Eds.), *Understanding Iran’s role in the Syrian conflict* (pp. 3–10). London: Royal United Services Institute for Defence and Security Studies.
11. Aras, B. (2014). Davutoğlu Era in Turkish foreign policy revisited. *Journal of Balkan & Near Eastern Studies*, 16(4), 404–418.
12. Aslanlı, A. (2018). Rusya’nın Suriye Politikası [online]. *ORSAM*. [Viewed 14 February 2020]. [https://orsam.org.tr/d\\_hbanaliz/75tr.pdf](https://orsam.org.tr/d_hbanaliz/75tr.pdf).
13. Associated Press. (2015). Putin Visits Iran for Talks on Syria’s Future [online]. *Time.Com*. [Viewed 18 April 2020]. <http://0-search.ebscohost.com.library.metu.edu.tr/login.aspx?direct=true&db=a9h&AN=111173069&site=ehost-live>.
14. Azizi, H. (2019). Why the Ankara Summit Is Important [online]. *Valdai*. [Viewed 02 May 2020]. <https://valdaiclub.com/a/highlights/why-the-ankara-summit-is-important/>.
15. Baczynska, G. (2015). Moscow-hosted Syria talks end, sides agree only to meet again [online]. *Reuters*. [Viewed 23 August 2020]. <https://www.reuters.com/article/us-syria-crisis-moscow-talks/moscow-hosted-syria-talks-end-sides-agree-only-to-meet-again-idUSKBN0L21VV20150129>.
16. Baczko, A., Dorransoro, G., & Quesnay, A. (2018). *Suriye: Bir İç Savaşın Anatomisi*. İstanbul: İletişim.
17. Bağcı, H. (2009). Reaction to: Baran, Z., & Lesser, I. O. (2009). Turkey’s identity and strategy: A game of three-dimensional chess. In: M. Schiffer, & D. Shorr (Eds.), *Powers and principles: International leadership in a shrinking world* (pp. 197–224). Plymouth: Lexington Books.
18. Bağcı, H. (2015). Strategic Depth in Syria: From the Beginning to the Russian Intervention [online]. *Valdai Discussion Club*. [Viewed 5 September 2019]. <https://valdaiclub.com/a/valdai-papers/valdai-paper-37-strategic-depth-in-syria-from-the-beginning-to-russian-intervention/>.
19. Bağcı, H. (2013). Suriye’de doğrular yanlışlar... [online]. *Star*. [Viewed 27 March 2020]. <https://www.star.com.tr/acik-gorur/suriyede-dogrular-yanlislar-haber-759105/>.

20. Bağcı, H., & Açıklın, Ş. N. (2015). From chaos to cosmos: Strategic depth and Turkish foreign policy in Syria. In: Ş. Ş. Erçetin, & S. Banerjee (Eds.), *Chaos, complexity and leadership 2013* (pp. 11–26). Springer International Publishing.
21. Bağcı, H., & Erdurmaz, S. (2017). Turkey-Russia relations in the Era of the justice and development party (AK Party): From honeymoon to separation and reconciliation again. In W. Zellner (Ed.), *Security Narratives in Europe* (pp. 131–146). Germany: Nomos Verlagsgesellschaft mbH & Co. KG.
22. Barkey, H. J. (2014). Turkey's Syria predicament. *Survival*, 56(6), 113–134.
23. BBC News. (2016). Syria conflict: Ceasefire agreed, backed by Russia and Turkey [online]. *BBC News*. [Viewed 20 August 2020]. <https://www.bbc.com/news/world-middle-east-38460127>.
24. BBC News Türkçe. (2018). İran Cumhurbaşkanı Ruhani: Türkiye'nin Afrin'deki operasyonu nafile [online]. *BBC News*. [Viewed 16 April 2020]. <https://www.bbc.com/turkce/haberler-dunya-42959710>.
25. Behraves, M. (2017). Iran's Syria policy post-IS: Staying for the long haul [online]. *Middle East Eye*. [Viewed 14 April 2020]. <https://www.middleeasteye.net/opinion/irans-syria-policy-post-staying-long-haul>.
26. Borshchevskaya, A. (2018). Moscow's middle east resurgence: Russia's goals go beyond damascus. *Middle East Quarterly*, 25(1), 1–13.
27. Byrne, D. (1998). *Complexity theory and the social sciences: An introduction* (pp. 1–6). New York: Routledge.
28. Carmichael, T., & Hadžikadić, M. (2019). The fundamentals of complex adaptive systems. In T. Carmichael, A. J. Collins, & M. Hadžikadić (Eds.), *Complex adaptive systems views from the physical, natural, and social sciences* (pp. 1–16). Switzerland: Springer.
29. Charap, S. (2013). Russia, Syria and the doctrine of intervention. *Survival*, 55(1), 35–41.
30. Cîndea, I. (2006). Complex systems—new conceptual tools for international relations. *Perspectives: Central European Review of International Affairs*, 26(Summer), 46–68.
31. Clemens, W. C. (2014). *Complexity science and world affairs*. New York: State University of New York Press.
32. Çoban, M. İ. (2020). *Astana Process in Context with Iranian, Russian and Turkish Foreign Policies on Syrian Complexity*. Master of Science Thesis. Middle East Technical University. Retrieved from October 15, 2020, from <http://etd.lib.metu.edu.tr/upload/12625609/index.pdf>.
33. Cudworth, E., & Hobden, S. (2015). Complexifying international relations for a posthumanist world. In E. Kavalski (Ed.), *World politics at the edge of chaos: Reflections on complexity and global life* (pp. 169–188). New York: State University of New York Press.
34. Davutoğlu, A. (2016). *Stratejik Derinlik, Türkiye'nin Uluslararası Konumu* (108th ed.). İstanbul: Küre.
35. Del Sarto, R. A. (2017). Contentious borders in the Middle East and North Africa: Context and concepts. *International Affairs*, 93(4), 767–787.
36. Deutsche Welle. (2017). New Russia-Syria accord allows up to 11 warships in Tartus port simultaneously [online]. *Deutsche Welle*. [Viewed 7 March 2020]. <https://www.dw.com/en/new-russia-syria-accord-allows-up-to-11-warships-in-tartus-port-simultaneously/a-37212976>.
37. Einstein, A. (1993). *Relativity: The special and the general theory*. Translated from German into English by Robert W. Lawson. New York: Routledge.
38. Esfandiari, G. (2017). IS Propaganda Increasingly Targeting Iran And Its Sunnis [online]. *Radio Free Europe*. [Viewed 14 April 2020]. <https://www.rferl.org/a/iran-islamic-state-propaganda-targets-sunnis/28531534.html>.
39. Esfandiary, D., & Tabatabai, A. (2015). Iran's ISIS policy. *International Affairs*, 91(1), 1–15. <https://doi.org/10.1111/1468-2346.12183>.
40. Freire, M. R., & Heller, R. (2018). Russia's power politics in Ukraine and Syria: Status-seeking between identity, opportunity and costs. *Europe-Asia Studies*, 70(8), 1–28. <https://doi.org/10.1080/09668136.2018.1521914>.
41. Geyer, R., & Rihani, S. (2010). *Complexity and public policy: A new approach to 21st century politics, policy, and society*. New York: Routledge.

42. GlobalSecurity.org. (2020). Operation Euphrates Shield [online]. *Global Security*. [Viewed 16 April 2020]. <https://www.globalsecurity.org/military/world/war/syria-euphrates-shield.htm>.
43. Goodarzi, J. M. (2020). Iran and the Syrian civil war. In R. Hinnebusch & A. Saouli (Eds.), *The war for Syria: Regional and international dimensions of The Syrian uprising* (pp. 138–155). London: Routledge.
44. Harrison, N. E. (2006). Complex systems and the practice of world politics. In N. E. Harrison (Ed.), *Complexity in world politics: Concepts and methods of a new paradigm* (pp. 183–196). New York: State University of New York Press.
45. Harrison, N. E. (2006). Thinking about the world we make. In N. E. Harrison (Ed.), *Complexity in world politics: Concepts and methods of a new paradigm* (pp. 1–24). New York: State University of New York Press.
46. Hashem, A. (2017a). In Syria, Iran sees necessary war [online]. *Al-Monitor*. [Viewed 12 April 2020]. <https://www.al-monitor.com/pulse/originals/2017/03/iran-syria-intervention-ham-edani-quds-force-memoir.html>.
47. Hashem, A. (2017b). Iran's post-ISIS regional strategy. *Turkish Policy Quarterly*, 105–112.
48. Hurriyet Daily News. (2017). Turkey, Russia sign memorandum to coordinate strikes in Syria [online]. *Hürriyet Daily News*. [Viewed 16 April 2020]. [www.hurriyetdailynews.com/turkey-russia-sign-memorandum-to-coordinate-strikes-in-syria-108469](http://www.hurriyetdailynews.com/turkey-russia-sign-memorandum-to-coordinate-strikes-in-syria-108469).
49. Jervis, R. (1997). *System effects: Complexity in political and social life*. New Jersey: Princeton University Press.
50. Kavalski, E. (2015). Complexifying IR: Disturbing the “Deep Newtonian Slumber” of the mainstream. In E. Kavalski (Ed.), *World politics at the edge of chaos: Reflections on complexity and global life* (pp. 253–272). New York: State University of New York Press.
51. Kavalski, E. (2007). The fifth debate and the emergence of complex international relations theory: Notes on the application of complexity theory to the study of international life. *Cambridge Review of International Affairs*, 20(3), 435–454.
52. Kissane, D. (2011). *Beyond anarchy: The complex and chaotic dynamics of international politics*. Stuttgart: ibidem.
53. Kissane, D. (2015). Cleopatra's nose and complex international politics. In: Ş. Ş. Erçetin, & S. Banerjee (Eds.), *Chaos, complexity and leadership 2013* (pp. 57–72). Springer International Publishing.
54. Lehmann, K. E. (2012). Unfinished transformation: The three phases of complexity's emergence into international relations and foreign policy. *Cooperation & Conflict*, 47(3), 404–413.
55. Lohrmann, R. (2000). Migrants, refugees and insecurity. Current threats to peace?. *International Migration*, 38(4), 3–22.
56. Maloney, S. (2017). ISIS attacks Iran and accusations fly [online]. *Brookings*. [Viewed 13 April 2020]. <https://www.brookings.edu/blog/markaz/2017/06/09/isis-attacks-iran-and-accusations-fly/>.
57. Mearsheimer, J. J. (2018). *The great delusion, liberal dreams and international realities*. New Haven: Yale University Press.
58. Naumkin, V. (2017). What Awaits Syria? [online]. *Russia in Global Affairs*. [Viewed 23 February 2020]. <https://eng.globalaffairs.ru/articles/what-awaits-syria/>.
59. Notte, H. (2016). Russia in Chechnya and Syria: Pursuit of strategic goals. *Middle East Policy*, 23(1), 59–74.
60. Oktav, Ö. Z. (2020). Turkish-Iranian relations in Syria. In R. Hinnebusch & A. Saouli (Eds.), *The war for Syria: Regional and international dimensions of the Syrian uprising* (pp. 176–188). London: Routledge.
61. Onjanov, N. B. (2018). *Ara Bulucu; Suriye Düğümü*. Translated from Kazakh into Turkish by Aşur Özdemir. Ankara: Panama.
62. Oztig, L. I. (2019). Syria and Turkey: Border-security priorities. *Middle East Policy*, 26(1), 117–126.
63. Papadopoulos, M. (2018). Russia-Turkey Relations and the Kremlin's “Kurdish Card” [online]. *Global Research*. [Viewed 13 April 2020]. <https://www.globalresearch.ca/russia-turkey-relations-and-the-kremlins-kurdish-card/5661007>.

64. Parker, J. W. (2020). Qassem Soleimani: Moscow's Syria Decision—Myth and Reality [online]. *Institute for National Strategic Studies*. [Viewed 28 April 2020]. <https://inss.ndu.edu/Media/News/Article/2074132/qassem-soleimani-moscows-syria-decision-myth-and-reality/>.
65. Root, H. L. (2014). *Dynamics among nations: The evolution of legitimacy and development in modern states*. Massachusetts: The MIT Press.
66. Rubin, J. Z. (1992). Conclusion: International mediation in context. In J. Bercovitch & J. Z. Rubin (Eds.), *Mediation in international relations; multiple approaches to conflict management* (pp. 249–272). New York: Palgrave Macmillan.
67. Rumer, E. (2019). Russia in the Middle East: Jack of All Trades, Master of None [online]. *Carnegie Endowment For International Peace*. [Viewed 12 March 2020]. <https://carnegieendowment.org/2019/10/31/russia-in-middle-east-jack-of-all-trades-master-of-none-pub-80233>.
68. Sağlam, M. (2013). İnadin Ötesinde: Rusya'nın Suriye Politikası. *Ankara Üniversitesi SBF Dergisi*, 68(4), 211–217.
69. Sandole, D. J. D. (2006). Complexity and conflict resolution. In N. E. Harrison (Ed.), *Complexity in world politics: Concepts and methods of a new paradigm* (pp. 43–72). New York: State University of New York Press.
70. Shaheen, K. (2016). Aleppo: Russia-Turkey ceasefire deal offers hope of survival for residents [online]. *The Guardian*. [Viewed 24 August 2020]. <https://www.theguardian.com/world/2016/dec/13/deal-reached-to-evacuate-rebels-and-civilians-from-aleppo>.
71. Sinkaya, B. (2015). İran-Pyd İlişkileri: Taktik Ortaklık. *Middle Eastern Analysis/Ortadoğu Analiz*, 7(70), 50–52.
72. Sinkaya, B. (2011). İran-Suriye İlişkileri ve Suriye'de Halk İsyanı. *Middle Eastern Analysis/Ortadoğu Analiz*, 3(33), 38–48.
73. Sinkaya, B. (2017). İran'ın Suriye Stratejisi. *Akademik Ortadoğu*, 11(2), 49–64.
74. Smith, L. (2014). *Kaos*. Translated into Turkish by Hakan Gür. Ankara: Dost.
75. Soltaninejad, M. (2019). Coalition-building in Iran's foreign policy: Understanding the “Axis of Resistance”. *Journal of Balkan and Near Eastern Studies*, 21(6), 716–731.
76. Souleimanov, E. A., & Dzutsati, V. (2018). Russia's Syria war: A strategic trap? *Middle East Policy*, 25(2), 42–50.
77. Stein, A. (2018). What Turkey's Afrin Operation Says about Options for the United States [online]. *Atlantic Council*. [Viewed 17 April 2020]. <https://www.atlanticcouncil.org/blogs/syriasource/what-turkey-s-afrin-operation-says-about-options-for-the-united-states-2/>.
78. Stent, A. E. (2019). *Putin's world: Russia against the west and with the rest*. New York: Hachette Book Group.
79. Suchkov, M. A. (2017a). Moscow's Leverage in Syria is Strong, But Limited [online]. *Russia in Global Affairs*. [Viewed 28 February 2020]. <https://eng.globalaffairs.ru/articles/moscows-leverage-in-syria-is-strong-but-limited/>.
80. Suchkov, M. A., (2017b). Russia's “Post-West World Order”: Why Turkey Matters. *Turkish Policy Quarterly*, 69–78.
81. Sullivan, C. J. (2018). Sidestepping a quagmire: Russia, Syria, and the lessons of the soviet-afghan war. *Asian Affairs*, 49(1), 48–55.
82. The Health Foundation. (2010). Evidence scan: Complex adaptive systems [online]. *The Health Foundation*. [Viewed 15 May 2020]. <https://www.health.org.uk/sites/default/files/ComplexAdaptiveSystems.pdf>.
83. Tomé, L. (2016). Complex systems theories and eclectic approach in analysing and theorising the contemporary international security complex. In Ş. Ş. Erçetin & H. Bağcı (Eds.), *Handbook of research on chaos and complexity theory in the social sciences* (pp. 19–32). IGI Global: Springer.
84. Tomé, L., & Açıkalın, Ş. N. (2019). Complexity theory as a new lens in IR: System and change. In Ş. Ş. Erçetin & N. Potas (Eds.), *Chaos, complexity and leadership 2017: Explorations of chaos and complexity theory* (pp. 1–16). Switzerland: Springer.
85. Trenin, D. (2010). *Russia's policy in the middle east: Prospects for consensus and conflict*. Carnegie Endowment, New York: The Century Foundation.

86. Tür, Ö. (2019). Turkey's role in middle east and gulf security. *Asian Journal of Middle Eastern and Islamic Studies*, 13(4), 592–603.
87. Türkiye Cumhuriyeti Dışişleri Bakanlığı. (2016). No: 333, 29 Aralık 2016, Suriye'de Çatışan Taraflar Arasında Ülke Genelinde Ateşkes İlanı Hk. [Online]. *Turkish Ministry of Foreign Affairs*. [Viewed 30 April 2020]. [http://www.mfa.gov.tr/no\\_-333\\_-29-aralik-2016\\_-suriye\\_de-catisan-taraflar-arasinda-ulke-genelinde-ateskes-ilani-hk\\_.tr.mfa](http://www.mfa.gov.tr/no_-333_-29-aralik-2016_-suriye_de-catisan-taraflar-arasinda-ulke-genelinde-ateskes-ilani-hk_.tr.mfa).
88. UNHCR. (2020). Syria Regional Refugee Response [online]. *UNHCR*. [Viewed 02 May 2020]. <https://data2.unhcr.org/en/situations/syria>.
89. Unnikrishnan, N., & Purushothaman, U. (2017). Russia in middle east: Playing the long game? *India Quarterly: A Journal of International Affairs*, 73(2), 251–258.
90. Urry, J. (2003). *Global complexity*. Cambridge: Polity.
91. Vakıf, S. (2018). Understanding Tehran's long game in the levant. *Uluslararası İlişkiler*, 15(60), 105–120.
92. Wilhelmsen, J. (2019). Putin's Power Revisited: How Identity Positions and Great Power Interaction Condition Strategic Cooperation on Syria. *Europe-Asia Studies*[online], 1–31. <https://doi.org/10.1080/09668136.2019.1602594>.
93. Wilson, J. L. (2010). The legacy of the color revolutions for Russian politics and foreign policy. *Problems of Post-Communism*, 57(2), 21–36.
94. Yeşilyurt, N. (2013). Orta Doğu'yla ilişkiler. In: B. Oran (Ed.), *Türk Dış Politikası, Kurtuluş Savaşından Bugüne Olgular, Belgeler, Yorumlar* (Vols. III (2001–2012), pp. 401–62). İstanbul: İletişim.
95. Yükselen, H. (2017). Kompleksite Kuramı ve Diyalektik. In F. Yalvaç (Ed.), *Tarihsel Materyalizm ve Uluslararası İlişkiler* (pp. 309–332). İmge Kitabevi Yayınları: Ankara.
96. Yükselen, H. (2020). *Russia and Turkey in Syria: Testing the extremes*. İstanbul: SETA.
97. Хопёрская, Л. Л. (2018). «Исламское Государство. 2.0»: Новые вызовы в Центральноазиатском Регионе. *Большая Евразия: Развитие, безопасность, сотрудничество*. 1(2), 212–217.
98. Бифолки, Д. (2018). Геополитика и терроризм на Северном Кавказе: последствия конфронтации/сотрудничества ЕС и России и пропаганда джихадистов. *Государственное управление. Электронный вестник*, 68, 7–37.